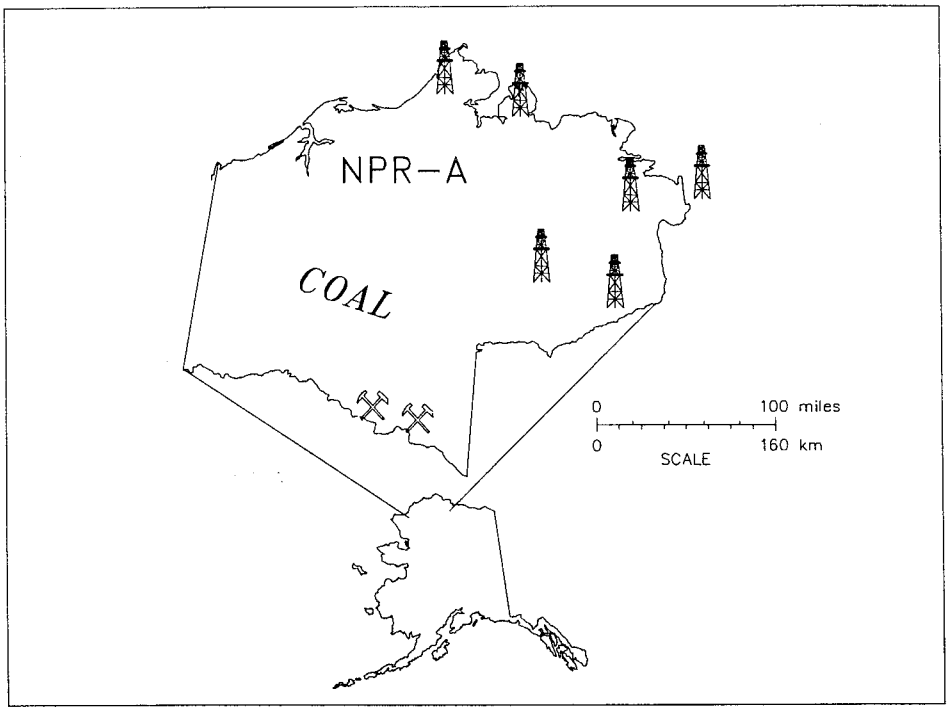
National Petroleum Reserve–Alaska

Minerals Reader

Bureau of Land Management
Alaska State Office
Division of Mineral Resources



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Edited by A.C. Banet & T.C. Mowatt

Forward

This paper should not be viewed as an official minerals policy position paper. With the diminishing minerals budget in Alaska and the uncertainty of reorganization , staffing levels, and position management, it became necessary to consolidate all the minerals papers and "proposals" discussed internally by the Division of Minerals over the years concerning NPRA, into one document to ensure continuity of minerals management into the future. If any of the "proposals" are seriously considered for implementation, they should be reviewed by the Washington Office and the Arctic District Office for comment and input.

Since this paper was started over a year ago, some of the information contained herein may be out of date.

G.W. Brougham
June 2, 1994

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Potential in NPRA for Elements Needed for Superconductivity Research, Author unknown (AK-985)

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National Petroleum Reserve-Alaska Competitive Leasing Terms, Borkoski, 1990, 18p (including 4 attachments)
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NATIONAL PETROLEUM RESERVE-ALASKA

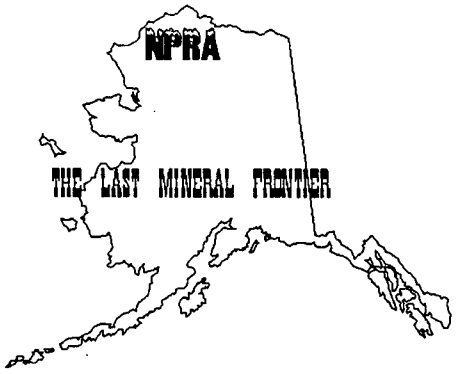
MINERALS READER

Introduction

From its designation as Naval Petroleum Reserve #4 in 1923 to the present, the National Petroleum Reserve in Alaska (NPRA) has been an area of high mineral interest as well as misconceptions. With the diminishing lease sale interest in the first half of the 1980s to its proposed designation as a national wildlife refuge in the early 1990s, the BLM-Alaska Division of Minerals has written several issue papers in response to many different inquiries regarding the energy and mineral resource potential of this 23 million acre reserve. This paper summarizes the minerals information contained in those papers and discusses how to again foster interest in energy and mineral resource exploration within the reserve. Contrary to popular belief and the results of the 1984 NPRA lease sale, industry interest within NPRA is not dead, but merely uncertain and could probably be clarified by specific actions by the Federal Government.

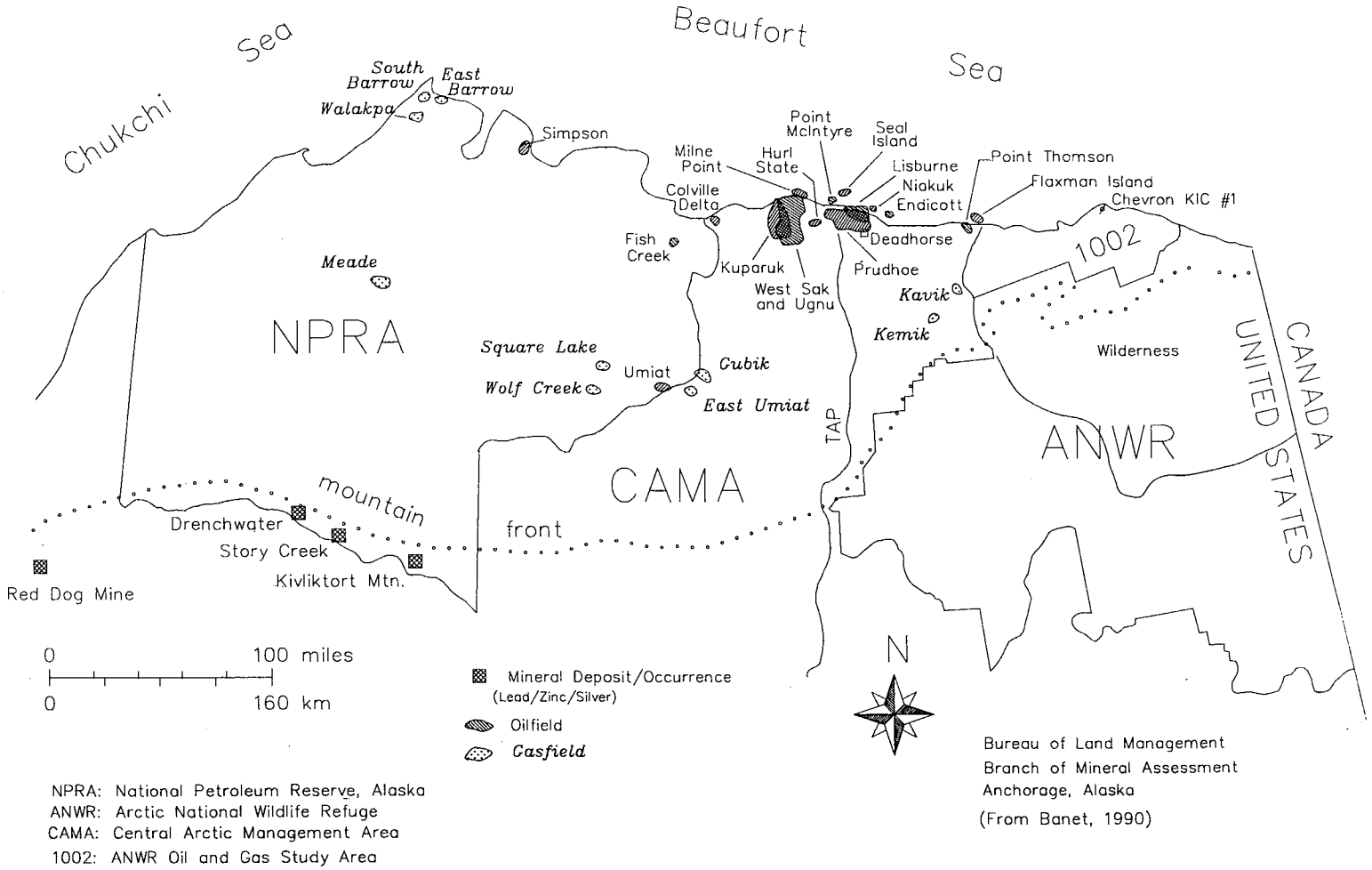
By compiling this minerals information into one concise document, it is hoped that this paper will guide BLM management in the future planning for land management within NPRA. It will also serve as a source of information that will inform Congress and the Public about the overall mineral potential of the reserve and the need to keep NPRA in a multiple use land status. For easy reference, all BLM authors and papers are indicated in bold type.

All the BLM unpublished references are attached. All BLM Open File Reports can be obtained from BLM, Office of External Affairs.



NORTHERN ALASKA OIL, GAS, MINERAL AREAS

(DEVELOPED AND UNDEVELOPED)



NPRA: National Petroleum Reserve, Alaska
ANWR: Arctic National Wildlife Refuge
CAMA: Central Arctic Management Area
1002: ANWR Oil and Gas Study Area

Bureau of Land Management
Branch of Mineral Assessment
Anchorage, Alaska
(From Banet, 1990)

Figure 1

Executive Summary

Oil and Gas

The Umiat field, with estimated reserves of approximately 70 to 100 million barrels, would be considered a giant field by lower 48 standards, but is uneconomic due to its isolation. Contrary to popular belief, most of the wells drilled in the Navy/USGS program were not totally "dry" holes. Many of the wells drilled found at least shows of oil or gas. Many of these wells were drilled for geological assessment purposes rather than for resource delineation per se.

The most recent (1980) USGS assessment of NPRA gave estimated ranges of recoverable resources of: Oil: 300 million barrels to 5.4 billion barrels, **mean**=2.1 billion barrels; Gas: 1.8 trillion cu.ft. to 20.4 trillion cu. ft., **mean**=8.5 trillion cu. ft.

In 1982, the first of four NPRA lease sales were held. These sales generated a total of $84.7 million dollars in bonus bids. The lack of industry interest in the 1984 NPRA oil and gas lease sale made many believe that this was the end of the oil and gas leasing program in NPRA. However, this belief fails to consider why interest waned:

Due to the isolation factor, a large economic field size was needed to cover the cost of development;

More favorable lease terms in other areas;

Passage of ANILCA, which for the first time offered the possiblity that the Coastal Plain area of the Arctic National Wildlife Refuge, long thought to be the *best* onshore province for a major discovery, might be opened for oil and gas exploration and leasing;

Uncertainty over native selections and land ownership within the reserve;

Development restrictions i.e. lack of unitization and no provisions allowing temporary suspension of development;
Fluctuating and uncertain oil prices.

Several conditions have changed which would again foster industry interest in the area:

Oil and Gas development has expanded to within 10 miles of the eastern boundary of the reserve, allowing for much smaller fields in NPRA to be economic;

Active exploration and leases on state lands adjacent to the reserve;

Lack of leasing opportunities in ANWR;

Discoveries in the Colville Delta, Beaufort Sea, Chukchi Sea and Cook Inlet, renewing exploration interest in Alaska;

New theories on hydrocarbon plays within NPRA.

Despite these more optimistic conditions for leasing, several impediments remain:

High minimum bid requirements ($25 acre), set when oil prices were rising;

High royalty rates (16 2/3 %), set when oil prices were rising;

Lack of clarification on Unitization, which would allow combining and joint development of leases.

Provisions requiring immediate development of leases.

The first two items can be set by the State Director. The last would need clarification by the solicitor and if necessary, Congressional action.

Other Known or Suspected Minerals

Coal: NPRA may contain up to 40% of the nation's remaining coal reserves; perhaps up to four trillion tons.

Zinc, Lead, Silver: Several areas of southern NPRA (Drenchwater and Story Creeks, and Kivliktort Mountain) have known mineralization featuring these metals. The Drenchwater Creek area, based on preliminary samples, contained some concentrations higher than those at the world class Red Dog deposit. Based on this preliminary data, one cannot assume that a world class deposit exists within NPRA, but the possibility certainly exists. The BLM 3031 manual would classify these areas as having "high" potential for these elements.

Strategic and Critical Minerals: Regional trends of rock units associated with concentrations of such elements as silver, cadmium, nickel, vanadium, copper, cobalt, and fluorine trend into southern NPRA. However, this only infers, but does not confirm, their existence within the reserve.

Oil and Gas

Exploration

In the 19th century natives and early explorers were aware of oil and gas along the coast and oil shale within the mountains of what is now NPRA. Interest in the oil and gas potential of NPRA goes back to the turn of the century with the verification of oil seeps at Cape Simpson. Patents for oil and gas were granted under the mining laws of 1872 for properties in the Cape Simpson Area. In 1923 President Harding made this area of Alaska The Naval Petroleum Reserve # 4.

Oil and Gas interest blossomed with the creation of the area into National Petroleum Reserve # 4. Between 1946 and 1981 the combined Navy/USGS drilling program drilled approximately 100 wells within the reserve, concentrating in the northern section of the reserve. This program discovered several small oil or gas fields at Barrow, Walakpa, Fish Creek, and Umiat (Fig. 1). The Umiat field is believed to contain between 70 million and 100 million barrels of oil. Although large by lower 48 standards, due to its isolation, this is too small to develop as a "stand-alone" field on the North Slope. Some common exploration and geotechnical misconceptions about this drilling program are that the vast majority of these wells were "dry holes". Quite the contrary is true. Forty five of the wells contained at least a show of oil or gas (Fig. 2). Of the approximately 100 "wells" drilled within the reserve, 49 were merely shallow core tests ranging in depth from 50 to 300 feet. **Banet (1991)** states that "only 30 wells have been drilled with modern methods and cdp seismic mapping on these 23 million acres." In addition, 4 wells were drilled by industry in the 1980s. One, Brontosaurus southwest of Barrow was dry, but was believed to be more important as a stratigraphic test for the then as yet untested Chukchi Sea offshore area. Two of these wells were drilled by the Artic Slope Regional Corporation in the Barrow gasfield area. These wells are confidential. The fourth industry well, Chevron Livehorse, was plugged and abandoned, but was thought to be testing an offshore structure. Between 1990 & 1992, ASRC drilled and completed 8 additional wells in the Walakpa Gas field.

Well information in the northern foothills region of southern NPRA is very sparse. Only two wells (Awuna and Lisburne) have been drilled in this region. Based on information from these wells and USGS reports, **Bascle and Foland (1992)** have rated this area as having the lowest potential for oil within the reserve. If potential exists, it will likely be gas. This is based on the reservoir properties and thermal maturity data interpreted from these two wells. Bascle and Foland used the the 1980 USGS hydrocarbon play assement estimates and apportioned these estimates across NPRA. By this method **Bascle and Foland (1992)** estimate recoverable resources in the 3.95 million acre Utukok Special Area to range between 19.4 million barrels to 598.2 million barrels (mean of 185 million barrels); gas at 0.4 trillion cubic feet to 6.6 trillion cubic feet.

Despite the Navy/USGS drilling program, some 36,000 square miles of NPRA remain untested for any type of hydrocarbon play **(Banet, 1991)**. The drilling density amounts to about one well per 900 square miles. In addition to the drilling program, some 15,600 miles of seismic data have been collected within NPRA. This includes data from as far back as 1953. Much of this is done on a 6 x 12 mi. grid, which is considered reconnaissance density and not dense enough to identify some of the smaller, less well defined structures thought to exist within the reserve. This level of seismic data would have missed the Prudhoe Bay field. Reconnaissance surveys are useful for identifying trends.

Mowatt, et al., (1989, in press, 1993) presented a generalized summary of the potential energy resources of western Arctic Alaska. Their abstract states in part:

"The area of concern encompasses much of northewestern Alaska, including the National Petroleum Reserve in Alaska (NPRA).

.... An appreciable portion of the area is underlain by sedimentary rocks, with potential for oil and /or gas resources. Several small fields have been discovered, and there are numerous hydrocarbon shows in individual wells, although this vast region remains relatively untested by the drill. A large quantity of coal derived natural gas may have been generated, at least some of which may remain reservoired within the region. Somewhat more speculative are potential resources occurring trapped under permafrost, and/or as "gas hydrates," at relatively shallow depths."

Leasing

Between 1982 and 1984, four lease sales were held in

National Petroleum Reserve–Alaska

Oil & Gas Activities

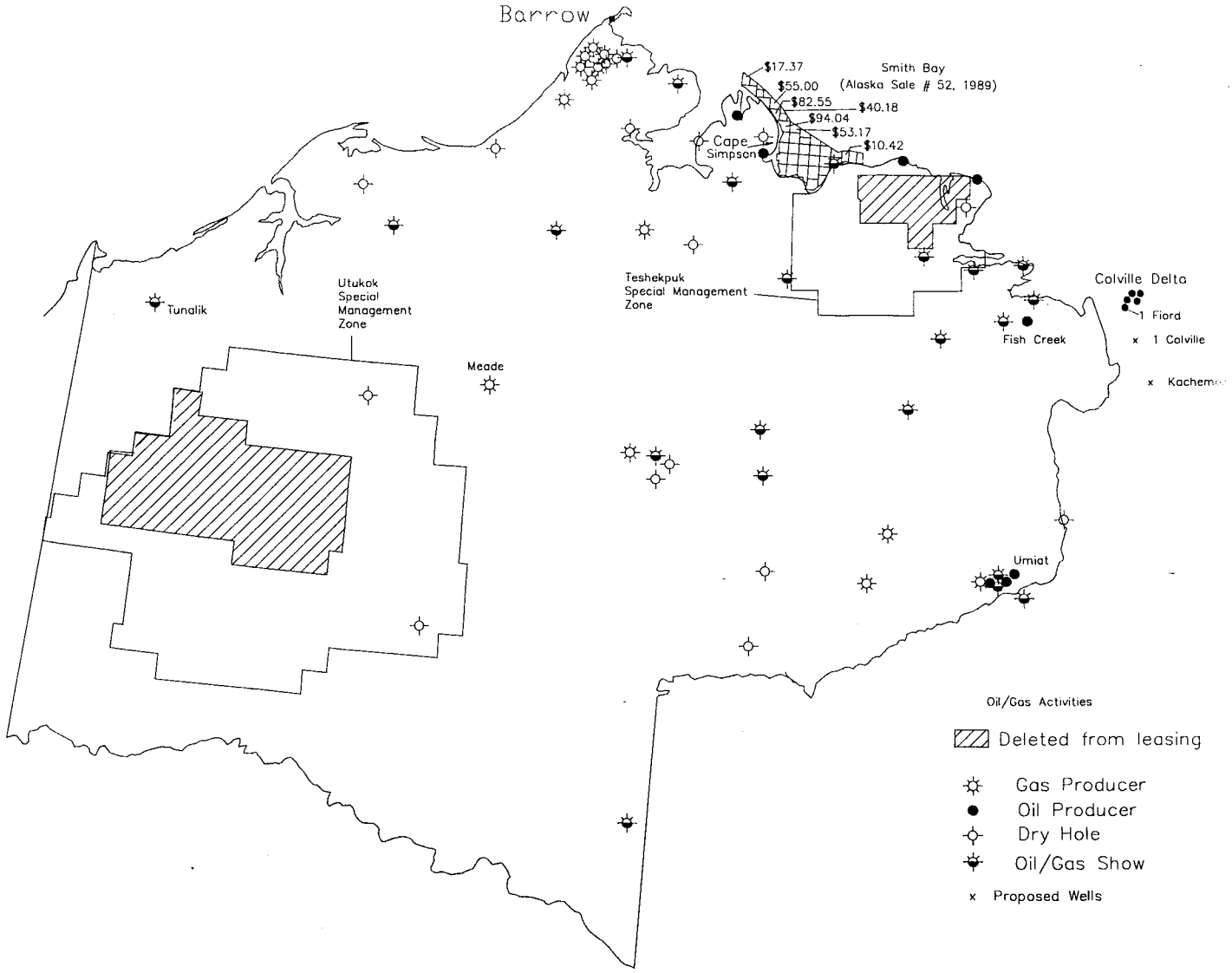


Figure 2

NPRA. The first three sales successfully garnered $84,817,945 in bonus bids and leased 1.3 million acres. The average bonus bid was $62.94 per acre. The fourth offering received no bids. This was not totally unexpected. Previous to the fourth sale, the Onshore Minerals Management Service (now the BLM Division of Mineral Resources) recommended that a sale not be held as the acreage offered was of relatively low potential compared to previous offerings. **Borkoski (1990)** has summarized the results of the four sales, as well as other statistics concerning acres leased and leases still active. Table 1 gives a summary of the companies that bid in the three lease sales. It should be noted that the leases active data is now dated. There are no remaining active leases within the reserve.

Further, NPRA is not leased under the Minerals Leasing Act of 1920. It is leased under the Department of Interior Approprations Act of 1981. This act does not extend to the Secretary the same authority to conduct lease sales as he has in the rest of the country under the 1920 act. **Borkoski (1990)** states the shortcomings in the Appropriations act which may influence future lease sales:

> The absence of authority to unitize. Unitization allows multiple lease holders over a large prospect to join together and develop the prospect together;
>
> The inability to extend a primary lease term beyond 10 years;
>
> The lack of authority for the Secretary to grant suspensions of production on leases capable of producing in paying quatities, pending the development of necessary infrastructure;
>
> The 60,000 acre limitation on the size of an oil and gas lease tract.

Although not an impediment to leasing, NPRA leasing differs from onshore leasing in the rest of the country in another way. The National Petroleum Reserve Production Act of 1976, requires that NPRA be leased according to the Outer Continental Shelf Lands Act Amendments of 1978. This Act reserves the right of the Secretary to reject any bid not considered adequate, as determined by the Secretary. DOI, through it's Minerals Management Service (formerly the Conservation Division of the USGS) has determined that the best way to provide the Secretary with the information to exercise this authority is through pre- or post-sale tract evaluations. As of 1983, the Onshore Authority for this process now resides within the BLM and the Division of Mineral Resources. At this time, NPRA is the only onshore public land that is not leased under the Minerals Leasing Act of 1920 or the Oil and Gas Reform Act of 1987. Therefore, NPRA requires a tract selection and evaluation process before leasing.

For those concerned with federal budgetary matters, the National Petroleum Reserve Production Act (PL 94-258 and PL 96-514) sets the state/federal government revenue sharing in NPRA at a 50-50 state-federal split rather than a 90-10 split. This does not seem to be common knowledge within the state or federal governments.

Current Interest

At the time of the NPRA lease sales, the only infrastructure was at Prudhoe Bay, some 75-250 miles away, depending on the lease area. This meant that a super giant oil field in the 500 million to 1 billion barrel range had to be found in NPRA to support the cost of transportation to Pump Station 1. The exploration and data analysis of the 1970s and 1980s showed that a field of this size was not very likely. Since 1985, oil and gas development has moved steadily westward, such that now it is just outside the eastern boundary of the reserve. If the Colville Delta area is developed, perhaps it would lower the economic field size needed in NPRA down to the 100 million barrel range, which is a more likely field size expected in NPRA.

In 1989, the Arctic District Office sent a letter of interest to industry concerning a possible lease sale in NPRA. Industry response was classified as moderate, with the ANWR and Beaufort sea areas ranking higher. Five of the major oil companies expressed interest in leasing; two had no interest. Several smaller companies and consulting groups expressed interest in a lease sale. Those interested in leasing expressed interest in the Cape Simpson area, adjacent to industry leases in state offshore areas; the Colville Delta area of NPRA; and the Umiat area. Industry felt that 1992 would be favorable timing for the sale. Note that industry interest coincided with areas chosen by the Division of Minerals based on their geologic and economic assessment of the Northern area of NPRA and reviewing active leases on adjacent state lands. Industry response also included comments about federal government wetlands policy and other leasing conditions within the reserve, including

Table 1

NPR-A Lease History Summary by Company
(tracts leased)

A total of 58 tracts have been leased in the NPR-A; 53 were leased by a total of 6 major oil companies. Three of these majors, ARCO, Texaco, and British Petroleum leased a total of 23 tracts within the NPR-A or a total of 40 percent of all the tracts leased. All 23 of these tracts have since been relinquished and these three companies which constitute one-half of the major oil companies that were successful bidders, no longer hold an active interest in the NPR-A. In addition, Chevron has relinquished 9 of the 12 tracts leased and Shell Western has turned back 7 of its 12 tracts. Exxon stands alone in that it still retains all 6 of the leases won at the first lease sale.

*There are no remaining active leases

		Tracts Leased							
Sale	Leases	ARCO	Texaco	British Petroleum[1/]	Chevron	Shell	Exxon	Independents[2/]	Totals
#1	Acquired	--	4	1	12	3	6	--	26
(821)	Active	--	0	0	3	0	6	--	9
#2	Acquired	--	3	5	--	4	--	--	12
(822)	Active	--	0	0	--	1	--	--	1
#3	Acquired	7	3	--	--	5	--	5	20
(831)	Active	0	0	--	--	4	--	4	8
#4	Acquired	--	--	--	--	--	--	--	--
(841)	Active	--	--	--	--	--	--	--	--
TOTAL ACQUIRED		7	10	6	12	12	6	5	58
TOTAL ACTIVE		0	0	0	3	5	6	4	18
PERCENT OF LEASES ACTIVE		0%	0%	0%	25%	42%	100%	80%	31%
GROUP LEASES ACTIVE		All NPR-A leases relinquished by these companies.			47% of this groups's leases are still active.			80%	31%
PERCENT OF TOTAL ACTIVE LEASES		--	--	--	17%	28%	33%	22%	31%

1/ Formerly Standard Alaska Production Company.

2/ The names of the five independents are Alaska Land Leasing, Virginia Johnson, Christian B. Z. Buck, Scott & Wangenheim, J. L. Wagenheim & Assoc., Each independent acquired one lease. All leases are still active with the exception of the lease of Alaska Land Leasing.

From Borkoski, 1990

unitization.

Foland (1991), gives Teshekpuk Lake Special Management Area of NPRA more potential for oil than did the previous report by **Menge and Teseneer (1985)**. Foland estimates resources of 27 million barrels to 763 million barrels with a mean of 306 million barrels. It would seem by current industry activities both offshore and onshore that they concur with this more optimistic assessment.

Industry continues to apply for seismic permits within the reserve. In the first half of 1993, ARCO Alaska completed a seismic survey in Northeast NPRA and has applied for a seismic permit for the same area beginning in early 1994. This new data within the reserve stretches from Teshekpuk Lake eastward to the Colville St. # 1 well in the Colville Delta Area. This data makes important well ties both inside and outside of the Reserve. Using this new data, the Branch of Mineral Assessment will be beginning a new study of the Northeast section of the Reserve in hopes of gaining a better understanding of the geological relationship between NE NPRA and the discoveries in the Colville Delta area.

In a 1990 state sale offshore of Cape Simpson, industry offered bids in the range of $15/acre to $90/acre (Fig.1). Industry continues to bid on state leases along the Colville River at the eastern boundary of the reserve. In 1993 ARCO and its partners established the Kukpik unit in the Colville Delta 10 miles east of the Reserve. They are proposing to drill two more wells to further delineate the discoveries in this area.

New Exploration Areas

In February of 1993, Jerry Brosia of the Joint Federal-State Pipeline Monitoring Office chaired a State and Federal Committe to discuss possible new onshore areas for exploration on the North Slope in light of declining reserves at Prudhoe Bay. In attendance were earth scientists and managers from the Alaska Division of Geological and Geophysical Surveys (DGGS), U.S. Geological Survey (USGS), Minerals Management Service (MMS), and Bureau of Land Management (BLM). Gil Mull of the DGGS discussed the possibility of a large hydrocarbon play extending from western NPRA (Tunalik), offshore to the Burger well. All were in agreement that Mull's theory deserved further study. Consequently, DGGS funded a field trip to Tunalik for summer of 1993. Due to foul weather, the trip was only a partial success. However, petrographic and geochemical samples and data were gathered. Mowatt and Banet of the BLM will be the lead scientists for the interpretation of this data. Key wells in this area include Tunalik #1 and Peard #1, which were featured in an earlier study by **Mowatt and Dygas (1991)** dealing with reservoir rock quality and potential in fifteen selected wells within the NPRA. Banet has also investigated some geochemical aspects of the Tunalik well. Indursty has also expressed an interest in Mull's work.

Banet (1991) of the BLM also feels that the northern foothills region of southern NPRA has been unnecessarily underrated for future lease sales. He feels that the two wells (Awuna and Lisburn) failed to test and the USGS failed to consider the thrust/folding type of drilling targets that are producing in the Rocky Mountain regions of Canada and the United States. **Bascle and Foland (1992)** also make this statement in their report. These targets are much more difficult to find due to the complicated geology in which they are formed. Therefore, in the foothills region, a much higher density of exploration data is needed. However, when found, this foreland fold type of field can contain significant reserves.

Further, **Mowatt and Mowatt (1991)** state that petrologic and petrophysical studies in Brookian clastic sequences of NPRA reveal potential for the occurrence of significant reservoir rocks in these horizons. Previous to these studies, the probability of significant reservoir quality rocks being present was considered rather low. New mineral assessments of NPRA should take into consideration this new information.

Proposed Actions

Continued cooperation with the State of Alaska Dept of Geophysical and Geological Surveys cannot be overemphasized. The renewed interest expressed by industry in the Cook Inlet area of Alaska after an almost 20 year hiatus, is primarily due to the better understanding of Cook Inlet geology and the identification of new drilling targets based on updated theories on the formations underlying the Cook Inlet. Using the same reasoning, NPRA needs to be continually studied. BLM-Alaska is fortunate to have the expertise to make a significant contribution to this. These studies would cost BLM nothing extra than the professionals now on staff. With the professional staff available in house, BLM should not rely entirely on outside agencies for minerals

information on its lands, especially since the State of Alaska has a significant financial stake in the outcome of these studies and lease sales. Also, BLM geologists are best able to investigate, interpret and present the results of these studies in a manner useful to the land manager. Significant new information could change not only how industry looks at NPRA but, with 54% of our nation's oil needs being imported (**Borkoski,1990**), how the federal government looks at NPRA.

Whether or not NPRA is opened again to full scale leasing, current industry activity in the Colville Delta requires that BLM continue studying new information in northeast NPRA. An understanding of the relationship between the geology in this area of the reserve and that in the Colville Delta is absolutely essential to BLM as production in the Colville Delta could put notheast NPRA into a drainage situation. **Bascle and Foland (1993)**, state that they do not believe that northeast NPRA will be drained by activity within the Delta. However, their work pre-dates the now available seismic data. ARCO's (a partner in Kuukpik) exploration activities within the reserve would also tend to indicate possible future drainage of resources from the reserve.

Borkoski (1990) states that "Efforts should be made to enact legislation to reduce rental fees by 50 percent, from $3/acre to $1.50/acre." This would bring rental rates down to levels comparable to other onshore areas of the U.S. He goes on to say "Further, additional legislation should be introduced to give the Secretary authority to remove restrictive constraints and issue leases under the same type of authority as granted him under the Mineral Leasing Act of 1920." Attachment 4 of **Borkoski 1990**, a letter from Curt McVee to the Alaska Oil and Gas Association, states that "Consistent with Proviso 8 [of the 1981 Appropriations Act] lessees may agree to allocate and share production costs and income under unit plan concepts." The remaining unitization problems are concerned with: no provision to extend leases capable of production, but as yet not under production (for economic reasons or infrastructue difficulties), beyond the 10 year lease limit; a 60,000 acre lease size limit for consolidation of leases; and suspension of lease terms for unusual conditions. Legislation was proposed to clarify these issues. It is unclear whether or not the legislation was introduced or if it was, how far it went in the legislative process. Before leasing takes place in NPRA, this legislation should be re-introduced.

Lastly, the BLM should fund a cooperative study between the Division of Minerals and the Arctic Distric Office, with input from industry, to identify areas for leasing, leading to a 5-10 year oil & gas leasing program for the reserve. This program would then be ready to implement, if circumstances (oil embargo, etc.) warranted initiation.

If a lease program is reestablished within the reserve, the solicitor has determined that the State Director has the authority to set minimum bids and royalty rates (**Borkoski, 1990,** attachment 1). The current minimum bid of $25 per acre was set in the early 1980s when oil prices were rising. In contrast, most state of Alaska sales on the North Slope have minimum bids of $1-$5 per acre. Lowering the minimum bid from $25 to $5 per acre should not be viewed as a loss of $1.2 million in bonus bids to government on a 60,000 acre tract that is high risk or low potential. A tract of this type in all probabilty would not be leased at $25/acre. However, it would have a higher probabiltiy of being leased at $5/acre and would amount to a $300,000 increase in revenues to the government if the tract were leased.

Coal

Introduction

Ross Schaff former Chief of the DGGS, stated in the 1980 Focus on Alaska's Coal,".. the NPRA should probably be called the NCRA, the National Coal Reserve-Alaska." He goes on to state that the federal government has never initiated a systematic study of the coal resources of NPRA. His words are still true today. Despite work by the Arctic Slope Regional Corporation to systematically study and market the coal resources west of NPRA, the federal government as yet does not understand the coal potential of NPRA. Schaff goes on to say that "...Alaska may have perhaps 50% of the Nation's coal." He also says that Alaska's coal may be the energy equivalent of the worlds oil reserves. Schaff states that the North Slope alone may contain up to 4 trillion tons of "hypothetical or suspected" coal resources (Sanders, 1980). Further, in his talks with Jim Callahan, formerly of the BLM and USGS, they estimate that 80% of Alaska's coal is in NPRA. If these percents are valid, then NPRA may contain up to 40% of the Nation's remaining coal resources! Yet this resource is being ignored by the federal government; BLM did not attend the most recent Focus on Alaska's Coal.

Resource Estimates

Various estimates of the coal resources vary from 120 billion tons up to 4 trillion tons (suspected).
In 1988-1989, BLM Geologist Fred Payton reviewed several reports containing resource estimates and reviewed a small part of the coal data that BLM has in its possession. He reports that:

> In 1967 Barnes estimates coal resources at 120 billion tons;
>
> In 1976 Tailleur-Brosge estimate coal resources at 220 billion tons;
>
> In 1980 Callahan-Martin estimate coal resources at 848 billion tons.

After reviewing a sampling of BLM data, **Payton (1989)** recommends that the Callahan-Martin 1980 estimate be accepted as a reasonable estimate of the coal resources within the Reserve. Table 2 gives a summary of the Callahan-Martin work by coal ranking and depth. With data now available to BLM, Payton estimates that it would require at least one man-year to review the available data and generate new estimates. It is his opinion that whether you accept the 120 billion ton figure or the 848 billion ton figure, it is definately a lot of coal. Payton estimates that the 848 billion ton figure is 3 times the current estimated U.S. coal reserve base.

Former BLM/MMS/USGS geologist Jim Callahan outlines in notes to the file an analysis process for compiling and interpreting his available field data into a comprehensive report. This data was collected by Callahan during various field trips with the USGS and MMS. While with BLM, other duties prevented him from completing this task.

Mowatt, et al. (1989, in press, 1993) states "Bituminous-subituminous coal resources are on the order of at least 2.7 trillion tons, in seams as much as 20 feet thick (Fig. 3). These coals are low in ash and in sulfur content, some are of coking-quality. The region may contain on the order of at least 30 percent of the total coal resources potential of the United States".

Proposed Actions

As the primary caretaker of the Nation's mineral estate, BLM's mandate is to manage and sustain these resources for future generations. Although uneconomic at the present, the vast coal resources in NPRA could have a significant impact on future generations. To this end, Payton and Callahan recommend further study to identify and quantify areas that could be mined by surface methods. To stay abreast of new information and studies, the Bureau should provide funding to attend future "Focus on Alaska's Coal " meetings.

Other Known or Suspected Minerals

Introduction

Perhaps the least known of all of NPRA's mineral wealth is its "hard rock" mineral potential. Being a part of the same geological trend as the Red Dog zinc-lead mine, southern NPRA is thought to hold significant quantities of these minerals (Fig. 3). Although various separate qualitative geology, mineralogy, and geochemistry studies have been made by the USGS and Bureau of Mines (BM), no quantitative assessment studies have been completed. The BM is currently engaged in its Colville District study of the area. Results of this study are incomplete. BLM geologists have contributed several papers on this area of NPRA.

Mineral Potential

Perhaps the best of these papers is Mineral Resources of Western Arctic Alaska, BLM open file report #39 **(Mowatt, et al., 1991b)**. The report is concise and easy to read for the layman, but still comprehensive in that it identifies the previous studies, geology, possible minerals present, location, and outlines recommended future studies. Mowatt's work will be briefly summarized below.

Mowatt, et al.(1991b), identify the possible occurrence of zinc, silver and geochemical anomalies for zinc, lead, arsenic, barium, silver, chromium and four areas of known occurrence: 1) Drenchwater Creek; 2) Story Creek; 3) Kivliktort Mountain; 4) Whoopee Creek. However, since NPRA is closed to private sector mineral exploration, the necessary exploration work to delineate and quantify these occurrences and anomalies has not been done.

Mowatt, et al, (1991b) describe two geological settings based on geologic age. The northern setting is predominantly coal prone but is permissive of other mineral resources including uranium. The older of the

Table 2

Hypothetical Coal Resources in the Nanushuk Group in the National Petroleum Reserve--Alaska (In Millions of Tons)

Rank	Thickness (ft) / Depth (ft)	0-1,000	1,000-2,000	2,000-3,000	3,000-4,000	4,000-5,000	5,000-6,000	Subtotals*	Total*
Subbituminous	2.5-5.0	87,700	72,600	33,500	2,130	--	--	196,000	478,000
	5.0-10.0	96,300	79,600	36,800	2,340	--	--	215,000	
	10.0+	29,900	24,800	11,500	727	--	--	66,900	
Bituminous	1.2-5.0	64,900	52,900	36,600	13,600	1,780	149	170,000	370,000
	5.0-10.0	46,500	37,900	26,300	9,770	1,280	107	122,000	
	10.0+	29,600	24,200	16,700	6,220	813	68	77,600	
Subtotals*	1.2-5	153,000	125,000	70,100	15,700	1,780	149	366,000	848,000
	5.0-10.0	143,000	117,000	63,100	12,100	1,280	107	337,000	
	10.0+	59,500	49,000	28,200	6,950	813	68	145,000	

*Totals and subtotals rounded to 3 significant figures

From Callahan and Martin, 1980

two, the southern, encompasses or lies adjacent to known occurrences of phosphate rock, metalliferous oil shale, zinc, lead, silver, barite, chromite, platinum group elements, copper, and fluorite. This southern setting is also on trend with the world class Red Dog lead-zinc mine and contains the four areas mentioned above. The Red Dog mine is the second largest zinc deposit in the world. **Mowatt,et al (1991b)**, gives the average grades of ore at Red Dog as 17.1 percent zinc, 5.0 percent lead and 2.5 ounces of silver per ton.

In particular, the Drenchwater Creek area is known to contain high grade lead-zinc-silver deposits. "Analytical results show the presence of up to 26 percent zinc, 5.9 percent lead and 5.84 ounces of silver per ton" **(Mowatt, et al, 1991b)**. The deposit as currently mapped extends 7,000 to 10,000 feet. The geochemical anomalies of the region indicate that the zone could be up to 20 miles long and four miles wide. Analyses of samples from Story Creek indicate 18.5 percent lead and 19 percent zinc. In all, some 41 noteworthy metallic mineral sites have been identified as exploration targets within the southern geologic setting of NPRA. **Conrath** prior to the opening of Red Dog, states that "With the construction of a new port and road to the prospect (Red Dog) only 120 km west of Drenchwater Creek, the economic significance of Drenchwater Creek and surrounding mineralized areas becomes greatly enhanced." **Mowatt, et al, (1991a)** discuss the Red Dog deposit and address additional aspects of regional geology relevent to NPRA as well.

Although not as well defined, other mineral resources are thought to be present within NPRA. Based on analogous geologic settings, the rocks of southern NPRA may contain possible significant quantities of nickel, chromium, vanadium, copper, yttrium, molybdenum, cadmium, and lead. Oil shales also occur in the southern foothills of NPRA. In addition to their hydrocarbon content, oil shale samples contained anomalously high concentrations of the metals copper (.048 percent), cobalt (.024 percent), molybdenum (.044 percent), nickel (.096 percent), vanadium (.31 percent), barium (6.27 percent) and zinc (.7 percent). In addition, noteworthy levels of silver, gold, mercury and arsenic were also found in oil shale samples.

Strategic and Critical Minerals

Critical minerals are those defined as "Those minerals essential to the national defense the procurement of which, during war, while difficult, is less serious than those of strategic minerals because they can either be domestically produced or obtained in more adequate quantities from reliable foreign sources." Strategic minerals are defined as "Those commodities essential to the national defense for the supply of which, during war, we are wholly or in part dependent upon sources outside the boundaries of the United States." (Bureau of Mines, 1968)

Mowatt (July 1987) states that the Bureau of Mines currently lists silver, fluorine, gold, cobalt, and nickel as among those considered strategic or critical minerals. All of these minerals are known or thought to exist within the broad Northwest Alaska mineral trends which include southern NPRA. In addition, the USGS (1986) classifies the strategic and critical minerals of southern NPRA as follows:

<u>High potential, identified occurrences, possibility of recoverable quantities</u>:

sediment hosted lead, zinc, silver with cadmium, and antimony;
sulfide hosted lead, zinc, silver, with cadmium, and antimony.

<u>Some potential, identified occurrences, low probability of recoverable quantities</u>:

fluorspar
chromium
platinum group elements

<u>Some potential, no identified occurrences, permissive geological conditions</u>:

Carbonate hosted lead-zinc with cadmium, antimony, copper, cobalt, bismuth
Dolomite hosted copper-cobalt with copper, cobalt, zinc, lead, antimony
Massive sulfides in basaltic rocks--copper, zinc
Sandstone hosted uranium and vanadium

The occurrence of platinum and palladium (also considered as critical/strategic commodities) in noteworthy concentrations within mafic-ultramafic igneous rocks across the region south-southwest of, and adjacent to NPRA has been documented by **Mowatt (1991)**; the significance and extent of this association remain to be more fully elucidated.

The Bureau of Mines and the USGS are doing more detailed work in these areas to better define this potential. One exploration company has expressed an interest in this area, but was denied an exploration permit because NPRA is closed to all mineral entry except oil and gas. The Arctic Slope Regional

National Petroleum Reserve–Alaska

Coal and "Hard Rock" Minerals

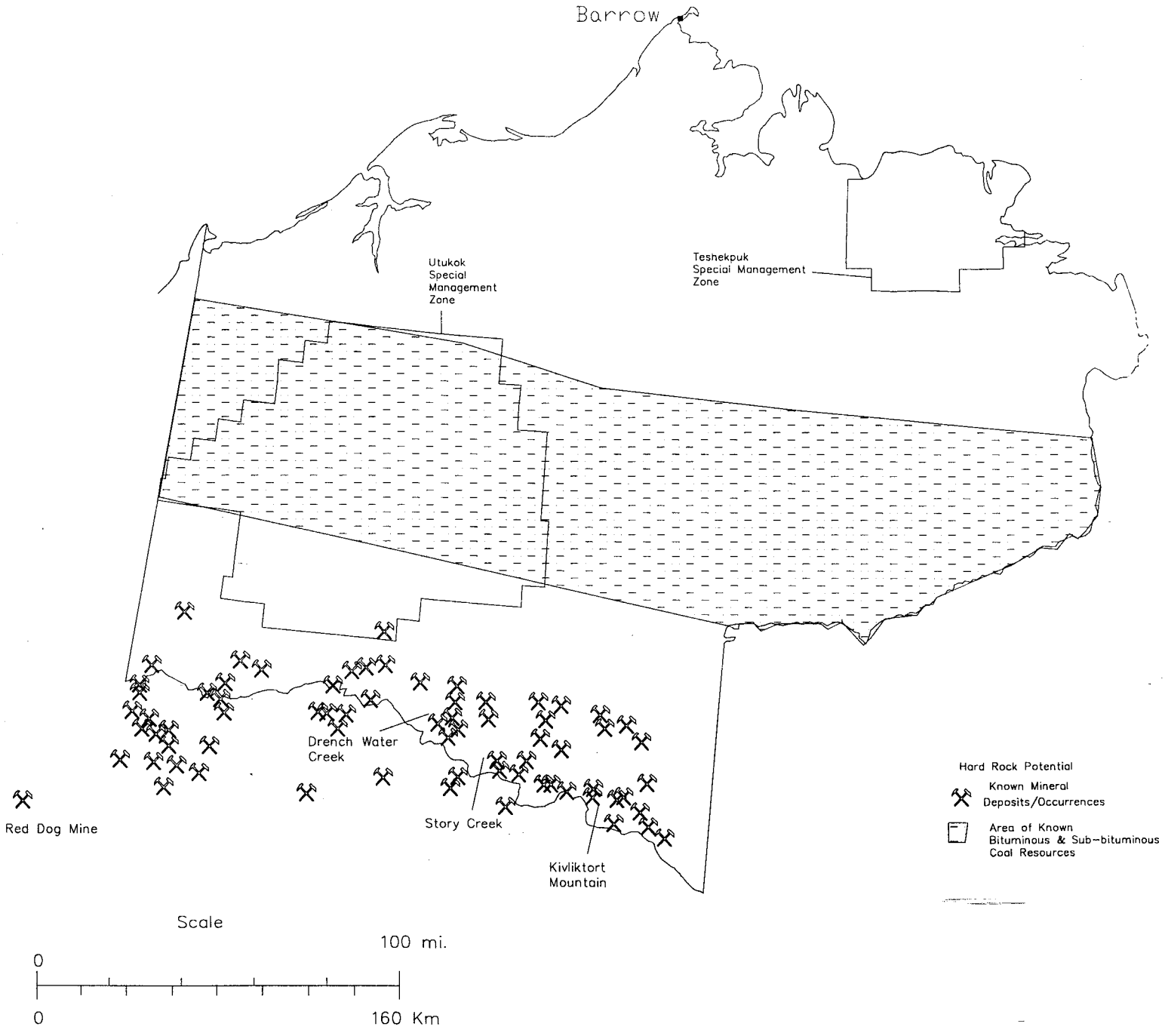


Figure 3

Corporation has also expressed interest in the area.

Proposed Actions

Although much of the mineral potential of this region is speculative, the evidence exists that this region of Alaska can be termed a potential "world-class" mineral belt and should be managed as such. Therefore, it is imperative that BLM actively participate in the BM/USGS Colville mining district studies. Again, only active participation by BLM will ensure that the land managers have the necessary information to make informative decisions. Other than transportation to and from the field, the costs of this participation would be nominal to the Bureau as BLM has the technical expertise on board at both the state office level and district level to be an active scientific participant.

Conclusion

Table 3 summarizes various resource information for NPRA. The mineral estimates are outdated. Those estimates that are more recent are based on old information gathered in the early 1980s. They have been hindered by inadequate funding for field work to gather new information and lab work to properly analyze geologic samples. Good resource management dictates that these estimates be revised using new information with modern analysis techniques.

Over the last ten years, the Bureau of Land Management and the Branch of Mineral Assessment have been in a reactive mode concerning the mineral potential of NPRA. The minerals management of the reserve has consisted of a group of minerals issue papers written in reaction to proposed Congressional action. These papers have been written on short notice; all speculated at the resource potential of NPRA. As the issue papers have pointed out, the National Petroleum Reserve in Alaska has the potential to be the nation's last great mineral frontier. These resources could have a significant impact on the states' and nations' economies. Over 50% of our nation's oil suppy comes from unstable foreign sources. NPRA has enough clean coal to replace a significant portion of our nations' oil needs. The reserve has speculative world class non-energy minerals deposits as well as speculative strategic and critical minerals. Accurate minerals studies take several years. Regardless of current leasing interest or policy, the Bureau should take steps now to identify the overall mineral potential of the reserve and incorporate this information into long term management plans; it has the expertise to do so.

National policy has placed NPRA into a dormant and conservation state because of its isolation. The NPRA is no longer isolated. Oil and gas development are now at its eastern border. Active exploration is occurring within its borders. There is now hard rock mineral resource development near its southern border. The State of Alaska, Industry, and the Natives are all interested in the untapped mineral wealth of NPRA. The BLM has the mineral and surface professional staffs to lead in the detailed study of the resources of area.

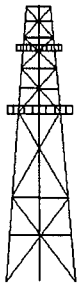


TABLE 3

TABLE 3

NPRA Resource Estimates Summary

Mineral	Date	Range	Mean
Oil	1980	.300 - 5.4 Bbbl	2.1 Bbbl
Gas	1980	1.8 - 20.4 Tcf	8.5 Tcf
Coal	1976-1991	.220 - 2.7 T tons	NA
Utukok Area			
Oil	1992	19.4 - 598 MM bbl	185.4 MMbbl
Gas	1992	.4 - 6.6 TCF	2316.9 Bcf
Teshekpuk			
Oil	1991	27 - 763 MMbbl	306 MM bbl
Gas	1991	.1 - 4.5 Tcf	1.7 Tcf

MM=million B=billion T=trillion cf=cubic feet bbl=barrels

Metallic Minerals

Mineral	Date	Sample Analysis
Lead	1991	18.5%
Zinc	1991	26%
Silver	1991	5.84 oz/ton

Strategic & Critical Minerals

Mineral	Potential
zinc	high
silver	high
cadmium	high
antimony	high
fluorspar	some
chromium	some
platinum group elements	some

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About the Bureau of Land Management Minerals Program

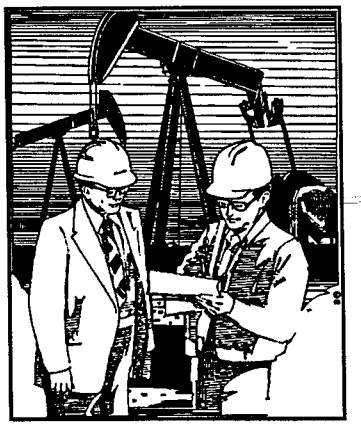
Few people realize that the Bureau of Land Management minerals program evolved over 100 years and involved three agencies, the General Land Office, the Bureau of Mines and the U.S. Geological Survey.

The roots of the BLM minerals program go back to the mining laws of 1866, 1870, 1872 and 1873. These laws effectively opened the west to minerals development and were administered by the General Land Office. In 1906 President Theodore Roosevelt temporarily withdrew coal lands from mineral entry under the mining laws. The U.S. Geological Survey (USGS) began systematically mapping coal lands and established the Lands Classification Board to oversee the project. By 1920, coal, oil, gas, nitrate, and phosphate lands were closed to mineral entry under the mining laws and the mineral rights reserved to the Federal government.

In 1920, Congress passed the Minerals Leasing Act. This act changed the disposal of oil, gas, coal, and some other minerals to competitive leasing. The responsibility for leasing oversight was given to the Bureau of Mines. In 1925 the Secretary of Interior transferred The Oil and Gas Leasing Division of the Bureau of Mines into the USGS. This Division combined with the Lands Classification Board to become the Conservation Branch of the USGS and in 1949 became the Conservation Division. It's functions were to: classify the mineral and water power potential of federal lands; manage exploration, development, and operations for minerals in the federal estate, including submerged lands under the outer continental shelf; maintain production accounts of minerals extracted from federal lands; provide economic evaluations of all minerals on federal lands considered for lease or exchange; provide consulting services to the Secretary of Interior on the management of nationally owned resources.

In 1946, the General Land Office and the Grazing Service were merged to form the Bureau of Land Management. The Acquired Minerals Act of 1947 gave BLM mineral lease administration responsibilities to go with its mining law administration. To handle these growing responsibilities, in 1951 the BLM created the Division of Minerals in Washington, D.C. In 1981, the Secretary of the Interior formed the Minerals Management Service (MMS) as a separate agency within the Department of Interior. The Conservation Division was eliminated and all employees and functions were transferred into the MMS. In 1982-83, The Secretary of Interior transferred all Onshore Minerals Management functions of MMS into the BLM.

Today, the Energy and Minerals Resources program within BLM has all the minerals responsibilities of the Conservation Division and the General Land Office. These include: inspection and enforcement of all minerals activities on public onshore lands to ensure compliance with federal environmental laws; leasing and lease management of minerals on all federal lands; identification and evaluation of subsurface energy minerals and the determination of their economic value; and recording, managing, patenting, and inspecting federal mining claims. The Bureau of Land Management continues the practice of balancing careful exploration and development of resources with sound environmental practices under the legislative mandate of sustained yield for future generations. In Alaska, the BLM Division of Mineral Resources, in addition to the responsibilities mentioned above, also works closely with the Fish and Wildlife Service on minerals evaluations and oil and gas management in the National Wildlife Refuges; and evaluates the recoverable oil and gas resource potential of the Arctic National Wildlife Refuge Coastal Plain area.



NPRA's Mineral Potential
A Very Brief Perspective

Prepared by
Alaska BLM, Branch of Mineral Assessment

The National Petroleum Reserve, Alaska (NPRA), covers some 23 million acres in northernmost Alaska. It was established based on the presence of geology favorable to petroleum and the presence of oil seeps at Simpson Lagoon, Skull Cliffs, Fish Creek, Umiat, the Lisburne well area, and oil-stained sandstones in the foothills. At present, the known oil discoveries are at Umiat, a sub-giant field or possibly a giant field estimated to be 70 to 120 million barrels, the Simpson area, and the Fish Creek area. The known gas fields include Barrow, east and south, which also have unproduced oil, Walakpa, Square Lake, Meade, and Wolf Creek areas.

To date, only some 30 wells have been drilled with modern methods and CDP seismic mapping on these 23 million acres. These wells were drilled for stratigraphic assessment rather than discovery, but most have oil shows. The drilling data and outcrop data indicate that there are at least four potential oil generating units in NPRA. Seismic interpretation shows the presence of both stratigraphic and structural traps. The complicated foreland and thrust region of NPRA is similar to and on trend with the recently explored and now productive foreland and thrust regions of the Rocky Mountain Cordillera. Little exploration has taken place in this area of NPRA.

Although no areas outside of the Barrow Gas Field (local market) are currently producing, the sediments, their geochemical richness, type and maturity indicate that large quantities of oil and gas have been generated. A large-scale, modern exploration effort is still required to adequately define the potential of this part of the North Slope Petroleum Province. Alaska's North Slope is probably the nation's best hope for adding to the nation's oil reserves. NPRA comprises about 50 percent (areally) of this oil province.

In addition to oil, NPRA contains large quantities of coal. Speculative estimates indicate that NPRA may contain up to four trillion tons of coal; if these estimates are correct, Alaska may contain 50 percent of the nation's coal. These resource estimates are highly speculative, but worthy of further study. Besides coal, southern NPRA contains undetermined quantities of phosphate deposits, which usually contain rare earth elements of strategic importance. This area of NPRA is also on trend with the Red Dog lead-zinc deposit, and similar mineralization has been identified in at least three areas of southern NPRA (more detailed information on these speculative estimates is in the attachments).

To date, economics seem to be the driving force behind the lack of interest in NPRA. During the leasing program in the early 1980s, there was no oil and gas development west of Prudhoe Bay. However, as oil development moves westward from Prudhoe Bay to the Colville River discoveries, and with the recent Red Dog mine operations, the economic outlook for NPRA could change; NPRA could once again move to the forefront for our nation's mineral needs.

Southern NPRA Mineral Potential
Utukok Area

Coal

Ross Schaff, former state geologist for Alaska, stated in 1980 in Proceedings of the Conference on Focus on Alaska's Coal, 1980:

1. Alaska may contain up to 50 percent of the nation's coal.

2. Eighty percent of this coal is located in NPRA.

3. Fifty-five percent of this coal is in the Utukok area of NPRA.

Oil and Gas

1. Besides coal resources, the Utukok area has very large anticlinal trends in excess of 100 miles long which may contain large hydrocarbon traps.

2. The area is essentially untested, with only two wells in the area. The northern (Kaolak No. 1) well was drilled by the U.S. Navy in 1951 to a depth of only 6,952 feet and, although no significant thicknesses of reservoir rock were found, nine shows of oil and gas were noted. Seismic data indicates that at least 10,550 feet of sedimentary rock lies untested below bottom hole.

Other Mineral Resources of Southern NPRA

1. Using methodology for mineral assessment required by BLM Manual 3031, the southern portion of NPRA has HIGH POTENTIAL for lead-zinc.

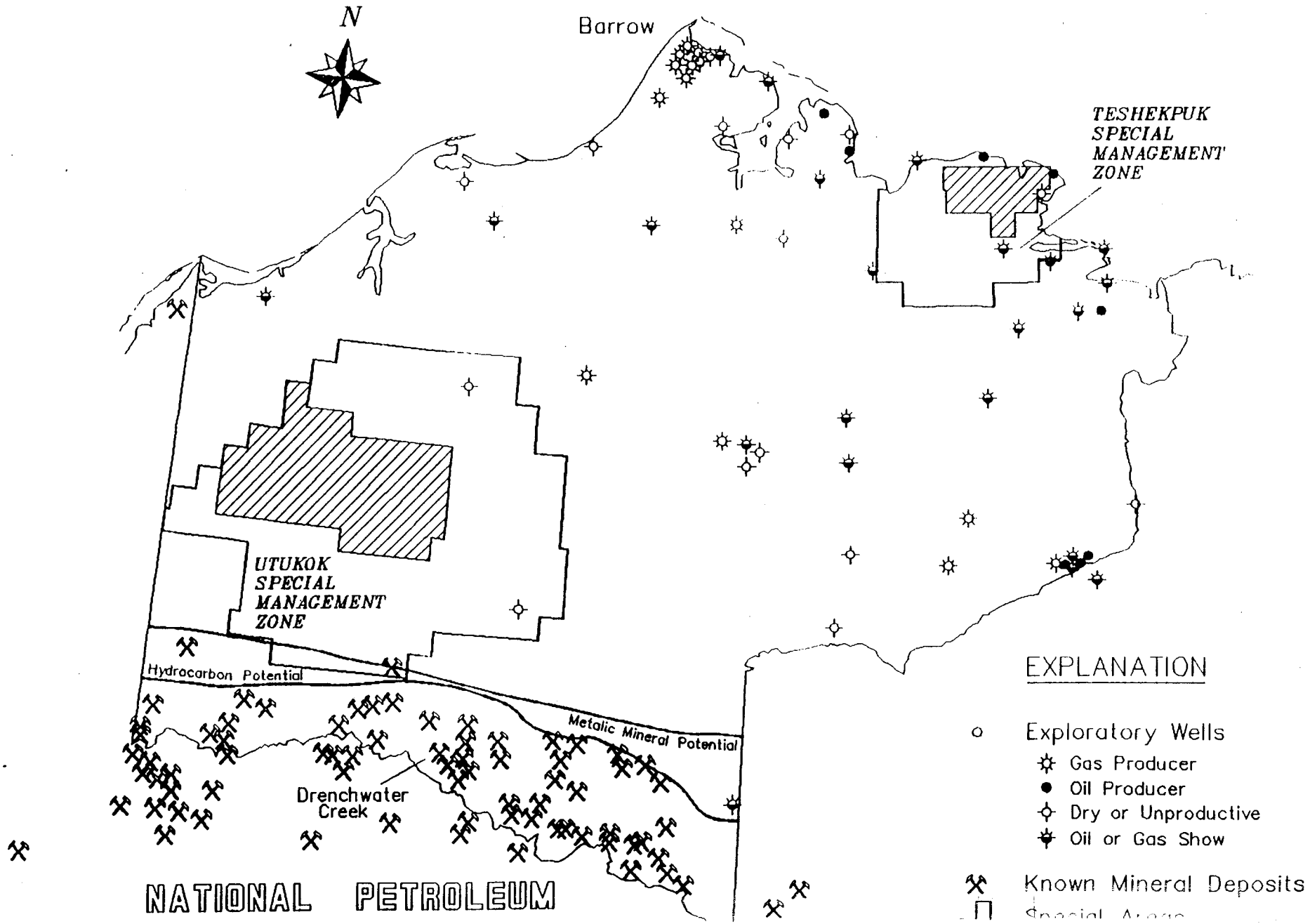
2. Southern NPRA is on trend with "world-class" base and precious mineral deposits RED DOG. "It is not now possible to state with any technical assurance that the area within NPRA has greater or lesser potential to contain significant mineral deposits than any other area within this trend." (Tom Mowatt - BLM.)

3. An example of a known mineralized zone within NPRA and this trend occurs at Drenchwater Creek where assays contain up to 31 percent zinc and 8.4 percent lead. These are not, however, strategic minerals. Associated silver, however, is.

4. Phosphate rocks are known in several occurrences within NPRA, but at this time are of undetermined extent and quality. These may yield valuable by-products such as uranium, vanadium, and rare earths. Given the breakthroughs in high temperature superconductors which have occurred in the last year, one of whose components are members of the rare earth family, in the long-term, the presence of rare earths may be the most valuable mineral occurrence of all. Anomalously high indications of other strategic and critical minerals are also present.

Interesting fact: NPRA is an area approximately equal to the state of Indiana.

NPRA has high mineral potential; however, investigations of the area have been relatively superficial. The type of detailed work necessary to resolve geologic features of the relatively small size of mineral deposits is totally inadequate.


N
Barrow
TESHEKPUK SPECIAL MANAGEMENT ZONE
UTUKOK SPECIAL MANAGEMENT ZONE
Hydrocarbon Potential
Metalic Mineral Potential
Drenchwater Creek
NATIONAL PETROLEUM
EXPLANATION
Exploratory Wells
Gas Producer
Oil Producer
Dry or Unproductive
Oil or Gas Show
Known Mineral Deposits

Standard to drill wildcat wells on Colville Rive

The Associated Press

Standard Alaska Production Co. plans to drill two wildcat wells on the North Slope this winter, ending several years of exploration inactivity.

The wells will be drilled on state leases in the Colville River area southwest of the ...aruk River oil field, said ...ael Brownhill, Stan...'s vice president for exploration. Brownhill was transferred from Texas to Alaska last year as part of the company's renewed effort to search for arctic oil.

ARCO Alaska Inc., the state's other major oil producer, recently drilled two wildcat wells and is sinking a third. ARCO also has transferred a top executive to Alaska as part of a new commitment to exploration.

Brownhill said Standard, the state's largest oil producer, is prepared to spend $10 million to $40 million on North Slope exploration projects this winter.

He said that in the interest of keeping development costs down, the company's immediate plan is to look for economically marginal oil fields near existing facilities.

"We're optimistic fields can be found in the central North Slope, but it's going to be tough," he said.

"There are going ... some wells and some ... pointments."

Standard's exploratio... gram dwindled whe... prices plunged to $10 a ... in early 1986.

Red Dog mill facility OK'd

VECO Inc. and Nana Development Corp., in a joint venture, have won a contract to install a mill facility at the Red Dog lead and zinc mine development near Kotzebue, said Pete Leathard, VECO president.

The contract is for $4 million to $5 million, said Lisa Parker, spokeswoman for Cominco Alaska Inc., the mine developer.

The modular mill is to be installed next summer so that operation can begin by the following winter. Leathard said that about 200 workers will be employed on the job. About half of the workers likely will be hired from the Kotzebue area, he said.

The facility is being built in the Philippines.

The Red Dog mine will be one of the largest of its kind when it starts production in the early 1990s.

National Petroleum Reserve-Alaska

Introduction

The National Petroleum Reserve-Alaska (NPRA) occupies most of the western portion of Alaska's prolific petroleum-producing North Slope Geologic Province. At its northeastern corner, it nearly abutts the major petroleum fields of the North Slope. It also contains the Umiat oil field, a currently non-produc-ing, but giant field which contains estimated in-place oil resources of some 70 to 120+ million barrels. It also contains the Barrow gas field which supplies gas to the City of Barrow. Despite the drilling of 23 exploration stratigraphic test wells in NPRA, large portions of this 23 million acre petroleum reserve remain virtually untested.

Exploration for petroleum in Alaska has proven to be largely disappointing outside of the North Slope. The only other major producing province in Alaska is the Cook Inlet-Kenai Peninsula area, which has the McArthur River Field -- a giant oil field, but this area has nowhere near the proven resources of the North Slope.

While other onshore basins in Alaska have received some exploration interest, the results in these have likewise been disappointing in regards to the finding of petroleum resources and/or reserves. The test wells in the onshore basins have largely been dry, exceptions occur on the Alaska Peninsula and at the once productive Katalla field east of the mouth of the Copper River. The tectonic and thermal histories of several of the onshore basins indicate that, if they do have any petroleum potential, they are likely to be gas prone. Furthermore, given the physical size of the other onshore basins, even if petroleum resources are discovered, they promise to be much smaller than the North Slope reserves.

National wildlife refuges (over 77 million acres in Alaska) cover large portions of the onshore Alaska basins. Of this more than 77 million acres, almost 19 million acres are currently designated wilderness lands. Turning the NPRA into a national wildlife refuge, and possibly into a wilderness area, with much of it untested for its petroleum potential, seems to be premature.

Major offshore fields have been found in the near offshore of the North Slope, but these can largely be considered to be in extensions of the North Slope geologic trends into the Beaufort Sea area. The other offshore areas that have been tested have been disappointing to date. The Minerals Management Service has offered about 48 million acres in its 11 planning areas, has leased about 5 million acres, and currently has about 2.6 million acres under lease. To date, the only announced commercial discovery is at Seal Island in the Beaufort Sea. Alaska now has about 25% of the nations petroleum reserves and the North Slope appears to offer the greatest potential to add to the reserve account. With the declining petroleum reserve position that this nation faces, further restrictions of petroleum exploration activity on large acres of Federal land seems inadvisable, especially on land that offers as much promise as does the NPRA.

Utukok area -oil and gas

The Utukok area lies in the northern foothills of the Brooks Ranges, numerous surface mapped "anticlinal trends", some extending to lengths as great as 200 miles. These trends represents the surface expression of a foreland fold and thrust belts that extends from NPRA to ANWR. Some of these trends are the Carbon Creek, the Snowbank, the Howard, the Blizzard, the Driftwood, and the Archimedes Ridge.

There has been an increasing awareness of the complexity of these "anticlines" throughout foreland fold and thrust belts of the world. Systems of thrust faults such as duplexs and imbricated thrust system are now increasing known as unexplored locations of hydrocarbon traps (Mitra, S, 1986).

Some examples of oil and gas fields found in similar tectonic settings in the Rocky Mountains are the Whitney Canyon, Ryckman Creek, Painter Reservoir, Pineview, East Anshutz Ranch, Elkhorn, Lodgepole, Yellow Creek. These fields average 129 million barrels with a maximum of 612 million barrels.

The Utukok area is essentially untested and never been offered for lease,with only one well (Kaolak #1) on the extreme northern end of the area. The well was drilled by the U.S. Navy in 1951 to depth of only 6952 ft. and although no significant thickness of reservoir rock there were 9 shows of oil and gas noted. Seismic data indicates that at least 10550 ft. of additional sedimentary rock lies untested below bottom hole.

Potential plays in the area include the Nanushak, Fortress Mountain, the Lisburne and the pre-Lisburne. It is interesting to note that although never drilled due to the start of leasing in NPRA the Carbon #1 well was proposed and site selected in the USGS assessment program for 1982. The proposed well was to be located on the Carbon trend and the proposal estimated potential reservoirs of Nanushak, Fortress Mountain, and Basal Cretaceous, with and estimated 38,000 acres potential closure within the Fortress Mountain which was the primary objective. Estimates made on the basis of the Tetra-Tech analysis of the Utokok area indicate 1.2 million acres of potential prospects, when stacked reservoirs are considered.

In summary, the Utokok are is an area with many potential targets which has not had a subsurface test.

Coal

The Utukok area contains vast amounts of coal that are relatively unknown outside of Alaska.

Barnes (1967) estimated that there were 120,197 million tons of "identified resources" coal on the North Slope of Alaska. Tailleur and Brosge (1976) calculated an "additional speculative resource" of 220 billion to 3.35 trillion tons, for a total of 321 to 3,471 billion tons. Schaff (1980) estimated between 402 and 4,000 billion tons of "hypothetical resources" and 60 to 146 billion tons of identified resources for a total of 460 to 4,146 billion tons of coal on the North Slope.

Schaff (1980) estimates that 55 percent of the coal on the North Slope of Alaska occurs within the Utukok area of NPRA. If this estimate is correct, the Utukok area may contain 177 to 2,280 billion tons of coal. If Schaff (1980) is correct in his other estimates; (1) 50 percent of the nation's coal is in Alaska, and (2) 80 percent of Alaska's coal is in NPRA, then the Utukok area may hold approximately one-quarter of the nation's coal resources (22 percent).

In addition to coal, the Utukok area has additional mineral potential. There are known phosphate occurrences with this area of NPRA, but the quantities are unknown. Phosphates are usually sources of the rare earth elements which can have strategic importance.

This southern portion of the Utukok area is also on trend with Red Dog, a "world class" lead-zinc discovery. It is not possible to say at this time if there is a greater or lesser potential of similar deposits in NPRA than outside it.

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Tailleur, I. L., and Brosge, W. P., 1976, Need to revise and test estimates of northern Alaska coal resources, in The U.S. Geological Survey in Alaska -- Accomplishments during 1976: U.S. Geological Survey Circular 751-B.

(coal; RT)

The National Petroleum Reserve, Alaska (NPRA) covers some 23 million acres in northermost Alaska. It was established based on the presence of geology favorable to petroleum and the presence of oil seeps at Simpson Lagoon, Skull Cliffs, Fish Creek, Umiat, the Lisburne well area, and oil stained sandstones in the foothills. At present, the known oil discoveries are at Umiat, a sub-giant field or possibly a giant field estimated to be 70 to 120 million barrels, the Simpson area, and the Fish Creek area. The known gas fields include Barrow, east and south, which also have unproduced oil, Walakpa, Square Lake, Meade, and Wolf Creek areas.

Table 1 shows the exploration and development wells and the particular phases of exploration that have taken place. To date, only some 30 wells have been drilled with modern methods and CDP seismic mapping on these 23 million acres. The drilling data indicate that there are at least four oil generating units in NPRA. The Shublik (Triassic), the Kingak Shale (Jurassic-Cretaceous), the Pebble Shale Unit (Lower Cretaceous), and the Torok Shale (Cretaceous). Mapping shows that these units underlie most of NPRA. Thermal maturity modeling indicates that thse units are thermally mature to generate oil in many areas of the reserve. Seismic facies analyses shows that petroleum reservoir units are also widespread in the NPRA subsurface. And, seismic structural interpretation shows the presence of both stratigraphic and structural traps, particularly the traps in the structurally complicated foreland and thrust region have recently been proven to be productive in foreland and thrust regions of the Rocky Mountain Cordillera.

Although no areas outside of the Barrow Gas Field are currently producing, the sediments, their geochemical richness, type and maturity indicate that large quantities of oil and gas have geen generated. A large-scale, modern exploration effort is still required to adequately define the potential of this part of the North Slope Petroleum Province.

Table No. 1

First Phase of North Slope Oil Exploration
1946-1953

Well	Depth	Notation
No. Simpson No. 1	3774	Drilled on basis of extensive surface seeps. 1945-1951, 33 shallow "core tests" were also drilled in this area.
So. Barrow No. 1	3553	Gas well.
So. Barrow No. 2	2504	Gas well.
So. Barrow No. 3	2900	Gas well.
Grandstand No. 1	3937	Oil well in Umiat Field p/a.
Fish Creek No. 1	7020	Drilled on basis of surface seeps. Tested oil 200 bopd from Nanushuk.
Oumalik No. 1	11872	
. Oumalik No. 1	6035	Gas shows.
Square Lake No. 1	3987	Gas well p/a.
Wolf Lake No. 3	3760	Gas well p/a.
Titaluk No. 1	4020	
Knifeblade 2a	1805	
Meade No. 1	5305	Gas well p/a.
Simpson No. 1	7002	Oil shows.
Topagoruk No. 1	10503	Gas shows.
E. Topagoruk	3589	
Umiat No. 1	6005	Produced oil.
Umiat No. 11	3303	Produced oil.
Umiat No. 2		Oil recovered in Dst.

Table No. 1 (page 2)

First Phase of North Slope Oil Exploration
1946-1953

Well	Depth	Notation
Umiat No. 3		Bailed oil.
Umiat No. 4		Bailed oil.
Umiat No. 5		400 bopd.
Gubik No. 1	6000	Tested producible gas and recoverable oil.
Kaolak No. 1	6952	
Barrow No. 7	2180	Gas well.
Barrow No. 9	2429	Gas well.
Barrow No. 10	2240	Gas well.
Barrow No. 11	2171	Gas well.
Barrow No. 12		Dry well.
Barrow No. 13	2249	Marginal gas well.
Barrow No. 14	1906	Gas well.
Barrow No. 15	2270	Gas well.
Barrow No. 16	2332	Dry well.
Barrow No. 17		1.09 MMCFD and oil cut mud.
Barrow No. 18		Gas well.
Barrow No. 19		Gas well, best in field.
Barrow No. 20		Gas well, marginal oil well.

1987 drilling: 2 gas wells
2 confidential wells.

Second Phase of Exploration
1974-1977

Well	Depth	Notation
So. Barrow No. 12	2285	
Cape Halkett No. 1	9900	
So. Harrison Bay	11,290	Minor shows.
Atigaru Point No. 1	11,535	Oil and gas shows.
W. Fish Creek No. 1	11,423	Drilled at surface seeps. Fish Creek section removed.
W. T. Foran No. 1	8864	Dead oil, good porosity.
So. Simpson No. 1	8795	Gas shows in Torok.

Third Phase of Exploration
USGS-Husky
1977-1981

Well	Depth	Notation
So. Barrow No. 16	2400	
Walakya No. 1	3666	Producible gas, Jurassic sands, oil stained sand.
W. Dease No. 1	4173	Oil shows, some porosity.
Tulugeak No. 1	4015	
Walakpa No. 2	4360	Gas well, drilled to delineate Walakpa Field 6 mile down dip.
No. Kalikpik No. 1	7395	Gas shows, drilled on seismic anomaly.
No. Inigok No.1	10,170	Gas shows.
Koluktak No. 1	5882	Gas shows, good porosity.
Awuna No. 1	11,200	Drilled on surface expression of "triangle xone." Tested 2000+ bwpd.
So. Meade No. 1	9945	Tested gas, oil shows, good porosity.
Kugrua No.1	12,588	Gas shows.
Kuyanak No. 1	6690	Last well drilled.
Drew Point No. 1	7946	Gas show, some oil shows in Sag 16'.
Inigok No. 1	20,102	Gas show and residual oil.
Ikpikpuk No. 1	15,481	Minor gas shows. Lower Cretaceous.
E. Simpson No. 2	7505	Dead oil, good porosity in Ivishak River kekitok.
J. W. Dalton No. 1	9367	Residual oil in Sadlerochit sands.
E. Simpson No. 1	7739	Heavy oil in Ivishak, gas.

Third Phase of Exploration (page 2)
USGS-Husky
1977-1981

Well	Depth	Notation
Seabee No. 1	15,611	Gas shows.
E. Teshepak No. 1	9000	Oil shows, Cretaceous sands.
Lisburne	11,608	Drilled on surface seeps, gas shows.

Fourth Phase of Exploration (page 2)
Industry wells
1981-Present

Well	Depth	Notation
Chevron Livehorse No. 1	900	Minor shows of oil and gas.
ARCO Brontosaurus	Held confidential	

SUMMARY: OIL AND GAS RESOURCE ASSESSMENT UTUKOK CARIBOU/GRIZZLY SPECIAL MANAGEMENT AREA AND UTUKOK CARIBOU DELETED AREA

The Utukok Caribou/Grizzly Special Management Area (USMA) and the Utukok Caribou Deleted Area (UCDA) in the western part of the National Petroleum Reserve in Alaska have a low probability of having economically recoverable oil and gas resources.

The shallow potential reservoir rocks in the area are thin and have low porosity and permeability values, at least as exposed at the surface and in the nearest wells. The deeply buried potential reservoir rocks appear to be below the oil preservation window, and any hydrocarbons that they may contain would probably be natural gas. The source rocks in the area tend to have low organic carbon content of a gas-prone nature. No subsurface geological data exists for the area, but extrapolations from the surface geology, from the subsurface geology of the nearby test wells, and from reflection seismic data hold little promise for the oil and gas potential of the USMA and UCDA areas.

While the available data shows little promise for the area, subsurface data from within the area and new exploration concepts could change the assessment presented here. In this regard, it should be emphasized that no wells have been drilled within the confines of the USMA or the UCDA, that is, this area has not been evenly lightly explored for oil or gas.

Proposing lease sales offering the UCDA and the USMA seems unwise at this time. Remote even by north slope standards, nothing of the known fold and thrust belt structural style characterizing southwestern NPRA's geology distinguishes its petroleum potential from less environmentally sensitive NPRA areas to the north and east. In fact, interpretation of the United States Geological Survey 1988 Alaskan north slope hydrocarbon assessment suggests southwestern NPRA is the least hydrocarbon rich part of the Reserve.

The following tables present estimated potential resouces for the USMA and the UCDA:

Table 1

Utukok Mean Oil, Gas and Area
as a Percent of NPRA Hydrocarbons and Area*

	% Oil	% Gas	% NPRA
UCDA	3	5	5
UCDA + USMA	7	14	17

Basis: USGS 1988 NSHA (Bird, 1991) and Mast, Bird, and Crovelli, 1991, personal communication.

* NPRA encompasses about 36,000 square miles, and , based on the USGS 1988 NSHA, the estimated mean conventionally recoverable hydrocarbons are 2.6 billion barrels of oil and 16.6 trillion cubic feet of gas.

Table 2

NPRA Utukok Areas*
Estimated Recoverable Hydrocarbons
Area: 3.95 million acres

	Oil (MMB)	Gas (BCF)
Mean	185.4	2316.9
F_{95}	19.4	410.3
F_{05}	598.2	6646.2

Basis: Mast, Bird, and Crovelli, 1991, personal communication.

* The Utukok caribou deleted area and contiguous caribou/grizzly special management area.

Table 3

NPRA Utukok Caribou Deleted Area
Estimated Recoverable Hydrocarbons
Area: 1.198 million acres

	Oil (MMB)		Gas (BCF)	
	(a)	(b)	(a)	(b)
Mean	61.0	57	802.7	800
F_{95}	4.5	13	76.0	130
F_{05}	219.3	131	2648.4	2110

Basis: (a) Mast, Bird, and Crovelli, 1991, personal communication.
(b) UCDA prospect maps and USGS 1988 NSHA (Bird, 1991).

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Bascle, R.J., and Foland, R.L., (in preparation, 1991), Oil and gas assessment, Utukok Special Management Area, National Petroleum Reserve in Alaska: U.S. Bureau of Land Management Open-file Report.

Bird, K.J., 1991, Geology, play description, and petroleum resources of the Alaska North Slope (Petroleum Provinces 58-60), U.S. Geological Survey Open-file report 88-450Y, 52 p.

Gryc, George, ed., 1988, Geology and exploration of the National Petroleum Reserve in Alaska, 1974 to 1982: U.S. Geological Survey Professional Paper 1399, 940 p.

SUMMARY: OIL AND GAS RESOURCE ASSESSMENT TESHEKPUK LAKE SPECIAL MANAGEMENT AREA

The Teshekpuk Lake Special Management Area (TSMA) in the northeastern National Petroleum Reserve in Alaska (NPRA) (this report refers to the area marked 'special management zone' on the attached map) has a high potential for having recoverable oil and gas resources. The geology of the area may make it one of the areas in the NPRA with the highest potential for having economically recoverable petroleum resources. Other areas of the NPRA with a high potential are around the Umiat oil field in the southeastern part of the reserve and the Simpson area just northwest of the TSMA.

The TSMA occupies a large area on the southern flank of the Barrow high. This setting is somewhat analogous to the producing oil fields and large, non-producing oil fields on Alaska's North Slope. The details of the geology differ.

Several exploratory test wells in the vicinity provide subsurface geological data. Promising oil and gas shows exist in some of the wells, but all wells have been classified as dry holes. The drilling data shows that the Teshekpuk Lake area has several potential reservoir rock formations and several potential source rock formations. Some of the wells encountered good porosity, but the potential reservoirs produced water upon testing. Abundant reflection seismic data, when tied to the well data, allow the identification of potential plays and traps, some of which have not yet been tested or have not been adequately tested, i.e., they are large enough that one well drilled into them is insufficient to test the structure.

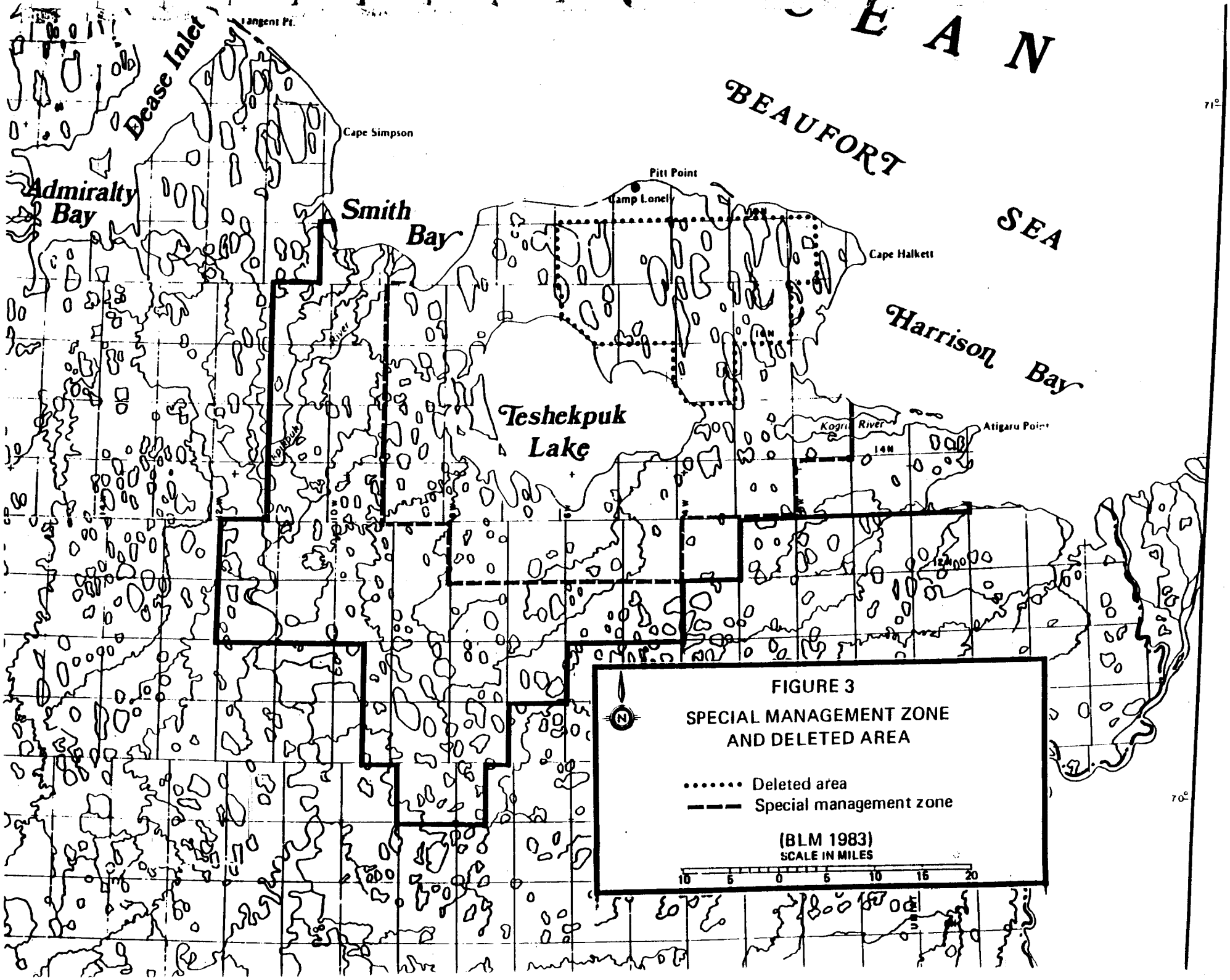
The Lisburne Group carbonates, the group which contains the Lisburne Oil Pool of the Prudhoe Bay Field reaches almost 1,400 feet in thickness beneath the TSMA. The Ivishak Formation, the formation which contains the Prudhoe Bay Oil Pool, reaches almost 820 feet in thickness. The J.W. Dalton Test Well No. 1 encountered dead oil and asphalt in the Ivishak Formation. This indicates that oil has been produced and has migrated through the TSMA. Whether this oil still exists within the confines of the TSMA is yet to be determined. The Sag River Sandstone, another reservoir formation at Prudhoe Bay, reaches thicknesses of almost 160 feet beneath the TSMA.

Only five widely-spaced oil test wells have been drilled within the confines of the TSMA, approximately 1 well per 300 square miles. All have been classified as dry holes. Still, these wells leave most of the TSMA unexplored. Given the thicknesses of potential reservoir rock, the indications of oil or gas, or both, encountered in the wells, and the large acreage still unexplored, it is still quite possible for the TLSMA to contain sizable hydrocarbon resources. Only future exploration could unequivocally answer the question of whether hydrocarbon resources exist within the Teshekpuk Lake Special Management Area.

The TSMA has the following estimated potential resources:

	95%	5%	Mean
Oil (MMB)	27.3-77.0	310.5-763.9	306.6
Gas (TCF)	0.1-0.4	0.8-4.5	1.7

Source: Interpretation of USGS 1988 North Slope Assessment: Bird, 1991.


Dease Inlet
Tangent Pt.
Cape Simpson
Admiralty Bay
Smith Bay
Pitt Point
Camp Lonely
Cape Halkett
BEAUFORT SEA
Harrison Bay
Teshekpuk Lake
Kogru River
Atigaru Point
14N
12N
71°
70°
FIGURE 3
SPECIAL MANAGEMENT ZONE
AND DELETED AREA
Deleted area
Special management zone
(BLM 1983)
SCALE IN MILES
10 5 0 5 10 15 20

REFERENCES USED

Bascle, R.J., and Foland, R.L., (in preparation), Oil and gas assessment,Teshekpuk Lake Special Management Area, National Petroleum Reserve in Alaska: U.S. Bureau of Land Management Open-file report.

Bird, K.J., 1991, Geology, play description, and petroleum resources of the Alaska North Slope (Petroleum Provinces 58-60), U.S. Geological Survey Open-file report 88-450Y, 52 p.

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
6881 ABBOTT LOOP ROAD
ANCHORAGE, ALASKA 99507-2599

January 22, 1993

Memorandum

To: Chief, Branch of Mineral Assessments (985)

From: Robert Bascle, Geologist, and R. Bascle
R.L. Foland, Geophysicist (985) RL Foland

Subject: Impact of recent ARCO Alaska, Inc. discoveries in the Colville Delta Area on NPR-A

ARCO Alaska, Inc. recently announced discoveries in two wells in the Kuukpik Exploration Unit in the Colville Delta area (Figure 1). ARCO tested two zones in each well, but provided no details on pay zones and intervals. Any projections of the potential impact of these discoveries upon the National Petroleum Reserve-Alaska (NPR-A) are, at best, premature.

ARCO's wells (PI Alaska Report, 12-22-92) are:

> 1 Fiord @ sw nw 2-12N-5E UM, which flowed 1,065 barrels of 32° oil per day from one interval and 180 barrels of 26° oil from a second interval, was drilled to a true vertical depth of 9,973 feet;
>
> 1 Kalubik @ nw sw 11-13N-7E UM, which flowed 1,200 barrels of 26° oil per day from one interval and 410 barrels of oil from a second interval, was drilled to a true vertical depth of 8,273 feet.

Four other wells (PI Alaska Report, 12-22-92) drilled within the exploration unit are "capable of production in paying quantities." Details on the productive intervals in these wells also have not yet been released. These wells include: Amerada Hess Corp., Colville 25-13-6 #1, 25-13N-6E; Texaco, Colville #1, 17-13N-7E; Texaco, #2 Colville, 23-13N-7E; and Texaco, Colville #3, 33-13N-7E.

Of the productive wells, the 1 Fiord, at about 10 miles distance, is the nearest to NPR-A. Of the dry holes, the Nechelik 1 is about four miles from NPR-A and down structural dip from the 1 Fiord well (Figure 1).

Although we have no information about the discovery intervals, we show in Figure 2 that the stratigraphic section in the Nechelik 1 well, six miles southwest of ARCO's 1 Fiord discovery (Figure 1), is quite similar to that of the East Teshekpuk 1 well in NPR-A, about 47.6 miles to the west of the Nechelik 1 well.

Given this high correlation in the stratigraphic sections, we can speculate that the formations penetrated by the 1 Fiord well extend into NPR-A. The Nanushuk Group thins significantly between the E. Teshekpuk and Nechelik wells, and it may not be present in the 1 Fiord and is probably missing from the 1 Kalubik.

If the discovery intervals lie within the shallow portion (less than 1,500 feet deep) of the wells, then the discovery intervals may not extend into NPR-A. Any deeper interval may extend into NPR-A. Even if the discovery intervals extend into NPR-A, these same intervals could be void of any hydrocarbons or reservoir lithologies within NPR-A.

An east trending seismic line that ties the South Harrison Bay 1, Nechelik 1, and BP-Colville 1 wells passes about 2.75 miles south of the 1 Fiord well. The interval (breakup sequence) containing time-stratigraphic equivalents of the sands likely testing oil in the 1 Fiord well was traced, via good quality seismic data, from the Nechelik well on the Colville River delta, where the breakup sequence is about 1,200 feet thick, westward, with scant thickness change, to the S. Harrison Bay well in the northeastern NPR-A. Clearly, time-stratigraphic equivalents of the strata thought tested by the 1 Fiord well pass into the northeastern NPR-A. No such certainty, however, attends the probability that the productive lithologies tested on the Colville River delta follow the break-up sequence into the NPR-A. Never-the-less, the productive play of the 1 Fiord and, presumably, other Colville River delta discovery wells, may extend into the NPR-A. The specific accumulation(s) tested by the Colville River delta wells, however, probably terminate(s) short of the NPR-A. Combining our meager knowledge of these productive wells with our notions of likely modes of break-up sequence oil occurrence, we are best off, at this point, acting as if the "break-up sequence play," that we assume productive beneath the Colville River delta, underlies the northeastern NPR-A.

When ARCO, Texaco, and Amerada Hess release more information about their discoveries, the question of possible impact upon NPR-A should be reinvestigated. If these discoveries are not economically viable, then the question of impact upon NPR-A becomes moot. ARCO is currently, or soon will be, drilling more wells in the delta to determine the economic viability of the discoveries.

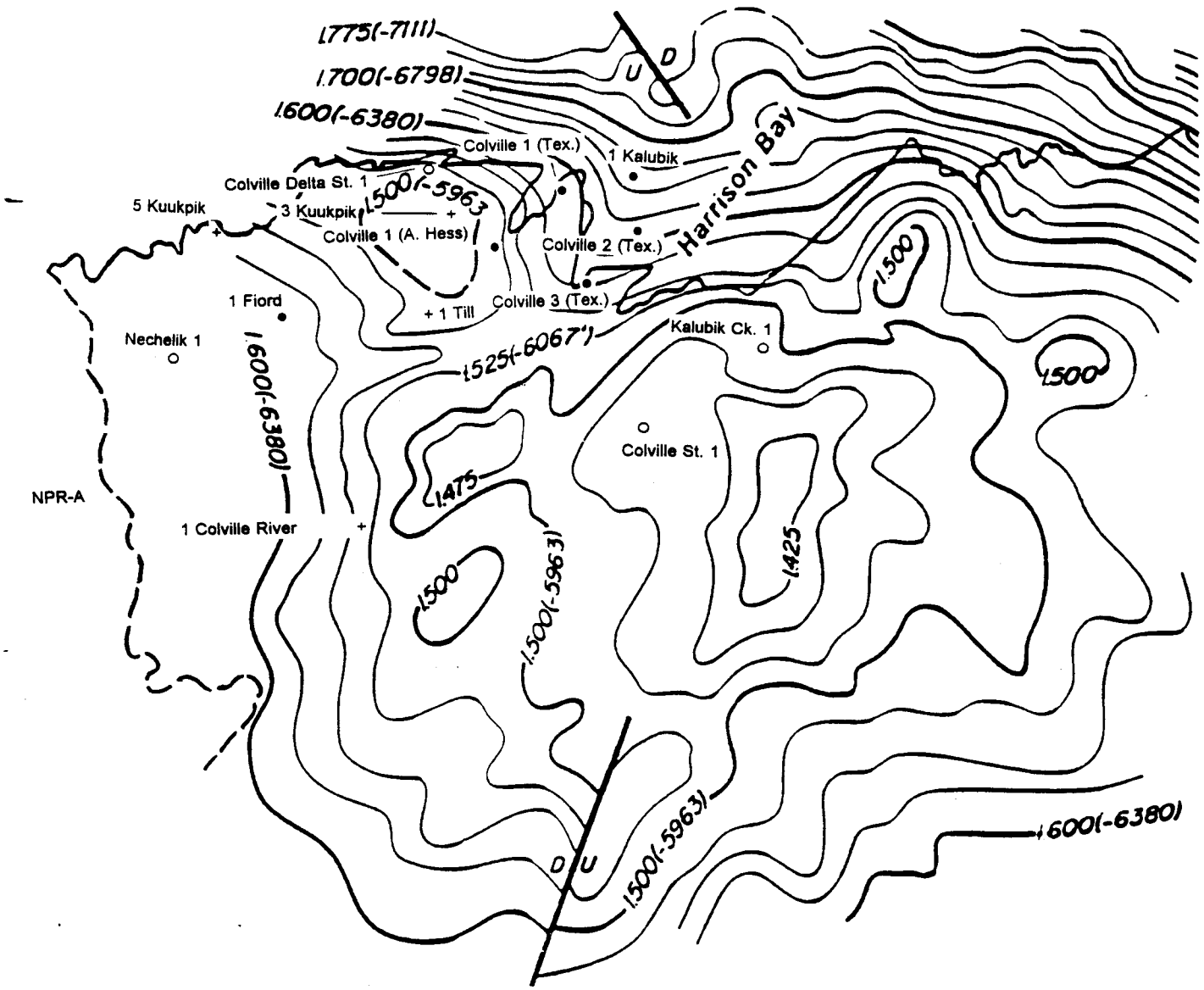


Figure 1. Map of Colville structure by G.L. Scott, Sinclair, 1964. Courtesy of Atlantic Richfield Company (from Specht et al., 1986). "•" represents a discovery well; "o" represents a dry hole; and "+" represents a well still to be drilled.

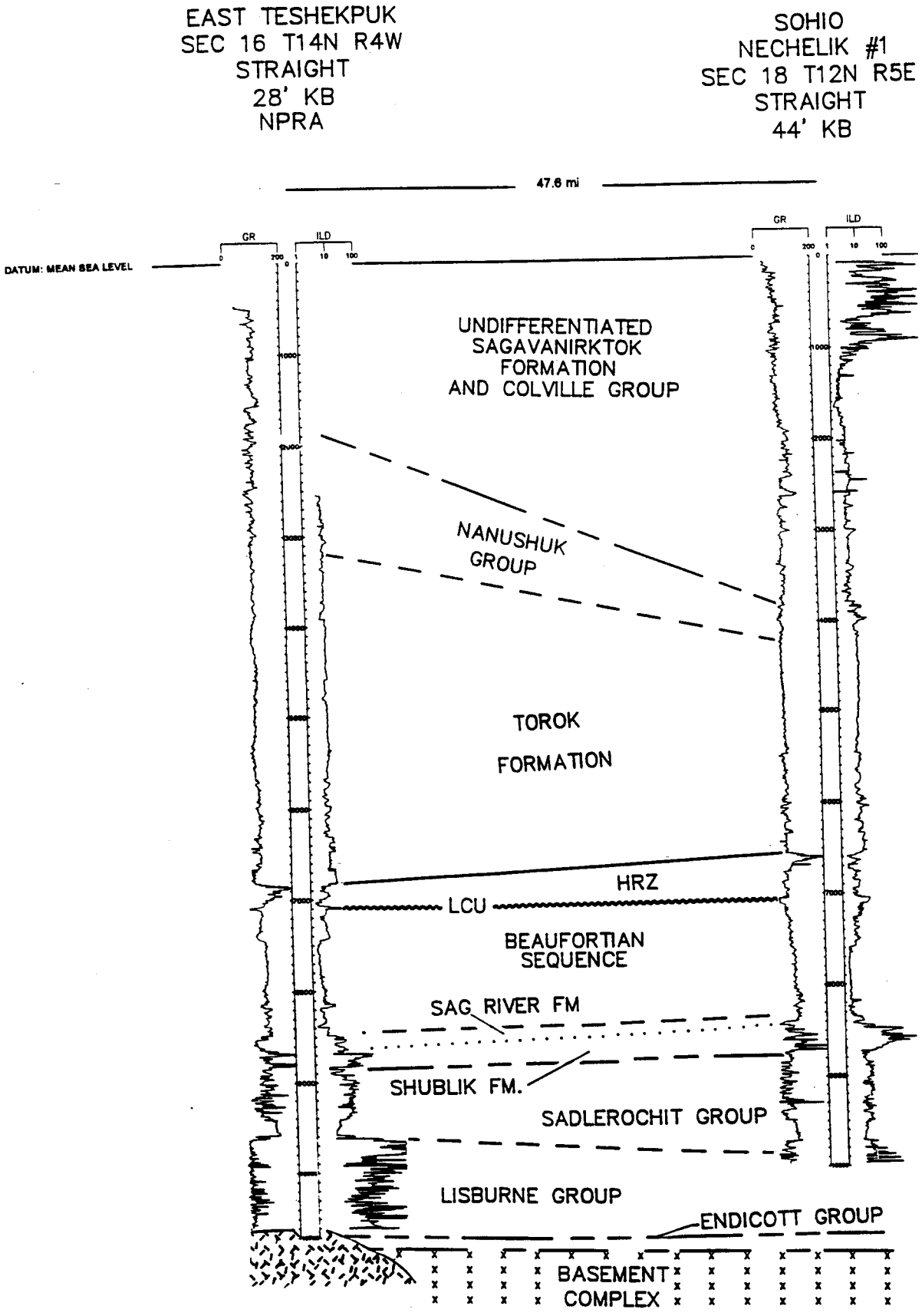


Figure 2. Stratigraphic cross-section between East Teshekpuk well in National Petroleum Reserve-Alaska and SOHIO's Nechelik #1 well four miles outside NPR-A in the Colville River delta (Modified from Scherr and others, 1991).

Reference

Scherr, J., S.M. Banet, B.J. Bascle, 1991, Correlation Study of Selected Exploration Wells from the North Slope and Beaufort Sea, Alaska: OCS Report MMS 91-0076, U.S. Minerals Management Service, Anchorage, Alaska.

Specht, R.N., Brown, A.E., Selman, C.H., and Carlisle, J.H., 1986, Geophysical case history, Prudhoe Bay Field: Geophysics, v. 51, no. 5, p. 1039-1049.

Report on the Texaco No. 1A Colville Delta

The Texaco No. 1A Colville Delta is located in the $SW^1/_4$, Sec. 17, T. 13 N., R. 7 E., Umiat Meridian, on a small island in the delta of the Colville River. The well was spudded April 9, 1985 and plugged and abandoned on April 26, 1985 after reaching a total depth of 6,640 feet, measured (6,490 feet, true vertical depth). The well flowed 25° API gravity oil from 414-1,075 BOPD and produced 36-391 MCF gas from an interval below 6,000 feet, measured depth (5,850 feet, minimum true vertical depth).

By projecting the productive interval (5,850-6,490 feet, TVD) along strike to a seismic line approximately 4.5 miles, it was determined that there is a small bed draped over the Colville structure in this interval, at least in the area of the seismic line. See figure 1 for a map of the Colville structure.

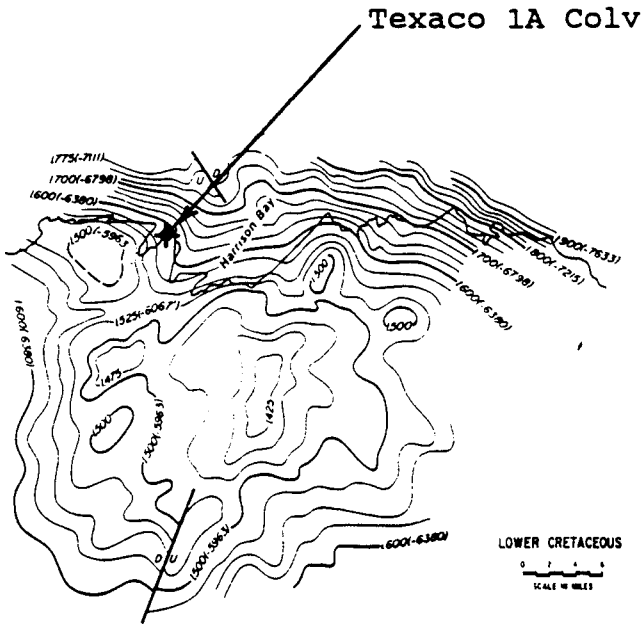


Figure 1. Map of the Colville structure by G.L. Scott, Sinclair, 1964. Courtesy of Atlantic Richfield Company (from Specht et al., 1986).

Tracing the seismic horizons that correspond to the top and bottom of the productive interval along tying seismic lines to the South Harrison Bay No. 1 well it was determined that the interval is Cretaceous in age and probably in the lower Nanushuk Group or upper Torok Formation. It is not possible to be more certain than this because of line quality and the fact that the traced horizons do not actually extend as far as the South Harrison Bay No. 1. Horizons above and below the traced horizons were the ones that were actually followed all the way to the South Harrison Bay No. 1.

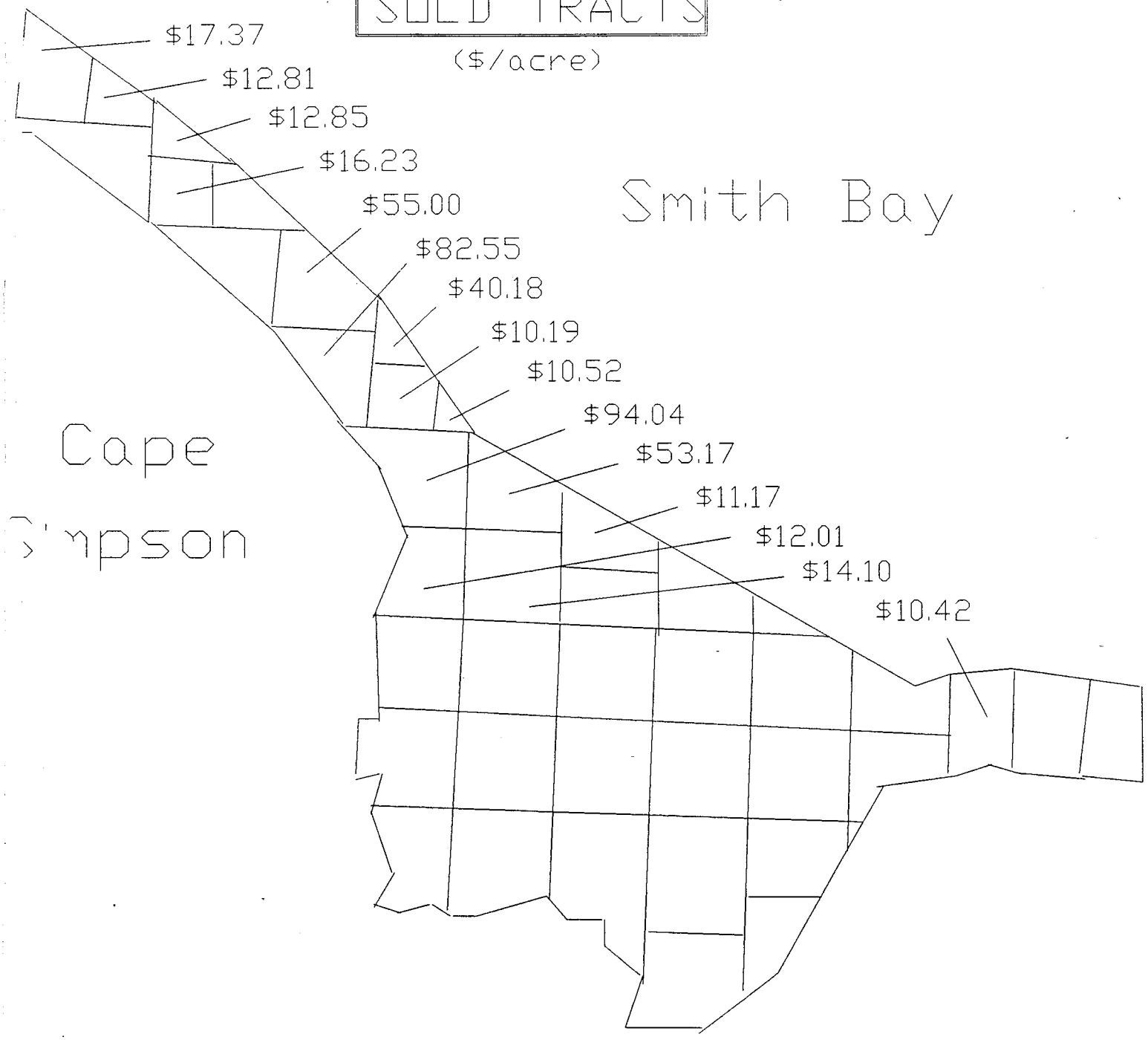
It is not possible to determine or even to estimate resources for the field discovered by the Texaco No. 1A Colville Delta well from the data available. The well is a tight hole on the Alaska State Oil and Gas Conservation Commission's indefinite restriction list.

References

Specht, R.N., Brown, A.E., Selman, C.H., and Carlisle, J.H., 1986, Geophysical case history, Prudhoe Bay field: Geophysics, v. 51, no. 5, p. 1039-1049.

SOLD TRACTS

($/acre)



ORIGINALLY PREPARED FOR: Under Secretary Gjelde

ISSUE: Mineral potential and future management of NPRA

SECRETARIAL STATEMENT:

POSITION OF MAJOR CONSTITUENTS:

BACKGROUND: The National Petroleum Reserve, Alaska (NPRA), covers some 23 million acres in northernmost Alaska. It was established based on the presence of geology favorable to petroleum and the presence of oil seeps at Simpson Lagoon, Skull Cliffs, Fish Creek, Umiat, the Lisburne well area, and oil-stained sandstones in the foothills. At present, the known oil discoveries are at Umiat, a sub-giant field or possibly a giant field estimated to be 70 to 120 million barrels, the Simpson area, and the Fish Creek area. The known gas fields include Barrow, east and south, which also have unproduced oil, Walakpa, Square Lake, Meade, and Wolf Creek areas.

To date, only some 30 wells have been drilled with modern methods and CDP seismic mapping on these 23 million acres. These wells were drilled for stratigraphic assessment rather than discovery, but most have oil shows. The drilling data and outcrop data indicate that there are at least four potential oil generating units in NPRA. Seismic interpretation shows the presence of both stratigraphic and structural traps. The complicated foreland and thrust region of NPRA is similar to and on trend with the recently explored and now productive foreland and thrust regions of the Rocky Mountain Cordillera. Little exploration has taken place in this area of NPRA.

Although no areas outside of the Barrow Gas Field are currently producing, the sediments, their geochemical richness, type and maturity indicate that large quantities of oil and gas have been generated. A large-scale, modern exploration effort is still required to adequately define the potential of this part of the North Slope Petroleum Province. Alaska's North Slope is probably the nation's best hope for adding to the nation's oil reserves. NPRA comprises about 50 percent of this oil province.

In addition to oil, NPRA contains large quantities of coal. Speculative estimates indicate that NPRA may contain up to four trillion tons of coal; if these estimates are correct, Alaska may contain 50 percent of the nation's coal. These resource estimates are speculative, but worthy of further study. Besides coal, southern NPRA contains undetermined quantities of phosphate deposits, which usually contain rare earth elements of strategic importance. This area of NPRA is also on trend with the Red Dog lead zinc deposit, and similar mineralization has been identified in at least three areas of southern NPRA.

PROGRAM CONTACT: John Santora or Gary Brougham

Progress Report Number 1

Reviewing available literature, especially U.S. Geological Survey Bulletin Number 1442, dated 1967, shows a total coal resource estimated at 120 billion tons in the National Petroleum Reserve in Alaska (NPRA). This evaluation is based on work that was done during investigations of petroleum possibilities of NPRA and adjoining areas in 1923-1926. and 1944-1953. The area investigated covers about 75 percent of NPRA. About 50 individuals over a period of 12 years contributed to this evaluation. Evaluation stemmed from measured coal outcrops from 115 localities and analysis gathered from a number of test wells widely dispersed throughout NPRA.

The estimated coal reserves were determined by assuming that an outcrop or drill hole establishes continuity in all directions within one mile for indicated coal and within six miles for inferred coal, using a factor of 1800 tons per acre-foot.

My next planned step is to review several seismic lines and present them on a suitable base map. From the logs I will determine the coal resource that, in all likelihood, will supplement the evaluation that has already been made.

Fred Payton
Geologist

985:FPayton:bhn:11/08/88:payton

NPRA Coal Progress Report No. 2

Three months ago I was assigned the task of reviewing the coal resources in NPRA. After analyzing, scrutinizing, and reviewing all available data, I have concluded that the present estimate of 848 billion tons of coal in NPRA cannot be improved.

For the past several weeks, a base map has been prepared identifying all the seismic lines in NPRA together with small scale maps showing in detail the most recent seismic lines and surface outcrops that were used in formulating the current resource estimate.

Three reports over the past 22 years have been prepared enumerating the coal resources in NPRA:

Barnes in 1967 estimated the coal resources in NPRA at 120 billion tons.

Tailleur-Brosge in 1976 nearly doubled the 1967 estimate to 220 billion tons.

Callahan-Martin in 1980 reported 848 billion tons. This estimate was a 3-man-year effort and was prepared and published for the 1980 Alaska Coal Conference.

This tonnage is an enormous quantity of coal. In comparison, the NPRA resource alone is three times the amount contained in the rest of the nation.

With all the available information, it would require one or more man-years of detailed work to reconstruct coal estimates. There is no assurance the end product would be appreciably different than the current estimate.

I recommend the Bureau accept the current resource estimate of 848 billion tons.

I am suggesting effort be directed in revealing areas that can be mined by surface methods and identifying hard rock resources.

Literally, there is a mountain of mineral resource information that has been generated over the years by several governmental agencies. The amount of data is voluminous. I suggest combining all information in one concise report.

This combined information would show that NPRA is a valuable mineral province. I estimate it would require about one man-year to accomplish this task.

Fred Payton

Fred Payton
Geologist

985:FPayton:bhn:03/24/89:coalrprt

Callahan Coal Notes

Analyses, coordinates (UTM), and depths of coal beds are compiled on a large spreadsheet "ANALYSES.WK1" (Symphony 1.1), by line and shotpoint number. Logs originals of Bureau of Mines analyses, and field notes are in 2 Xerox paper boxes marked with contents. The navigation data for seismic lines with reported or observed coal occurrences are on three floppy disks marked "Shotpoints(1),-(2) and -(3)". The logs (xerox copies) are in 3 ring binders, some in pretty rough shape, but will have to do unless the originals show up. The originals were in rolls, as they came off the logger. Most of the ones from the Utukok area were logged with the Well Reconnaissance machine in the warehouse. Ones further north toward Wainwright were logged with a couple of borrowed machines (natural gamma only).

The next step would be to get the shotholes which contain coal onto maps. In some areas (e.g., around Elusive Creek), it would probably be desirable to have enlargements of the 1:63360 maps, since the data points are pretty close together.

The coal information is of variable reliability: 1)logged with both density and natural gamma tools, sampled and analyzed; 2) logged with gamma tool only, with or without analyses; 3) coal observed in cuttings, no logs, sometimes sampled; 4) coal reported by driller, not confirmed.

If a scanner is available, it would be a good idea to get the logs scanned. I assume that dirt, fingerprints and scribbling could then be edited out. For the sake of preservation of the data, as much as anything, it would be a good idea to get the logs into a standard format showing the line and shotpoint numbers, coordinates, Sec., Township and Range, and the analysis, where available. Except for coal and ice lenses, identification of other rock types from the logs is pretty speculative, so lithologic interpretive logs would be pretty rudimentary.

The notes are not much. Operating between the drills and the pre-loader didn't allow time for much other than getting the logging tools in and out of the holes.

The 1979 auger holes are all in the area between the Utukok and Kokolik Rivers, and are plotted on aerial photos.

The best data is from around Elusive Creek - the machinery all worked well and the seismic operation was slowed down by hard drilling, so there was a little more time. Much of this was highgraded for a paper in the 1980 Alaska Coal Symposium, but could be expanded on.

The end product should be a well documented report showing structural basins containing coal bearing rocks, intervening barren areas, coal outcrops or subcrops, cross sections. Data points are close enough together for a reasonably accurate reserve-base estimate in parts of the area. An accurate estimate of strippable resources will require better elevation control than the 1:63360 maps. (The shotpoint data I got off the DG didn't include elevations). Where data is more sparse or fragmentary, gross, volumetric hypothetical resources could be calculated on the basis of thickness of section and percentage of coal - this was done for the coastal plain, but needs to be done in the foothills where varying thicknesses of the Nanushuk have been eroded away. The seismic data, or at least old Tetra-Tech structure maps, may be useful for estimating sediment volumes. See the 1980 coal symposium paper for more on this. Gary Martin did most of the work for the coastal Plain.

CALLAHAN
333-2

DRENCHWATER CREEK AREA

MINERALS EVALUATION

Fred Conrath

Introduction

The following report is a review of the mineral potential of the Drenchwater Creek area in southern NPRA, and was written at the request of Mike Menge, Resource Evaluation Branch Chief.

Location and Physiography

Drenchwater Creek is in the the Arctic Foothills physiographic province within the Rocky Mountain System of the North America Cordillera. The creek flows northward from the crest of the Brooks Range, into the Kiligwa River, a tributary of the Colville River. The area is characterized by low hills and ridges no more than a few hundred meters above the major drainages. A few kilometers south, the crest of the Brooks Range ranges from 1500 m to 2000 m above sea level. Travel by vehicle, at the present time, is practical only in winter. The nearest communities are Kotzebue, about 240 km to the southwest, and Umiat, about 280 km to the northeast.

Geology

The Drenchwater Creek area, on the eastern margin of the east-west striking Kagvik sequence, is about 120 km from the Red Dog Creek area, which lies on the western margin of the Kagvik sequence. The Kagvik sequence (pl. 4) is in the lowermost structural plate of a terrane characterized by east-west-striking gently south dipping thrust faults. This sequence is a structurally deformed rock unit that includes unnamed rocks of Mississippian age, the Siksikpuk Formation of Permian age, the Shublik Formation of Triassic age, and the Okpikruak Formation of Cretaceous age (Nokleberg and Winkler, 1982). Stratiform and volcanic zinc-lead-barium deposits occur within this sequence. One of the main occurrences of the stratiform zinc-lead-barium deposits in the Drenchwater Creek and Red Dog Creek areas is thinly-bedded stratiform sulfide minerals in organic-rich Mississippian shale and chert which have been hydrothermally altered and are adjacent to volcanic and volcaniclastic rocks. Sulfide-bearing zones of up to several thousand meters long occurs in both areas with up to 19.5 percent Zn, 9.5 percent Pb, and locally more than 150 ppm Ag (Lange, 1980).

The three main occurrences of stratiform zinc-lead-barium deposits in the Drenchwater Creek area are: (1) disseminated sulfide minerals and sparse barite in chert, shale, tuff, and tuffaceous sandstone; (2) disseminated to massive sulfide minerals and sparse barite in quartz-rich rock; and (3) extremely sparse disseminated to massive sphalerite and galena in veins cross-cutting cleavage in brecciated chert and shale (Lange, 1980).

Structural Setting

The sulfide deposits at Drenchwater Creek are within a zone 6 to 45-m-wide that extends eastward along strike from Drenchwater Creek for 1830 m and appears to be restricted to the Drenchwater thrust plate (pl. 6). This thrust plate thins to the east and is nonexistent east of Wager Creek. To the west, the thrust plate also thins and is absent in the area of Rolling Pin Creek, about 2 km

west of Drenchwater Creek (Nokleberg and Winkler, 1982).

Geochemistry

Rock, soil, and stream sediment samples from the Drenchwater Creek area have been analyzed. The data and sample locations were reported previously by Churkin and others (1978) as follows:

Rock samples			
Zn	<200 ppm	-	>10,000 ppm
Pb	15 ppm	-	>15,000 ppm
Ba	150 ppm	-	>5,000 ppm
Ag	<.05 ppm	-	>150 ppm
Soil samples			
Zn	<200 ppm	-	300 ppm
Pb	10 ppm	-	500 ppm
Ba	500 ppm	-	>5,000 ppm
Ag	<.05 ppm	-	7 ppm
Stream samples			
Zn	<200 ppm	-	1,500 ppm
Pb	20 ppm	-	300 ppm
Ba	2,000 ppm	-	>5,000 ppm
Ag	<.05 ppm	-	7 ppm

The highest values of zinc, lead, and silver were mainly downstream from the sulfide deposits in the Drenchwater thrustplate. However, relatively high values were found in samples taken from several unnamed tributaries in the area which may indicate potential sulfide deposits now obscured by the thick soil and tundra (Nokleberg and Winkler, 1982).

Ore Description and Genesis

Field and laboratory data, suggest that the stratiform deposits formed during a short-lived period of Mississippian submarine volcanism. Fragments of fine-grained feldspar, pumice lapilli, and mafic volcanic rocks in chert and shale are often replaced by aggregates of kaolinite, montmorillonite, sericite, chlorite, actinolite, barite, calcite, quartz, fluorite, and prehnite. Locally the chert is altered to siliceous medium grained metaquartzite. The sulfide minerals and barite form disseminated grains, massive sphalerite-rich layers, or, more rarely, quartz-sulfide grains, that crosscut cleavage. The sulfide and sulfate mineral deposition and the submarine volcanism most likely occured in an ocean basin adjacent to an incipient Andean-type arc environment or in a mature island arc environment. Metal-laden hydrothermal fluids were discharged onto a relatively flat deep ocean floor during submarine eruptions that yielded keratophyric to andesitic flows, tuff, and sills. The hydrothermal fluids spread out along the sea floor during discharge to form the disseminated stratiform zinc-lead-barium deposits that are stratigraphically adjacent to or enclosed in chert, shale, tuff, tuffaceous sandstone, and keratophyre. This suggests that zinc-lead-barium mineralization coincided with submarine volcanism and hydrothermal alteration. During the Cretaceous period intense deformation disrupted and partly remobilized the stratiform deposits (Nokleberg and Winkler, 1982; Lange, 1980).

Comparison to other areas

Both Drenchwater Creek and the Red Dog Creek areas have many similarities. It has been suggested by Tailleur (1970) that areas along the north side of the Brooks Range, where exposed iron-stained dark-gray chert and shale of Mississippian age occurs, there might be deposits of zinc, lead, and barium of economic importance. A large part of NPRA, between Drenchwater Creek and Red Dog Creek, contain rocks whose stratigraphy, structure, and age resemble those that host sulfide deposits in the Red Dog Creek area (Nokleberg and Winkler, 1982).

Stratiform zinc-lead deposits similar to those in the Drenchwater Creek area occur in the Mississippian rocks of the Kagvik sequence. In addition, Churkin and others (1978) showed that the Kagvik sequence can be traced along a continuous east-west trending belt in the northern Brooks Range and the Mississippian rocks of the Kagvik sequence are quite favorable for zinc-lead deposits. Coinciding areas of iron staining and zinc-geochemical anomalies in the Kagvik sequence were considered by Churkin and others (1978) as having the greatest potential for stratiform zinc-lead deposits. These areas include Spike, Kagvik, Elbow, Chertchip, Sorepaw, Drenchwater, and Safari Creeks (pl. 2).

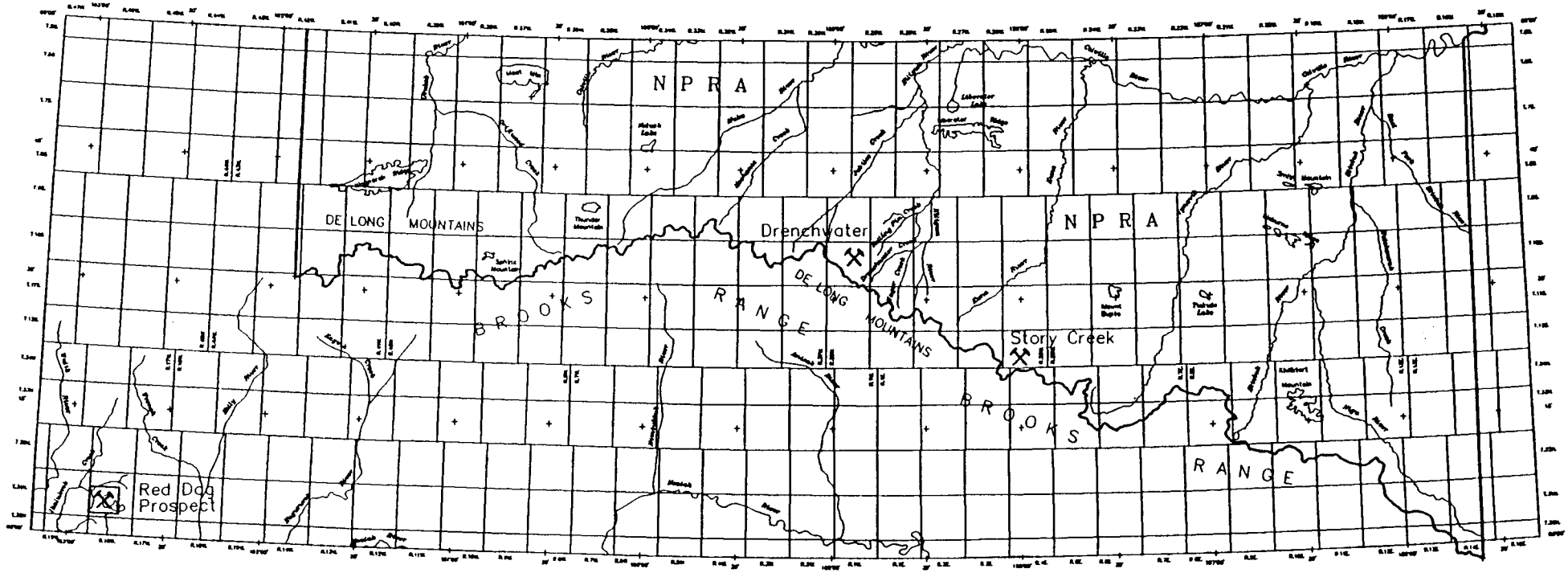
According to Jansons and Parke (1980) high grade zinc and lead mineralization occurs at Whoopee Creek, Story Creek, and Kivliktort Mountain and minor amounts of lead and zinc mineralization have been found at Koiyaktot Mountain and Isikut Mountain. Anomalously high base metal concentrations occur in stream sediments at Sphinx Mountain, Kagvik Creek, and Safari Creek. Slighty anomalous concentrations of base metals occur in stream sediments from the Spike Creek, Anisak River, and Ignisrok areas. The Mechanic Creek and Nuka River areas contain anomalous base metal concentrations in soils and rocks (pl.3 and 5). Nonmetallic minerals and commodities also occur within southern NPRA and the immediate surrounding area. Fluorite, phosphate, and oil shale occur at Mount Bupto. Coal, occurs near Story Creek. The Nuka Ridge oil sand contains minor amounts of tasmanite. Anomalously high barium concentrations occur in stream sediment samples from the Kagvik and Ignisirok areas.

Conclusions and Recommendations

In order to have an accurate economic mineral account of Drenchwater Creek, further exploration needs to be done to discover the true size and grade of the ore body. However, since the mineral deposit at Drenchwater Creek is located in the same geologic environment as the Red Dog Creek prospect and has a similar type of stratiform sulfide deposit, it is safe to say that this area could be of great economic value.

The Red Dog deposit is among the world's largest lead-zinc reserves. It is believed to be the world's largest and problably the world's highest grade lead-zinc deposits, mineable by open pit methods. According to the developer, Cominco American, the ore reserves are 85 million tons grading 17 per cent zinc, 5 per cent lead and 2.4 ounces of silver per ton (Canadian Mining Journal, 1983). With the construction of a new port and road to the prospect only a 120 km west of Drenchwater Creek, the economic significance of Drenchwater Creek and surrounding mineralized areas becomes greatly enhanced.

BASE MAP OF SOUTHERN NPRA



July 27, 1987

3031 (918)

Memorandum

To: M. Menge (985)

From: Tom Mowatt (918) TCM

Subject: Summary Comments on Mineral Resource Potential, National Petroleum Reserve in Alaska (NPR-A)

Per your verbal request of July 27, 1987, here are some comments relative to the "critical/strategic" mineral resources potential in NPR-A. These comments exclude consideration of coal, oil and gas, and sand and gravel resources.

The other mineral resources of NPR-A have yet to be evaluated in a technically substantive manner. Systematic, thorough, detailed exploration work has not been done due to the fact that the area has been closed to mineral entry and claim staking by the private sector for may years. Reconnaissance studies of the area and contiguous areas have been carried out by various Federal agencies, in particular U.S. Geological Survey and the Bureau of Mines. This work consisted of regional geologic and geochemical reconnaissance, as well as a few somewhat more detailed site specific investigations of mineralization occurrences which were discovered on the ground surface. No detailed geologic, geochemical, or geophysical studies have been done, nor has any subsurface exploration (i.e., drilling or detailed geophysical investigation) been done across the region.

Of significance is the fact that the geologic structural features and rock units which are known to exist within the southern portion of NPR-A represent extensions of those which are associated with known mineralization of present or potential economic significance recognized in contiguous portions of the region. This known mineralization includes the following commodities: zinc, lead, silver, barium, and flourine. Occurrences of each of these in noteworthy concentrations has

been verified in the southern portion of NPR-A. Significant lead-zinc mineralized rock occurs at the surface in the southern foothills at Drenchwater Creek, Story Creek, Koiyaktot and Kivliktort Mountains. Mineralized rock collected near Drenchwater assays to 31 percent zinc and 8.4 percent lead. Material from Story Creek assays to 34 percent lead and 49 percent zinc, and 27.4 ounces silver. Mineralized rock at Kivliktort Mountain assays to 30.5 percent zinc and 5.2 ounces silver. Lesser amounts of the same type of mineralization have been noted at several other localities. Geochemical investigations have established the presence of barite which may be associated with the lead-zinc deposits. The southern portion of NPR-A is a geologic extension of what has been termed "a potential world-class base metal district."

The area of concern is a portion of a larger region of known ore deposits, mineralization occurrences, and potentially favorable geologic relationships. This region occurs as an arcuate trend, extending from the Delong Mountains to the west (the site of "world-class" base and precious metal mineral deposits - e.g. Red Dog and associated deposits), along and within the southern portion of NPR-A (e.g. Drenchwater Creek, etc.), and on eastward, perhaps to the Canadian border and beyond. At this time, it is not possible to state with any technical assurance that the area within NPR-A has a greater or lesser potential to contain significant mineral deposits than any other area within this regional trend.

The present relatively depressed economic situation regarding the principal metallic elements of potential value in the area (zinc, lead, ± silver, cadmium) might well be factored into any decision-making process here. The lack of accessibility, transportation, infrastructure, etc., and attendant economic disincentives for this particular area also should be considered. It should be kept in mind in this context that the Red Dog deposit (some 77 million metric tons of ore with average grades of 17.1 percent zinc, 5.0 percent lead, and 82 grams per metric ton silver) is economically viable to a large degree only due to its relative proximity to the seacoast.

Phosphate rocks are known in several occurrences within NPR-A, but are of undetermined extent, thickness, and quality. Phosphate rock will continue to be important to world food requirements, as fertilizer materials, and may also yield valuable by-products such as uranium, vanadium and rare earths.

The oil shale occurrences within NPR-A are not well defined at present. Studies show that, in addition to having high yields of

hydrocarbon materials, they are enriched in potentially recoverable amounts of various elements, including arsenic, copper, cobalt, molybdenum, nickel, vanadium, zinc, silver, mercury, and gold. The regional trend of the rock units which include these phosphates and oil shales includes the southern portion of the NPR-A.

In summary, it would appear that there are distinct possibilities that significant mineral resource values may exist within the southern portion of NPR-A. In keeping with the methodology for energy and mineral resource assessment required by BLM Manual 3031, this area should be considered to have a high level of potential for the accumulation of mineral resources. This is based on the geologic environment, the inferred geologic processes, the reported mineral occurrences and/or valid geochemical/geophysical anomaly, and the known mines or deposits which indicate high potential for accumulation of mineral resources. The "known mines and deposits" do not have to be within the area that is being classified, but have to be within the same type of geologic environment. This interpretation has a certainty level (cf. 3031 Manual) of "C", i.e., the available data provides direct evidence but are qualitatively minimal to support or refute the possible existence of mineral resources.

There are several listings currently in use which attempt to classify mineral commodities in terms of their "critical/strategic" character for national needs. Telephone conversation July 27, 1987 with the U.S. Bureau of Mines, Fairbanks (Mr. J. Barker) confirms that silver and flourine, as well as gold, cobalt, and nickel, are presently considered as such commodities by the Bureau of Mines.

Any land-use decision which militates against/precludes continued investigation/exploration of this area will, of course, inhibit/prevent clearer elucidation of the mineral resources base of the area. To our knowledge, to date such investigations in the area have been relatively superficial, and have not involved subsurface work of any sort, with the exception of regional geophysical studies. These are totally inadequate to identify and resolve geologic features of the relatively small-size of mineral deposits.

If there are any questions, please call Tom Mowatt (AK-918), at 271-4419.

918.TMowatt.dl.x3114.07/27/87.wsfiles\debbie\tom\sumnpra

CRITICAL MINERALS

"Those minerals essential to the national defense the procurement of which, during war, while difficult, is less serious than these of strategic minerals (because they can either be domestically produced or obtained in more adequate quantities from reliable foreign sources)."

(Thrush, P.W., 1968, A Dictionary of Mining, Mineral, and Related Terms, U.S. Dept. of the Interior, Bureau of Mines, 1269 pages.)

CRITICAL PROTECTION SITE

A site designated through the fire management planning process which receives the highest priority for fire suppression action in order to protect human life, inhabited property, and designated physical developments.

CRUCIAL HABITAT

Use area necessary for the perpetuation of the population of one or more species. These areas provide an essential element of the life cycle of a species or population. Crucial habitat may include areas essential for food, shelter, breeding, rearing, escape, and movement.

CULTURAL RESOURCES

Those fragile and nonrenewable remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred--even though evidence of the event no longer remains, and (3) the environment immediately surrounding the resource.

CULTURAL RESOURCE INVENTORY

A descriptive listing and documentation, including photographs and maps, of cultural resources. Included are the processes of locating, identifying, and recording sites, structures, buildings, objects, and districts through library and archival research, information from persons knowledgeable about cultural resources, and varying levels of intensity of on-the-ground field surveys.

	state documents published by state officials; (2) applied to species whose populations are consistently small and widely dispersed or whose ranges are restricted to a few localities, such that any appreciable reduction in numbers, habitat availability, or habitat condition might lead toward extinction; or (3) applied to species whose numbers are declining so rapidly that official listing may become necessary as a conservation measure.
SMA	Special Management Area. (See Wildlife Special Management Areas)
STRATEGIC MINERALS	"Those commodities essential to the national defense for the supply of which, during war, we are wholly or in part dependent upon sources outside the boundaries of the United States." (Thrush, P.W., 1968, A Dictionary of Mining, Mineral, and Related Terms, U.S. Dept. of the Interior, Bureau of Mines, 1269 pages.)
SURFACE MANAGEMENT REGULATIONS	43 CFR 3809. Regulations for the implementation of the Mining Law of 1872.
SNCA	Steese National Conservation Area
THREATENED SPECIES	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range; and further defined by the Endangered Species Act of 1973, as amended.
UNDUE OR UNNECESSARY	Surface disturbances greater than those that would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of a similar character. This also takes into consideration the effects of the operation on the other resources and land uses, including resources and uses outside the area of operations.
VALID EXISTING RIGHT	A right granted to an operator or holder of an unpatented mining claim to develop a mining property, including the right to reasonable access, by virtue of establishing

DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

The strategic and critical mineral resources of the southern part of the National Petroleum Reserve in Alaska

by

Inyo Ellersieck and I. L. Tailleur

Open-File Report 86-158

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

1986

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THE STRATEGIC AND CRITICAL MINERAL RESOURCES OF THE SOUTHERN PART OF THE NATIONAL PETROLEUM RESERVE IN ALASKA

By Inyo Ellersieck and I. L. Tailleur

SUMMARY

The southern part of the National Petroleum Reserve in Alaska (NPRA) has not been explored in detail for strategic and critical minerals and elements. The geology, however, is fairly well known. By analogy with other, well-explored regions of similar geology, there is a very low potential for recoverable resources of most strategic and critical elements within the southern part of NPRA. The only strategic and critical elements known to exist in potentially recoverable quantities are zinc, lead, silver, cadmium, and antimony. Recoverable resources of some other elements may exist in currently undiscovered mineral deposits.

INTRODUCTION

Strategic and critical minerals are defined by the Strategic and Critical Minerals Stockpiling Act of 1979 (Public Law 96-41) as "...those that are needed to supply the military, industrial and civilian needs of the United States during a national emergency and whose supplies are dependent on imports." (Congressional Budget Office, 1983). The National Defense Stockpile includes 93 commodities derived from 34 different elements or minerals. Thirty-one of these elements and minerals are listed in Table 1. Jewel bearings and molybdenum have been excluded; jewel bearings because they are a synthetic product, and molybdenum because it is a net export of the U. S.

The arctic climate and remote location of southern NPRA influence the feasibility of extracting mineral resources. The distance from industrial areas presently makes transportation costs prohibitive for those materials which are required in large quantities at low unit cost, such as silica sand. There is no infrastructure of roads, rails, port facilities, or electric power at the present time. Mineral deposits that might be economically recoverable in populated areas that have such an infrastructure might be sub-economic within NPRA. Development of one resource which is sufficiently valuable to justify the capital investment necessary to build transportation and power facilities, however, could favorably affect the viability of smaller or less valuable mineral resources. Petroleum and coal, which have some potential for development within southern NPRA, therefore could have an impact on the future development of strategic and critical mineral resources of this area. This report is concerned only with the geological potential for occurrences of strategic and critical minerals in southern NPRA; considering whether such occurrences, if discovered, could be brought into production is beyond the scope of this report.

PREVIOUS WORK

Regional geologic mapping of southern NPRA is relatively complete (Tailleur and others, 1966; Mayfield and others, 1978; Curtis and others, 1982; Ellersieck and others, 1982; Mayfield and others, 1982; Sable and others, 1984a, 1984b, 1984c). Stream-sediment geochemical sampling has been done on a reconnaissance scale within the Reserve (Theobald and Barton, 1978) and in adjoining regions (Curtis and others, 1980; Ellersieck and others,

1980). Some studies have been made of non-fuel mineral resources in NPRA an the adjoining regions (Churkin and others, 1978; Jansons and Baggs, 1980; Jansons and Parke, 1981; Nokleberg and Winkler, 1982; Ellersieck and others, 1982). Reports on some ore deposits and mineral occurrences outside of NPRA provide information about the potential for undiscovered mineral resources in geologically similar areas within the Reserve (Tailleur, 1970; Degenhart and others, 1978; Mayfield and others, 1979; Jones, 1982; Hitzman, 1983).

MINERAL DEPOSIT MODELS

Although most of the strategic and critical elements can be found in trace amounts in most places in the earth's crust, they are present in concentrations that are economically recoverable only within certain geologic environments. Some are currently recovered from several different geologic settings, while others are more restricted in their occurrence. Knowledge of the geologic settings that have historically produced minerals or groups of minerals has been incorporated into models of ore deposit types (Cox, 1983a, 1983b). Each ore deposit model takes into account the tectonic setting, associated rock types, and mineralogy of the ore. These models can be used to predict whether or not the geological setting of southern NPRA is favorable for an undiscovered ore deposit type. The models can also be used to predict the occurrence of minerals that have not yet been identified within known deposits in NPRA.

An assessment of resources in undiscovered deposits is necessarily qualitative and based on subjective judgments. Although NPRA has not been explored in detail for strategic and critical minerals specifically, the current state of geologic knowledge is sufficient to eliminate the possibility of some ore deposit types with a high degree of confidence. Other deposit types may be permissible in the geologic framework as it is known at this time, but there is no known indication that they are present. Some mineral occurrences have been discovered in NPRA, providing evidence that undiscovered occurrences of a similar nature are possible.

The main criterion we used to assess the possibility of deposit types is the presence or absence of suitable host rock types. Even though large areas of the Reserve are concealed beneath surficial deposits, they are unlikely to contain rock types that are unknown in the exposed areas which have been mapped. It is highly unlikely, for example, that granitic rocks of any great extent are present in the southern part of the Reserve. Therefore ore deposits associated with granitic rocks are not expected.

A second, more subjective criterion is tectonic setting and geologic history. Certain ore deposit types are thought to be associated with specific geologic events. The model of tectonic development used in this assessment is based on the synthesis of events described by Mayfield and others, 1983. As ore deposits are studied in other parts of the world, new interpretations about their geologic setting and mineralogy are sure to evolve. The assessment of the potential for strategic and critical minerals in NPRA will probably be revised in the future, as new information about the geology of NPRA is gained, and as new ideas about ore deposits are developed.

Table 2 shows a greatly simplified list of deposit types and the strategic and critical minerals or elements commonly found within them. These

deposit types have been grouped into four categories. Category one includes mineral occurrences identified in NPRA which have a high potential for development. Category two includes deposit types which have been identified within the Reserve or in adjoining regions, but which seem to have a low probability of sufficient grade or quantity to make recovery feasible, either in the identified occurrences or in possible undiscovered ones. Category three includes deposit types which have not been identified within NPRA or the adjoining regions, but which are permissible within the geologic framework of NPRA as it is known today. If a particular deposit model calls for a special geologic condition, and we do not know whether or not the condition exists, we made the assumption that the deposit type is possible until proven otherwise. Category four includes ore deposit types which are constrained to rock types and geologic environments which are highly unlikely within southern NPRA.

ASSESSMENT OF POTENTIAL FOR INDIVIDUAL MINERALS

Table 1 summarizes the potential for individual strategic and critical minerals, based on our estimates of the probability for the deposit types in table 2. In addition to the uncertainty about the presence or absence of undiscovered ore deposit types, there also may be an uncertainty about the minor elements a given ore deposit type may contain. For example, bismuth is a common byproduct of lead ore, but some lead-bearing ores do not contain recoverable quantities of bismuth (Hasler and others, 1972).

The potential for each element or mineral in table one has been listed two categories. An element or mineral is classified as "identified" if it has been seen in a mineral occurrence in or near the Reserve, or if it is detected in chemical analyses from these occurrences. If an element or mineral is classified as "not identified", its potential is based on analogy with ore deposit types which have not been discovered in the Reserve. Elements identified in the Reserve may also occur in other, undiscovered, deposit types, so they are assigned a potential in both categories.

The estimation of potential is divided into three levels. "High" potential means that the element is known to occur in recoverable concentrations within southern NPRA, and there is a good chance that it may be present in quantities that would make recovery economically feasible. The only strategic and critical minerals in this category are lead, zinc, silver, cadmium, and antimony. Elements and minerals with "low" potential are dependent upon either the discovery of ore deposit types not presently known within the Reserve, or upon the discovery of recoverable quantities within known deposit types. Minerals and elements classified as having "low" potential actually possess the greatest level of uncertainty about the potential resource. If present in the Reserve, they may be present in quantities as high or higher than elements classified as having "high" potential. Elements and minerals with "very low" potential are those not found in any deposit types that have a significant probability of being found in southern NPRA.

SELECTED ELEMENTS WITH POTENTIAL IN SOUTHERN NPRA

ZINC, LEAD, SILVER, CADMIUM, ANTIMONY

Zinc-lead-silver occurrences have been discovered within the Reserve Drenchwater Creek and Story Creek (fig. 1). Both of these occurrences ar within the Brooks Range allochthon, a tectonic unit that also contains se other zinc-lead-silver occurrences (Mayfield and others, 1979). The Lik deposit (Wall Street Journal, 1977) and the Red Dog deposit (Jones, 1982) southwest of NPRA have been drilled and shown to contain significant reserves. Although the Drenchwater Creek occurrence has been classified a volcanogenic sulfide deposit (Nokleberg and Winkler, 1982), other zinc-lea silver occurrences in the Brooks Range allochthon do not seem to be closel associated with igneous rocks. It is possible that the Drenchwater Creek occurrence is a special case of a broader class of mineral deposits within Brooks Range allochthon. Whatever mineral deposit models are used, the Brc Range allochthon within NPRA has a high potential for the discovery of additional zinc-lead-silver occurrences.

Both the Drenchwater Creek and Story Creek occurrences have outcrops o ore-grade material, but the extent of this material cannot be determined fr surface exposures. Drilling and geophysical surveys are needed to measure resources in place at these two occurrences. Geochemical sampling is needec to determine the minor elements within the ore. The limited analyses available (Churkin and others, 1978; Jansons and Baggs, 1980; Jansons and Parke, 1981) suggest that antimony and cadmium are potential byproducts, but bismuth may not be present in recoverable quantities.

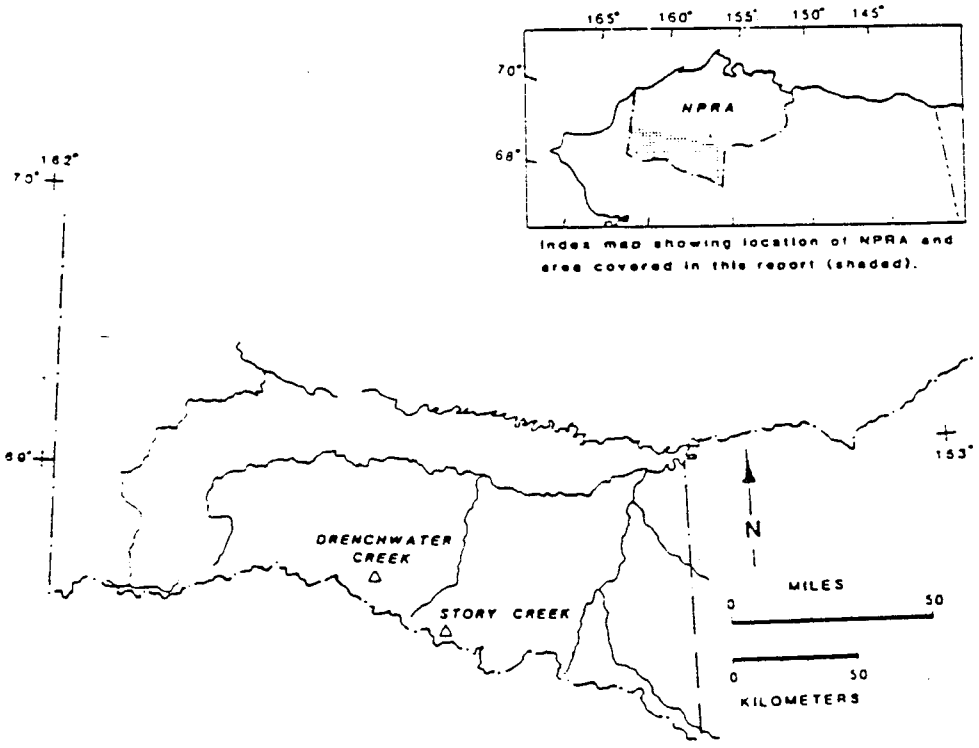

Figure 1 -Southern part of the National Petroleum Reserve in Alaska (NPRA) showing Drenchwater Creek and Story Creek mineral occurrences.

CHROMIUM

Chromium is present in the form of chromite layers in ultramafic bodies of the Misheguk Mountain allochthon (Mayfield and others, 1983). These layers are too thin and discontinuous to be minable at any of the locations where they have been seen (Degenhart and others, 1978; Jansons and Baggs, 1980). There are chromium stream-sediment geochemical anomalies in the Reserve (Theobald and Barton, 1978), which have their source in an ultramafic body that is just outside the boundary of the Reserve. Outcrops of ultramafic igneous rocks belonging to the Misheguk Mountain allochthon probably do not occur within the Reserve (Mayfield and others, 1983). Chromium, although present, is probably not a feasibly recoverable resource.

COPPER, COBALT

Copper sulfide minerals are present in trace amounts in the Drenchwater Creek and Story Creek zinc-lead-silver occurrences. Analyses of lead and zinc sulfides from these occurrences show anomalously high amounts of copper relative to the country rocks, but not recoverable concentrations. Cobalt is present in trace amounts in analyses of sulfide minerals in the same occurrences, but it is probably not enriched enough to be recoverable as a byproduct.

Copper and cobalt-bearing sulfides are present in the Ruby Creek deposit on the south side of the Brooks Range (Hitzman, 1983). The host rocks for the Ruby Creek deposit are carbonates of Devonian age. The Ivotuk and Kelly sequences in NPRA contain carbonates of Mississippian age (Mayfield and others, 1983) which are potential exploration targets for the same kind of deposit as Ruby Creek. Stream-sediment geochemistry in the vicinity of the outcrops of these sequences does not reveal anomalous concentrations of copper or cobalt. Reconnaissance geologic mapping has not turned up any positive indications of copper or other sulfide deposition in the carbonate parts of these sequences.

Basaltic volcanic rocks on Memorial Creek (Mayfield and others, 1978) have a small chance of containing copper sulfide deposits. This area has not been explored in detail.

FLUORSPAR

Fluorite (fluorspar) has been noted in thin sections of samples from Drenchwater Creek (Nokleberg and Winkler, 1982). The amounts are very small, and the possibility of finding recoverable quantities in this deposit is fairly low.

There is an occurrence of fluorite veins in dolomite belonging to the Ivotuk sequence at Mount Bupto (Jansons and Baggs, 1980). The primary source of this fluorite is unknown, but the amount visible at the surface is very small. There is some potential for fluorite in association with undiscovered lead-zinc or copper-cobalt deposits within the Ivotuk or Kelly sequences.

MANGANESE

The pebble shale member of the Early Cretaceous Kongakut Formation in t northeastern Brooks Range contains an interval approximately 50 meters thick that has manganiferous beds. The manganese is in the form of sedimentary manganese carbonate, and some analyses show up to five percent manganese (Detterman and others, 1975). Within NPRA, a thin interval of clay shale nea the base of the Cretaceous section in the Ivotuk sequence may be correlative with the pebble shale, but manganiferous beds have not been recognized.

Sedimentary manganese is also geologically possible at the top of the Carboniferous section in the Ivotuk sequence. There are also very small manganiferous concretions in the Etivluk Group cherts in several sequences. Stream-sediment geochemical sampling has not indicated any unusual concentrations of manganese in NPRA, however. The potential for manganese is unknown.

PLATINUM-GROUP ELEMENTS

Some prospecting has been done for platinum-group elements in placer deposits derived from the mafic-ultramafic bodies of the Misheguk Mountain allochthon. Prospect pits in the Avan Hills body revealed sub-economic amounts of platinum (C. F. Herbert, British Petroleum Co., written communication, 1977). Some geochemical samples of the Avan Hills and the Misheguk Mountain bodies revealed no anomalous concentrations of platinum-group elements (Degenhart and others, 1978). The chances of there being recoverable concentrations of platinum-group elements in placers within NPRA, where the mafic-ultramafic bodies do not outcrop, is very low.

VANADIUM

There is an unknown potential for vanadium in sedimentary deposits in the Nanushuk Group in the northern part of southern NPRA. Vanadium is commonly a co-product with uranium in this type of deposit, but the source areas for the sands of the Nanushuk Group make it unlikely that uranium will be found in this region. Therefore this type of deposit, if present, would need to be mined for vanadium alone and might not be economically viable.

Some vanadium is produced as a by-product from the distillation of crude oil. Therefore there is an unknown potential for vanadium in undiscovered oil resources in southern NPRA.

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TABLE ONE
STRATEGIC AND CRITICAL MINERALS AND ELEMENTS

MINERAL OR ELEMENT	OCCURRENCES IN NPRA IDENTIFIED	NOT IDENTIFIED	REMARKS
Aluminum	--	very low	
Antimony	high	low	byproduct of lead and zinc
Asbestos	--	very low	
Beryllium	--	very low	
Bismuth	low	low	possible byproduct of lead
Cadmium	high	low	byproduct of zinc
Chromium	low	very low	present in sub-economic concentrations
Cobalt	very low	low	present in trace amounts in lead-zinc occurrences
Columbium	--	very low	
Copper	low	low	
Diamond	--	very low	
Fluorspar	low	low	present in sub-economic concentrations
Graphite	--	very low	
Iodine	--	low	possible by-product of oil-field brines
Lead	high	low	may be part of significant zinc-lead-silver district
Manganese	--	low	
Mercury	--	very low	
Micasheet	--	very low	
Nickel	--	very low	
Platinum-group elements	low	very low	sub-economic concentrations in placers near NPRA
Quartz crystal	--	very low	
Rutile (Titanium)	--	very low	
Sapphire and ruby	--	very low	
Silver	high	low	co-product of zinc and lead
Talc	--	very low	
Tantalum	--	very low	
Thorium	--	very low	
Tin	--	very low	
Tungsten	--	very low	
Vanadium	--	low	
Zinc	high	low	may be part of zinc-lead-silver district

TABLE TWO

ORE DEPOSIT TYPES ASSOCIATED WITH STRATEGIC AND CRITICAL MINERALS

CATEGORY ONE

High potential, identified occurrences in or near NPRA, possibility of recoverable quantities:

1. Sedimentary-exhalative, sediment-hosted zinc-lead-silver
   (lead, zinc, silver, cadmium, antimony)

2. Massive sulfide associated with felsic to intermediate volcanics
   (lead, zinc, silver, cadmium, antimony)

CATEGORY TWO

Some potential, identified occurrence in or near NPRA, low probability of recoverable quantities:

1. Fluorite veins in carbonates
   (fluorspar)

2. Chromite in ophiolitic ultramafic rocks
   (chromium)

3. Placers derived from ultramafic plutons
   (platinum-group elements)

CATEGORY THREE

Some potential, no identified occurrence in or near NPRA, permissible geological conditions within NPRA, unknown quantities:

1. Carbonate-hosted lead-zinc (Mississippi Valley type)
   (lead, zinc, fluorspar, cadmium, antimony, copper, cobalt, bismuth)

2. Dolomite-hosted discordant copper-cobalt (Ruby Creek type)
   (copper, cobalt, zinc, lead, antimony)

3. Massive sulfide in basaltic rocks (Cyprus type)
   (copper, zinc)

4. Sandstone uranium-vanadium
   (vanadium)

POTENTIAL in NPRA
for
ELEMENTS NEEDED
for
SUPERCONDUCTIVITY RESEARCH

The current state of superconductivity research indicates that the elements needed to make superconductors includes yttrium, niobium, lanthanum, thallium, and bismuth, in addition to other more common elements such as copper. The occurrence potential in NPRA of each of these five less common elements will be discussed element by element.

YTTRIUM - Yttrium is one of the rare earth elements (REE). They are commonly found in carbonatites, tungsten veins, shoreline titanium placers, and phosphate deposits. The most common ore of the REEs is monazite. Monazite is a phosphate mineral and is often found in tin and sometimes in titanium placers. Monazite is not likely to occur in NPRA, nor are carbonatites or tungsten veins. There is a very low probability of occurrence of titanium deposits (Ellersieck and Tailleur, 1986). There are known phosphate deposits in the Lisburne Group and Shublik Formation on the Arctic North Slope and both the Lisburne and Shublik are found in NPRA. Cox and Singer (1986) indicate that there is some potential for the REEs to occur in this type of phosphate deposit.

NIOBIUM - Niobium is commonly found only in carbonatites (Cox and Singer, 1986) in the mineral pyrochlore (Weast, 1970). Niobium is also found in the mineral columbite (Weast, 1970). Columbite is commonly found in granitic rocks. There are no known carbonatites or granitic rocks in NPRA, nor are any likely to be found. There is a very low occurrence potential for niobium in NPRA.

LANTHANUM - Lanthanum is a REE. See the discussion on yttrium for the occurrence potential of lanthanum.

THALLIUM - Thallium is known to occur in hot spring gold deposits and carbonate hosted gold-silver deposits, where it is used as a geochemical indicator (Cox and Singer, 1986). Thallium most commonly occurs in crooksite, lorandite, and hutchinsonite (Weast, 1970). Crooksite is a selenide, but the last two are sulfides (Bates and Jackson, 1980), and thus thallium may occur in sulfide deposits. There are known sulfide deposits in southern NPRA, but it is not known if they have any associated thallium. It is not known if there are any hot spring gold deposits or

carbonate hosted gold-silver deposits in NPRA at this time. Thallium probably has a low occurrence potential in NPRA.

BISMUTH - Bismuth occurs in several minerals and as the native metal, but the most common source is as a byproduct of lead, copper, tin, silver, or gold smelting (Weast, 1970). There are known deposits of lead and zinc with some minor copper in southern NPRA which may have bismuth associated with them. There is a moderate potential for the occurrence of bismuth in NPRA (Ellersieck and Tailleur, 1986, give it a low potential, but they use only high, low, and very low potentials).

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STAFF COPY

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF MINERAL RESOURCES
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Memorandum

February 23,1990

3000 (985)

To: Deputy State Director for Mineral Resources, ASO (AK-980)

Through: Chief, Branch of Mineral Assessment

From: James Borkoski, Staff Economist

Subject: National Petroleum Reserve-Alaska (NPR-A) Competitive Leasing Terms

It should be pointed out that NPR-A has some significantly different lease terms applied to it than do other (onshore) competitive opportunities.

The purpose of this paper is to complete a comparative review and to point out areas where application of more liberalized leasing practices may help to further industry interest in the area.

Lease Terms

Minimum Competitive Bid - NPR-A, $25/acre, at the last onshore competitive lease sale, the minimum bid was also $25/acre for a 400-acre tract in the Beaver Creek Unit on the Kenai Peninsula. This sale was held almost eight years ago on September 1, 1982. This specific tract was very promising and received a total of five bids. The high bid was $1,130/acre. OCS - $25/acre; state of Alaska varies from $1/acre to $25/acre, but more than 90 percent of the tracts are offered at the $1/acre level.

Royalty - NPR-A is currently set at 16 2/3 percent by the Alaska State Director, other competitive federal onshore leases are on a sliding scale from 12 1/2 percent to 25 percent, depending on production. Federal OCS has several royalty systems, but for the most part utilizes either a 12 1/2 percent or 16 2/3 percent royalty rate. The state of Alaska utilizes either a 12 1/2 percent or a 16 2/3 percent royalty rate.

Rental - NPR-A, $3/acre by legislation; other federal competitive and noncompetitive leases are at the rate of $1.50/acre for 5 years, and then $2.00/acre thereafter. NPR-A sales have a 10-year primary lease term, whereas other onshore sales are limited to a 5-year period, at which time, a well capable of production must be completed.

With the exception of length of lease and rental, the determination of minimum acceptable bid and royalty rate are factors which can be determined by the Alaska State Office for each individual sale. See attachment 1 for the Solicitor's opinion regarding determination of royalty rate.

Factors that may have an adverse affect on leasing opportunities within the NPR-A which can only be altered through legislation are:

** The absence of authority to unitize leases;
** the inability to extend a primary lease term beyond 10 years except in limited cases;
** the lack of authority for the Secretary to grant a suspension of production on leases capable of production in paying quantities pending the development of necessary infrastructure, such as transportation pipelines;
** the 60,000-acre limit on the size of an oil and gas lease tract.

The basis for these constraints in the NPR-A is the DOI Appropriations Act (1981) which failed to provide the Secretary with similar provisions afforded him under the Mineral Leasing Act of 1920. As such, leasing authority within the NPR-A is severely constrained compared to the oil and gas leasing program in the rest of the nation. Draft legislation has been presented on several occasions over the past eight years to provide the Secretary with similar provisions afforded him under the Mineral Leasing Act of 1920, but to date no action has been taken (attachment 2).

Background

The NPR-A is a 37,000-square-mile-area located above the Arctic Circle, north of the Brooks Range and south of the Arctic Ocean (see figures 1 and 2). The NPR-A is west of the giant Prudhoe Bay and Kuparuk River oil fields. This area was set aside as the Naval Petroleum Reserve No. 4 in 1923 and jurisdiction was subsequently transferred to the Secretary of the Interior in 1976. A more detailed legislative history of this area is provided in the Final Environmental Impact Statement on Oil and Gas Leasing in the National Petroleum Reserve in Alaska (USDI, BLM, 1983).

During the period from 1975 to 1981, a federally financed exploration and drilling program was conducted in NPR-A. Approximately 11,235 miles of the total 14,770 line miles of seismic surveys completed in NPR-A were conducted during this same time period. A total of 28 wells were drilled prior to the initiation of a leasing program in NPR-A, and only modest hydrocarbon reserves were actually proven. No sufficient hydrocarbon reserves were identified to stimulate any commercial development.

A series of four competitive lease sales were conducted in the NPR-A between January 27, 1982, and July 18, 1984. The results of these sales are presented on Tables 1, 2, 3 and 4.

Offered at these competitive lease sales were 419 tracts covering 8.8 million acres. Of this total, 58 tracts were leased encompassing 1.4 million acres. As of January 22, 1990, only 18 of these leases were active, and the balance of 40 leases have been relinquished (figure 2). Currently, approximately 70 percent of the tracts as well as acreage leased within the NPR-A has been relinquished. Rental and bonuses paid to date total 105 million dollars.

It was interesting to note that one-third of the acreage leased at the first lease sale which was believed to be the most promising is still active and represents 56 percent of the total (active) acreage under lease. In comparison, cumulatively, only one-quarter of the acreage leased at the second and the third lease sales are still being held. In the same vein, it was also of interest to note that close to one-half of the acreage offered at the first sale received bids while, cumulatively, less than 8 percent of the acreage offered at the last three sales attracted bidders. At the last NPR-A competitive lease sale, held on July 18, 1984, 64 tracts were offered, but no bids were received.

Commercial development to date has consisted of one well being drilled by ARCO, the Brontosaurus, completed to a depth of 6660 feet five years ago in March 1985. As a result of a poor showing, ARCO has since relinquished all seven of its leases (figure 2).

Industry Interest

Commercial interest in the NPR-A at the present time is in the moderate range in comparison to other leasing opportunities in Alaska and in the United States as a whole. Five of six major oil companies that successfully participated in previous NPR-A sales have expressed various degrees of interest in a future sale. This interest was expressed as a result of a request for public comment this past December. A summary of these comments has been compiled and is available for review. As regards the NPR-A, it is a simple fact that this area is a remote, high cost development area and, to date, only modest hydrocarbon reserves have been proven. The one well drilled by ARCO was a duster, and since lease sales have been initiated over eight years ago, less than 14 percent of the tracts offered have been bid on and approximately 70 percent of the tracts leased have been relinquished.

There are two main and divergent theories on how the main development of the NPR-A will come about (see attachment 3). Basically, both hold that the needed legislation on unitization, suspension of production, etc., discussed in the body of this report as well as attachment 3, must be enacted.

The first theory contends that, since the NPR-A will be a high cost development area, the government further compounds this problem by holding out for high bonuses, rental, and royalties which will have the impact of deferring interest in the area and delay the development of NPR-A.

The second theory holds that Prudhoe Bay is the nucleus and that development will extend from this point. If this is the case, more liberal lease terms would not significantly affect the timeframe for development.

The bottom line is that we do not know exactly how industry feels about this or if the majors are in agreement on this point. We do know that the legislation for NPR-A was developed in 1981 when oil prices were in the range of $37/barrel and that, due to significant changes in market conditions, oil companies have been forced to restructure, and are much more conservative and selective in spending acquisition and development dollars. A review of the tracts leased in the NPR-A may provide an overview. Of the total of 58 tracts leased in the NPR-A, 53 were leased by a total of 6 major oil companies. Three of these majors, ARCO, Texaco, and British Petroleum leased a total of 23 tracts within the NPR-A, or a total of 40 percent of all the tracts leased. All 23 of these tracts have since been relinquished and these three companies which represent one-half of the major oil companies that were successful bidders no longer hold any active interest in the NPR-A. Chevron has relinquished 9 of the 12 tracts leased and Shell Western has turned back 7 of its 12 tracts. Exxon stands alone in that it still retains all 6 of the leases won at the first lease sale which is also the greatest number of active leases held by any one company. A review of acreage indicates that EXXON and Shell are holding 70 percent of the active acreage and the balance is held by Chevron (17 percent) and independents (13 percent). See table 4.

The question now that management must resolve is, do we want to foster leasing within the NPR-A? If the answer is yes, then we must look at what we can do to market our product in light of changes that have occurred within the oil and gas industry since the enactment of the NPR-A legislation. Successful state sales have been held adjacent to NPR-A. These areas have the same oil and gas potential as NPR-A, yet have received moderate interest and bids. We must assume, therefore, that factors other than the oil and gas potential are stifling interest.

To make our product more marketable, we should think in terms of lowering the acquisition and retention costs which can be done on a local level and, secondly, we should again petition the Legislative Council through the Secretary to enact legislation to remove singular and restrictive constraints upon the NPR-A.

Specific Recommendations

1. Minimum bid - Should be reduced from $25/acre to a suggested level of $5/acre by the State Director.

2. Royalties - Should be reduced from 1/6 to 1/8 sliding scale in line with other competitive oil and gas lease sales by the State Director.

3. Other constraints - Efforts should be made to enact legislation to reduce rental fees by 50 percent, from $3/acre to $1.50/acre, for the primary lease term and, thus, treat the rental rates the same as all other onshore competitive and noncompetitive leases. Further, additional legislation should be introduced to give the Secretary authority to remove restrictive constraints and issue leases under the same type of authority as granted him under the Mineral Leasing Act of 1920.

Some positive results may be seen regarding the success of competitive lease sales if positive steps are taken to enact the three points recommended above. Points one and two can be realized through the stroke of a pen. Enactment of point 3 can be a lengthy process, but it is expected that there will be a strong correlation between efforts expended and point in time realized.

As regards lowering acquisition costs, economic theory holds that there is a price/quantity relationship. This relationship holds that as prices increase, some buyers will either drop out or reduce their participation in the market, resulting in a decrease in the quantity sold. Since there is insufficient sales data for the NPR-A to draw meaningful demand curves, we can only speculate on the impact of maintaining high acquisition and holding costs in an area that only holds an undemonstrated promise of success (maybe). It is reasonable to assume that if acquisition costs are lowered, acreage leased and total dollars realized by the government will be increased. Pursuing increased total revenues is only desirable up to the point of diminishing returns. It is believed that this point was reached some time ago and is well demonstrated by industries' interest in the NPR-A. To date, only 14 percent of the acreage offered has been bid upon, and only about 4 percent of the offered acreage is currently being actively held under lease.

It should again be pointed out that a local commitment and resolution of points 1 and 2 of the three recommendations will still leave us 50 percent away from our goal of a total commitment to NPR-A leasing and development.

The final 50 percent involves removing the restrictive constraints surrounding unit formation, suspension of production, extension of a primary lease term, limitation on the size of a lease tract, and the fact that rental rates are twice as high as any other competitive or noncompetitive lease rates in the United States. These points will have to be addressed again (attachment 2). The impact of these constraints can readily be demonstrated, in part by a review of the NPR-A lease history.

Prior to the first NPR-A lease sale, industry voiced their concern about these points. Both the Washington Office and the Alaska State Office insisted as early as 1981, via written communicaitons, that these concerns would be alleviated shortly via special legislation. See attachment 4 (correspondence from the Alaska State Director to the Alaska Oil and Gas Association). That was almost nine years ago, and this situation has still not been resolved.

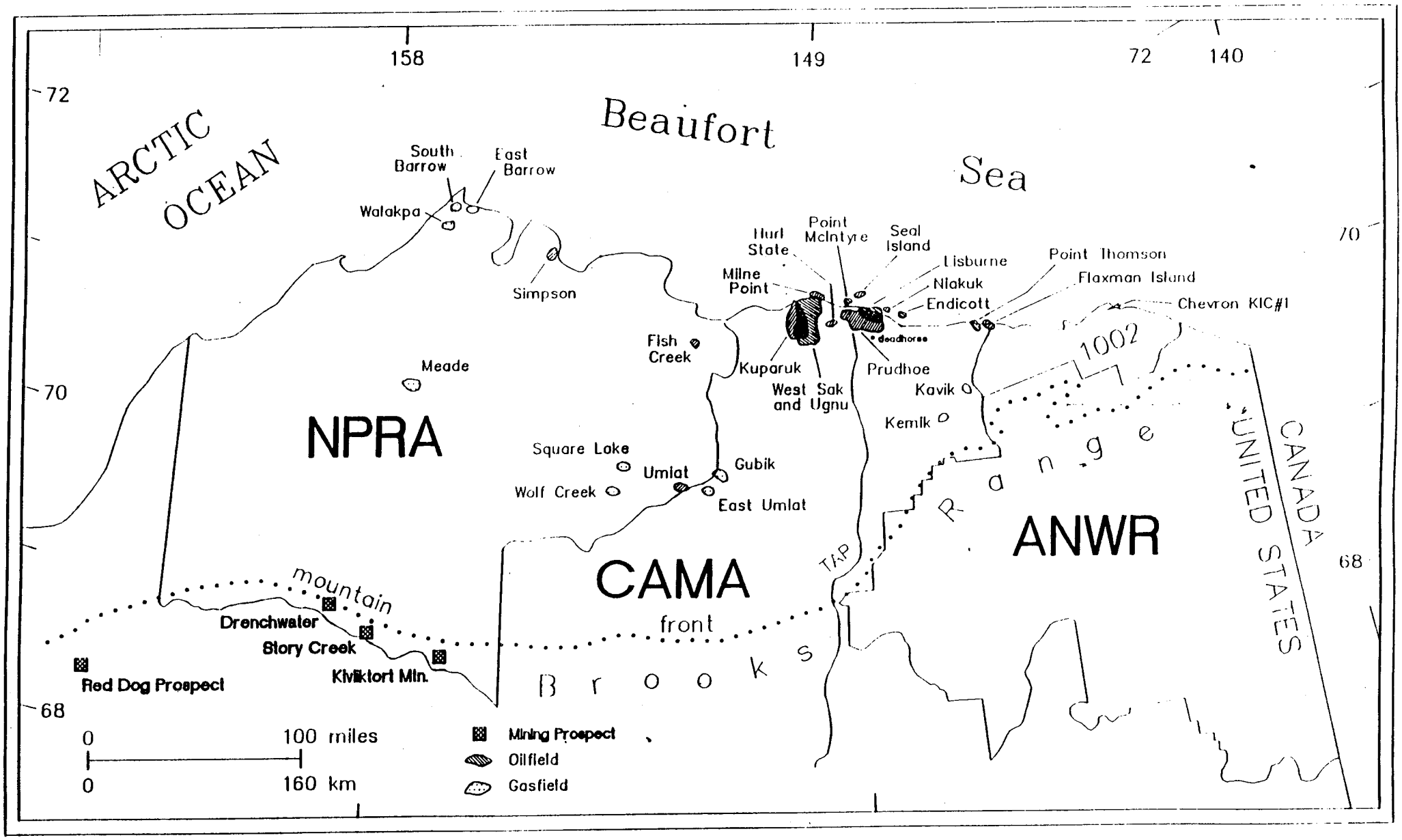
Industries' deemphasis on NPR-A leasing since then may be some measure of the impact that failure to enact this legislation has had. Also, in the past, nominations from major oil companies have often requested that action be taken to resolve this problem area.

It should also be pointed out that it has been almost six years since a competitive oil and gas lease sale has been held in Alaska and, nationally, oil imports are at an all-time high (54 percent January 1990). As regards the state's economy, little needs to be said. A financial crisis is facing the state as a result of increasing budgets with decreasing revenues. Alaska's oil and gas economy (85 percent revenues) needs all the help it can get.

To date, we have treated the NPR-A as if it were a sacred cow; unfortunately, the oil companies do not share this viewpoint. If we are to foster development within the NPR-A, we must market our product in a form that will heighten the interest in acquisition and development of the natural resourses within. Enactment of the specific recommendation does not guarantee any overnight changes, but most assuredly, industry will respond to the changes and interest in exploration and development within the NPR-A will be strengthened. Failure to take action guarantees the same level of minimal industry interest in the area and will certainly extend the timeframe for development while the state of Alaska continues to successfully develop their lands to the east of NPR-A.

James Borkoski

9 Attachments
1 - Letter, Solicitor's opinion
2 - Draft legislation
3 - Development theories
4 - Letter to AK Oil & Gas Commission
5 - Table 1
6 - Table 2
7 - Table 3
8 - Table 4
8 - Figure 1
9 - Figure 2



Major Oil/Gas Fields, North Slope Alaska

NATIONAL PETROLEUM RESERVE - ALASKA

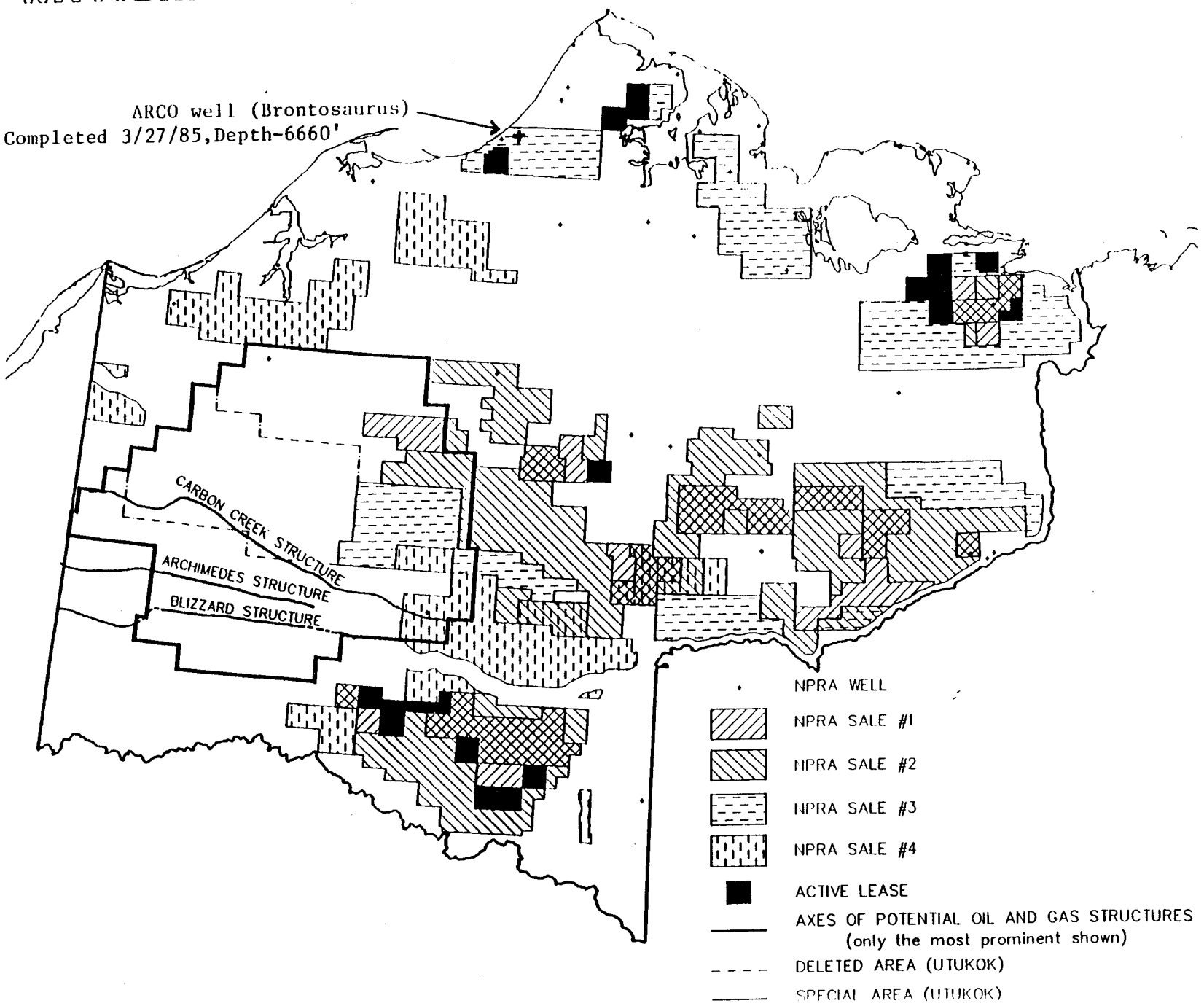


Table 1
NPR-A LEASE HISTORY
First Lease Sale, January 27, 1982

Tracts offered = 59
Tracts leased = 26
Active leases = 9

SALE NO.	TRACT NO.	Leased ACREAGE	BONUS AMOUNT	SERIAL NO.	EFFECTIVE	LESSEE	STATUS	ANNUAL RENTAL	RENT PAID TO DATE
821	3	22,896	$3,022,897.06	AA-46601	5-1-82	Standard AK Production	RL 12-24-86	$68,688.00	$343,440.00
821	4	22,704	$2,436,000.00	AA-46602	6-1-82	Texaco Producing	RL 7-3-89	$68,112.00	$476,784.00
821	6	22,704	$1,831,000.00	AA-46603	6-1-82	Chevron USA Inc.	Active	$68,112.00	$544,896.00
821	8	24,047	$11,700,366.40	AA-46604	6-1-82	Chevron USA Inc	RL 12-21-87	$72,141.00	$432,846.00
821	12	22,722	$2,950,000.00	AA-46605	5-1-82	Shell Western E&P*	RL 4-21-89	$68,166.00	$477,162.00
821	13	22,813	$7,155,297.45	AA-46606	6-1-82	Chevron USA Inc	RL 12-21-87	$68,439.00	$410,634.00
821	15	22,993	$1,315,199.60	AA-46608	5-1-82	Chevron USA Inc	RL 4-30-87	$68,979.00	$344,895.00
821	16	22,813	$1,758,822.30	AA-46609	5-1-82	Chevron USA Inc	RL 12-21-87	$68,439.00	$410,634.00
821	18	40,103	$5,117,142.80	AA-46610	5-1-82	Chevron USA Inc	RL 12-21-87	$120,309.00	$721,854.00
821	29	34,146	$1,224,134.10	AA-46611	5-1-82	Chevron USA Inc	RL 4-30-87	$102,438.00	$512,190.00
821	31	22,993	$1,117,450.80	AA-46612	5-1-82	Chevron USA Inc.	RL 4-30-87	$68,979.00	$344,895.00
821	32	22,716	$604,000.00	AA-46613	6-1-82	Exxon Corp.	Active	$68,148.00	$545,184.00
821	35	34,454	$1,105,973.40	AA-46616	6-1-82	Chevron USA Inc.	RL 5-27-87	$103,362.00	$516,810.00
821	36	34,454	$1,076,500.00	AA-46617	5-1-82	Shell Western E&P*	RL 4-21-89	$103,362.00	$723,534.00
821	37	34,466	$1,001,237.30	AA-46618	5-1-82	Chevron USA Inc.	RL 4-30-87	$103,398.00	$516,990.00
821	42	22,820	$652,652.00	AA-46619	5-1-82	Chevron USA Inc.	Active	$68,460.00	$547,680.00
821	45	22,820	$1,625,000.00	AA-46620	6-1-82	Texaco Producing Inc.*	RL 4-24-86	$68,460.00	$273,840.00
821	46	22,908	$641,000.00	AA-46621	6-1-82	Exxon Corp.	Active	$68,724.00	$549,792.00
821	48	22,733	$1,204,850.00	AA-46622	6-1-83	Shell Western E&P*	RL 12-30-86	$68,199.00	$272,796.00
821	49	22,820	$1,452,000.00	AA-46623	6-1-82	Texaco Producing Inc.*	RL 4-24-86	$68,460.00	$273,840.00
821	50	22,908	$701,000.00	AA-46624	6-1-82	Exxon Corp.	Active	$68,724.00	$549,792.00
821	53	22,733	$2,218,740.80	AA-46625	5-1-82	Chevron USA Inc.	Active	$68,199.00	$545,592.00
821	54	28,688	$719,000.00	AA-46626	6-1-82	Exxon Corp.	Active	$86,064.00	$688,512.00
821	56	34,460	$3,450,000.00	AA-46627	6-1-82	Exxon Corp.	Active	$103,380.00	$827,040.00
821	57	22,906	$1,146,000.00	AA-46628	6-1-82	Exxon Corp.	Active	$68,718.00	$549,744.00
821	58	22,996	$1,125,000.00	AA-46629	6-1-82	Texaco Producing Inc.*	RL 4-24-86	$68,988.00	$275,952.00
821	26	675,816	$58,351,265.01						$12,677,328.00

Sale No. 1 - Average winning bid - $86.34/acre

Second Lease Sale
May 26, 1982

Tracts offered = 212
Tracts leased = 12
Active leases = 1

822	5	22,704	$681,120.00	AA-49962	9-1-82	Standard Ak Production	RL 11-12-86	$68,112.00	$272,448.00
822	6	5,628	$163,212.00	AA-49963	9-1-82	Standard AK Production	RL 11-12-86	$16,884.00	$67,536.00
822	7	5,760	$151,956.00	AA-49964	9-1-82	Standard AK Production	RL 11-12-86	$17,280.00	$69,120.00
822	8	5,628	$151,956.00	AA-49965	9-1-82	Standard AK Production	RL 11-12-86	$16,884.00	$67,536.00
822	3	5,760	$1,209,600.00	AA-49966	9-1-82	Standard AK Production	RL 11-12-86	$17,280.00	$69,120.00
822	15	22,800	$973,560.00	AA-49967	9-1-82	Shell Western E&P	Active	$68,400.00	$547,200.00
822	119	22,993	$739,224.95	AA-49968	9-1-82	Texaco Inc.*	RL 2-25-86	$68,979.00	$275,916.00
822	147	34,320	$1,000,428.00	AA-49969	9-1-82	Texaco Inc.*	RL 2-25-86	$102,960.00	$411,840.00
822	148	10,120	$374,440.00	AA-49970	9-1-82	Shell Western E&P*	RL 8-22-89	$30,360.00	$212,520.00
822	149	34,367	$1,702,000.00	AA-49971	9-1-82	Shell Wetern E&P*	RL 8-22-89	$103,101.00	$721,707.00
822	201	45,651	$1,376,377.65	AA-49972	9-1-82	Texaco Inc.*	RL 2-25-86	$136,953.00	$547,812.00
822	210	36,418	$1,217,147.00	AA-49973	9-1-82	Shell Western E&P*	RL 8-31-89	$109,254.00	$764,778.00
822	12	252,149	$9,741,021.60						$4,027,533.00

*Denotes Lead Company

Sale No. 2 - Average winning bid - $38.63/acre.

As of 01/22/90

Table 1

NPR-A Lease History
Third Lease Sale
July 20, 1983

Tracts offered = 84
Tracts Leased = 20
Active Leases = 8

SALE NO.	TRACT NO.	Leased ACREAGE	BONUS AMOUNT	SERIAL NO.	EFFECTIVE	LESSEE	STATUS	ANNUAL RENTAL	RENT PAID TO DATE
831	1	34,074	$954,000.00	AA-51195	4-1-85	Shell Western E&P*	Active	$102,222.00	$511,110.00
831	6	22,151	$593,000.00	AA-51209	4-1-85	Shell Western E&P*	Active	$66,453.00	$332,265.00
831	7	35,227	$2,881,568.60	AA-51210	3-1-84	ARCO AK Inc.	RL 4-24-86	$105,681.00	$211,362.00
831	8	22,890	$2,191,030.80	AA-51211	3-1-84	ARCO AK Inc.	RL 4-24-86	$68,670.00	$206,010.00
831	9	22,890	$1,786,564.50	AA-51212	3-1-84	ARCO AK Inc.	RL 4-24-86	$68,670.00	$137,340.00
831	10	22,889	$726,725.75	AA-51213	3-1-84	ARCO AK Inc.	RL 4-24 86	$68,667.00	$137,334.00
831	11	18,748	$476,199.20	AA-51214	3-1-84	Christian B.Z. Buck	Active	$56,244.00	$337,464.00
831	12	22,991	$648,000.00	AA-51215	4-1-85	Shell Western E&P*	RL 12-30-86	$68,973.00	$137,946.00
831	13	22,991	$603,513.75	AA-51216	3-1-84	ARCO AK Inc.	RL 4-24-86	$68,973.00	$137,946.00
831	14	22,991	$603,513.75	AA-51217	3-1-84	ARCO AK Inc.	RL 4-24 86	$68,973.00	$137,946.00
831	15	22,991	$603,513.75	AA-51218	3-1-84	ARCO AK Inc.	RL 4-24-86	$68,973.00	$137,946.00
831	27	22,895	$650,218.00	AA-51219	12-1-84	Texaco Inc.*	RL 11-26-86	$68,685.00	$137,370.00
831	28	22,895	$622,057.15	AA-51220	12-1-84	Texaco Inc.*	RL 11-26-86	$68,685.00	$137,370.00
831	29	22,895	$576,954.00	AA-51221	12-1-84	Texaco Inc.*	RL 11-26-86	$68,685.00	$137,370.00
831	34	22,992	$713,000.00	AA-51222	4-1-85	Shell Western E&P	Active	$68,976.00	$344,880.00
831	36	2,555	$724,260.96	AA-51223	3-1-84	Alaska Land Leasing	TM 3-1-85	$7,665.00	$7,665.00
831	36	14,677	1/	AA-51223-A	3-1-84	H.L. Wangenheim & Assoc.	Active	$44,031.00	$220,155.00
831	37	22,704	$772,000.00	AA-51224	4-1-85	Shell Western E&P	Active	$68,112.00	$340,560.00
831	41	16,532	$599,539.84	AA-51225	3-1-84	Scott & Wangenheim, SOPA	Active	$49,596.00	$297,576.00
831	41	640	1/	AA-51225-AH	3-1-84	Virginia Johnson	Active	$1,920.00	$11,520.00
831	20 2/	419,618	$16,725,660.05						$4,059,135.00

Sale No. 3 - Average winning bid = $39.86/acre
All sales - Average winning bid = $62.94/acre

Fourth Lease Sale
July 18, 1984
Sale No. 841 - 64 tracts offered - no bids received

GRAND TOTALS	1,347,583	$84,817,945.66	$4,042,749.00	$20,763,996.00

Leased Acreage as of 1-22-90 398,161

*Denotes Lead Company

1/ Leases segregated after issuance, bonuses are reflected in base leases numbers 36 and 41, listed above segrated lease.
2/ Total comes to 20, but includes two segregated leases. Only 18 tracts were actually bid on.

Table 2

NPR-A Lease History Summary
(tracts leased)

Sale	Date of Sale	Number of Tracts				Percent by Individual Sales		Percent of all Sales		
		Offered	Bid on	Leased	Active	Tracts Leased vs. Offered	Tracts Active vs. Leased	Total Leases Offered	Total Leases Leased	Total Leases Active
821	01/27/82	59	29	26[1/]	9	44%	35%	14%	45%	50%
822	05/26/82	212	12	12	1	6%	8%	51%	21%	6%
831	07/23/83	84	20[1/]	20[1/]	8	24%	40%	20%	34%	44%
841	07/18/84	64	0	0	0	0	0	15%	0	0
	TOTALS	419	61[3/]	58[3/]	18	14%	31%	100%	100%	100%

1/ Actually, 18 tracts were bid on; two were later segregated (tracts 36 and 41).

2/ Three high bids rejected.

3/ Includes two leases segregated after the sale.

Table 2 (continued)

NPR-A Lease History Summary
(acreage leased)

Sale	Date of Sale	Acreage				Percent by Individual Sales		Percent of all Sales		
		Offered	Bid on	Leased	Active	Acreage Leased vs. Offered	Acreage Active vs. Leased	Acreage Offered	Acreage Leased	Acreage Active
821	01/27/82	1,516,257	755,325	675,816	222,843	45%	33%	17%	50%	56%
822	05/26/82	3,519,515	252,149	252,149	22,800	7%	9%	40%	19%	6%
831	07/23/83	2,195,845	419,618	419,618	152,518	19%	36%	25%	31%	38%
841	07/18/84	1,590,677	0	0	0	0	0	18%	0	0
	TOTALS	8,822,294	1,404,101	1,347,583	398,161	15%	30%	100%	100%	100%

Table 3

NPR-A Lease History Summary by Company
(tracts leased)

A total of 58 tracts have been leased in the NPR-A; 53 were leased by a total of 6 major oil companies. Three of these majors, ARCO, Texaco, and British Petroleum leased a total of 23 tracts within the NPR-A or a total of 40 percent of all the tracts leased. All 23 of these tracts have since been relinquished and these three companies which constitute one-half of the major oil companies that were successful bidders, no longer hold an active interest in the NPR-A. In addition, Chevron has relinquished 9 of the 12 tracts leased and Shell Western has turned back 7 of its 12 tracts. Exxon stands alone in that it still retains all 6 of the leases won at the first lease sale.

Tracts Leased

Sale	Leases	ARCO	Texaco	British Petroleum[1/]	Chevron	Shell	Exxon	Independents[2/]	Totals
#1	Acquired	--	4	1	12	3	6	--	26
(821)	Active	--	0	0	3	0	6	--	9
#2	Acquired	--	3	5	--	4	--	--	12
(822)	Active	--	0	0	--	1	--	--	1
#3	Acquired	7	3	--	--	5	--	5	20
(831)	Active	0	0	--	--	4	--	4	8
#4	Acquired	--	--	--	--	--	--	--	--
(841)	Active	--	--	--	--	--	--	--	--
TOTAL ACQUIRED		7	10	6	12	12	6	5	58
TOTAL ACTIVE		0	0	0	3	5	6	4	18
PERCENT OF LEASES ACTIVE		0%	0%	0%	25%	42%	100%	80%	31%
GROUP LEASES ACTIVE		All NPR-A leases relinquished by these companies.			47% of this groups's leases are still active.			80%	31%
PERCENT OF TOTAL ACTIVE LEASES		--	--	--	17%	28%	33%	22%	31%

1/ Formerly Standard Alaska Production Company.

2/ The names of the five independents are Alaska Land Leasing, Virginia Johnson, Christian B. Z. Buck, Scott & Wangenheim, J. L. Wagenheim & Assoc., Each independent acquired one lease. All leases are still active with the exception of the lease of Alaska Land Leasing.

NPR-A Lease History Summary by Company
(acreage leased)

Sale	Leases	ARCO	Texaco	British Petroleum 1/	Chevron	Shell	Exxon	Independents 2/	Totals
#1	Acquired	--	91,340	22,896	327,085	79,909	154,586	--	675,816
(821)	Active	--	0	0	68,257	0	154,586	--	222,843
#2	Acquired	--	102,964	45,480	--	103,705	--	--	252,149
(822)	Active	--	0	0	--	22,800	--	--	22,800
#3	Acquired	172,869	68,685	--	--	124,912	--	53,152	419,618
(831)	Active	0	0	--	--	101,921	--	50,597	152,518
#4	Acquired	--	--	--	--	--	--	--	1,347,583
(841)	Active	--	--	--	--	--	--	--	398,161
TOTAL ACQUIRED		172,869	262,989	68,376	327,085	308,526	154,586	53,152	1,347,583
TOTAL ACTIVE		0	0	0	68,257	124,721	154,586	50,597	398,161
PERCENT OF ACREAGE ACTIVE		0%	0%	0%	21%	40%	100%	95%	30%
GROUP ACREAGE ACTIVE		All NPR-A leases relinquished by these companies.			44% of this groups's acreage is still active.			95%	30%
PERCENT OF TOTAL ACTIVE ACREAGE		--	--	--	17%	31%	39	13%	30%

SUMMARY

	Active Leases and Acreage		
	Leases	Acreage	Percent of Acreage
Exxon	6	154,586	39%
Shell	5	124,721	31%
Chevron	3	68,257	17%
Independents (4)	4	50,597	13%
TOTALS	18	398,161	100%

ATTACHMENT 1

APR 15 1982

Note to Director

From: Lois Mason, Branch of Alaska Resources,
Division of Oil and Gas

Subject: Authority to Reduce Royalty Rate on NPR-A Leases

The NPR-A oil and gas leasing regulations state at 43 CFR § 3133.1:

> "Royalty on oil and gas shall be at the rate specified in the notice of sale as to the tracts, if appropriate, and in the lease, unless the Secretary, in order to promote increased production on the leased area through direct, secondary or tertiary recovery means, reduces or eliminates any royalty set out in the lease."

The Solicitor's Office (Larry McBride - SOL/ER) indicates, indeed, that we have the authority to reduce the royalty rate on NPR-A leases.

The language in the NPR-A regulations is worded in the above manner for two reasons. First, it is based on the requirements stated in the FY 1981 Department of the Interior Appropriations Act that: a) fixes no minimum production royalty rate; and b) requires the bidding systems used in NPR-A lease sales to be "based on" the bidding systems included in section 205(a)(1)(A) through (H) of the OCS Lands Act Amendments of 1978. The wording of the NPR-A regulation allows flexibility for those bidding systems that do not permit the setting of the royalty rate in advance and, in those instances, the rate cannot be specified in the sale notice (e.g., net profit share system).

Second, because the Appropriations Act is silent, additional language from section 205(a)(3) of the OCS Lands Act Amendments was borrowed that allows the Secretary, in order to promote increased production on the lease area through direct, secondary, or tertiary recovery means, to reduce or eliminate royalty set forth in the lease for such area.

Two important features merit note. One is that the language only allows reduction or elimination, not an increase in royalty. Thus, should it be found (when development and production in NPR-A are imminent) that the 1/6 level is too high, it could be reduced to 1/8. The reverse, however, to increase from 1/8 to 1/6, is not allowable. Second, definitive standard criteria for consideration of royalty reductions would be advisable a) to avoid unreasoned discrimination among lessees and b) to avoid successful appeals from adverse actions that may assert that the standards used are arbitrary and capricious. Such criteria, however, could be administratively developed without formal inclusion in the NPR-A leasing rules to allow the full flexibility of the current regulation language as to stand in force.

/s/ Lois E. Mason

cc:
500:RF 510 SOL/ER - McBride
530:RF 530-Patton
530:LMASON:mlb:4/15/82:x37753

ATTACHMENT 2

Draft Legislation to Authorize the Unitization of Oil and Gas Leases in the National Petroleum Reserve - Alaska (NPRA)

Background

On May 22, 1981, the Departmental Solicitor concluded that the Department of the Interior Appropriations Act for Fiscal Year 1981 constituted new and independent leasing authority for the NPRA. Since the Mineral Lands Leasing Act (MLA) of 1920 does not apply to the NPRA, the Secretary is not granted the extent of authority to conduct an oil and gas leasing program in the NPRA as he has in the rest of the nation. Comments from industry suggest that the shortcomings in the Appropriations Act listed below may have had an adverse affect on the two sales held earlier this year.

Problem Areas

* The absence of authority to unitize;
* The inability to extend a primary lease term beyond 10 years except in limited cases;
* The lack of authority for the Secretary to grant suspensions of production on leases capable of producing in paying quantities pending the development of necessary infrastructure (transportation, pipelines);
* The 60,000-acre limitation on the size of an oil and gas lease tract.

Benefits of Recommended Legislation

* The granting of unitization authority to the Secretary would allow him to approve cooperative or unit agreements. This authority would also remove the 60,000-acre limitation on tract sizes since there is no limit placed on the size of a unit. Unitization would permit orderly development, efficient production of the resource, and allow industry to share in the high upfront costs of exploration, development, and the associated risks and benefits.
* The draft bill would grant to the Secretary the authority to extend the primary lease term if the lessee can demonstrate that he has diligently pursued development to secure and maintain production of oil or gas reserves. This would alleviate industry's fear that they would lose a lease if, after a diligent comprehensive drilling program, they were unable to achieve production by the tenth year.
* The Secretary would be granted the authority to suspend production if a well capable of production is shut-in pending the construction of infrastructure. Currently, a lease cannot be extended beyond the primary lease term if it is not producing, or if approved drilling or reworking are not being conducted. The draft bill would prevent a lessee from losing the lease if a well was capable of production but was shut-in while awaiting the necessary insfrastructure, e.g., transportation.

* The draft bill would, through the granting of unitization authority, remove the 60,000-acre limitation on tract size, so that companies with large tracts would not be prevented from entering into unit agreements with others. The average active tract size as of January 22, 1990, is 22,120 acres. The largest tract lease to date was 45,651 acres. This tract was leased to Texaco at the second lease sale and has since been relinquished.

Attachment 3

Theories on How Development of the NPR-A will Come About

Theory One

The first theory contends that industries' concerns, expressed in the body of this report, are, for the most part, real and that their resolution would foster and promote an expansion of industry interest in the NPR-A, create an atmosphere of successful lease sales and shorten the timeframe for exploration and development activities. This theory holds that, since the NPR-A in within a high cost remote area, costs are further compounded by the minimum bonus bid of $25/acre, the $3/acre rental, and the one-sixth royalty rate. Further, this theory holds that the minimum economic field size necessary for development would have to be increased in order to sustain a profitable venture.

The results of the government holding out for increased bonuses, rentals, and royalties will be, put simplistically, to defer interest in lease sales and delay the development of NPR-A resources. The resultant delay in production would delay receipt of royalty revenues and may lower the net present value of royalties and other incomes below what would be realized by a more liberalized leasing policy. The feeling expressed by industry is that the lease terms were developed in early 1981 when oil prices were in the range of $37/barrel. In light of current marketing conditions, it is believed that the rents, royalties, and bonuses need to be reexamined.

Theory Two

Theory two holds that Prudhoe Bay is the nucleus, and that exploration and development efforts will continue to extend from this point. The speed of this exploration development will depend on a number of points such as product pricing, general market conditions, significant discoveries, the proximity and access to an extending infrastructure such as pipelines and roads, etc., and the status of the Arctic National Wildlife Reserve (ANWR). The status of ANWR is seen as very significant if that area is opened to development. Dollars that might otherwise be utilized in a westward expansionary effort from Prudhoe Bay and, ultimately, into the NPR-A would for the most part be absorbed by exploratory efforts in a eastern direction into ANWR. This type of effort on the part of industry could significantly delay further interest in lease sales as well as exploration and development activities in NPR-A.

This theory holds that, although industry would prefer more liberal leasing terms in NPR-A to be demonstrated by the favorable resolution of the points of contention previously raised, this resolution would not significantly decrease the timeframe for successful NPR-A lease sales or exploratory and development activities in that area. This theory does hold, though, that needed legislation on unitization, suspension of production, etc., must be enacted.

The scenario as this theory sees it is as follows:

> Presently, industry is continuing development of Prudhoe Bay. Exploration, development, and production activity has continued west approximately 30 miles into the Kuparuk River field and, with it, the necessary gathering lines and infrastructure. In conjunction with this, exploration activities have continued further west into the Colville Delta adjacent to the NPR-A. If available funds are not diverted into ANWR, this westward progression is expected to continue into NPR-A.

ATTACHMENT 4

3130(916)

DEC [illegible] 81

William W. Hopkins, Executive Director
Alaska Oil & Gas Association
505 West Northern Lts. Blvd., Suite 219
Anchorage, Alaska 99503

Dear Mr. Hopkins:

Your organization together with oil and gas companies have expressed two concerns involving the extension of leases on NPR-A.

The absence of provisions in our rules and lease form addressing unit formation and extension by shut-in production is derived from proviso 8 in the Appropriations Act, "each lease shall be issued for an initial period of up to ten years, and shall be extended for so long thereafter as oil or gas is produced from the lease in paying quantities, or as drilling or reworking operations, as approved by the Secretary, are conducted there on." The Act requires production not a well capable of production, nor production from another lease.

The Mineral Leasing Act (MLA) of 1920 has a provision maintaining leases with shut-in wells and for extending leases committed to units on which production has occurred (30 USC 5226 (f) and 226 (j)). The Mineral Leasing Act does not apply to NPR-A and the Appropriations Act is an independent leasing authority which obviated acreage limitations and other MLA problems. It also renders provisions of the MLA inapplicable.

Consistent with proviso 8, lessees may agree to allocate and share production costs and income under unit plan concepts. We understand industries concern lies with extension of leases beyond the 10 years not just the allocation or sharing of operations, we have included no express rules treating these types of "unitization". Further, no Secretarial approval of such agreements is required by the Appropriations Act and is required by our rules only to the extent they constitute assignments of interest in leases under 43 CFR 3135. Also consistent with proviso 8, the Department intends to propose rules allowing consolidation of leases into a single lease (with a 60,000 acre limit) which will partially resolve the problem of lease extensions under limitations contained in proviso 8.

We understand from contacts with our Washington Office that special legislation is being considered to cover extensions for both shut-in wells pending availability of transportation and suspension of lease terms for unusual conditions.

(916):CMCVEE:bgg:12/03/81:x3632:101

Sincerely yours,

/S. [illegible]

State Director

STEPS TO LEASE SALE

It is recognized that this is a list of the major steps involved and that coordination with 912, 918, 930, 973 and 974 is necessary.

Official	Action	Proposed Date
060	Expression of Interest	accomplished
910/980	Set date of sale	August 29, 1991
060/984/985	Map of proposed sale area	May 30, 1990
980	*Review by State & BLM for environmental issues	July 15, 1990
982	Preliminary land status review	August 15, 1990
060/980	Final sale area map & announce sale to public no tracts shown	August 20, 1990
	*is EA needed??	
060/984	Draft tract map to 980	December 1, 1990
060/984 985	Final tract map to 980 & Pre-sale estimates of values	April 1, 1991
060/984 982	Final lease stipulation coord. & Land status check	April 15, 1991
982	Prepare detailed statement	May 10, 1991
982	*Detailed statement to Dept. of Justice	May 29, 1991
982	Notice of sale in Fed. Reg. & Detailed statement mailed to public	July 26, 1991
982	Mock sale	August 26, 1991
982	Hold Sale	August 29, 1991

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Arctic District Office
1150 University Avenue
Fairbanks, Alaska 99709-3844

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
3130 (060)

22 NOV 1989

Dear Sirs:

As a part of the Bureau of Land Management's (BLM) Oil and Gas Leasing Program, we are soliciting expressions of interest for competitive leasing in the National Petroleum Reserve in Alaska (NPR-A). This request appeared in the Federal Register on November 3, 1989.

Specific public comments are requested regarding a proposed calendar year 1990 competitive lease sale, a proposed lease area and future NPR-A lease sales.

Please note the attached map, provided for your convenience in recording areas within NPR-A which might be of interest to you. There are two methods of possible response. First by making notations of interest areas on the attached map. Second, by letter, describing your areas of interest and response to the questions below.

The BLM conducts a demand analysis prior to scheduling lease sales and will be conducting such an analysis this year. Should the demand analysis demonstrate the need for a sale, BLM will publish a notice of sale and publish maps depicting blocks of NPR-A lands with lease tracts and proposed stipulations for the sale.

To help us prepare the demand analysis, we would appreciate your cooperation by answering the following questions:

1. The Bureau of Land Management proposes to offer for competitive lease an onshore area in the north central NPR-A bounded by Cape Simpson on the east, private subsurface on the north, and the Chuckhi Sea to the West.

   a. If a 1990 lease sale were scheduled in the NPR-A, would you submit a bid at such a sale?

   b. Please comment on whether the general area of the 1990 Proposed Lease Sale area is of interest to you.

   c. Please comment on any other areas of specific interest: such as the tracts selected to be offered in the 1985 sale, which was not held, tracts which have not been previously offered, or tracts which you would like to have re-offered in 1990.

2. What is your timing preference for the next NPR-A lease sale?

   a. If not in the year 1990 or 1991, when might leasing in the NPR-A be most preferable?

   b. Past lease sales have been scheduled during the summer (July). The summer lease sale date was selected to provide sufficient sale preparation time for both industry and the Bureau of Land Management.

   Present policy is to notify industry of preliminary lease tracts and proposed stipulations 7 months prior to a sale (i.e., a December notice for a July sale), in the belief that this timing will provide sufficient opportunity for gathering and analyzing geophysical data specific to the proposed tracts. Does this practice provide such an opportunity or should BLM's NPR-A leasing process be adjusted to reflect a different schedule?

3. What priority would you place on NPR-A leasing relative to other leasing opportunities in Alaska?

4. Are there any terms, conditions, stipulations or other factors currently imposed on NPR-A lease sales and leases that you would like to see changed if a sale were offered in 1990?

Comments that contain proprietary information should be so marked, and, to the extent possible under the Freedom of Information Act, will be treated confidentially.

Additional copies of the attached map, Request for Comments 1990 are available at the Public Rooms of the Bureau of Land Management's Alaska State Office, Anchorage, Alaska and the Fairbanks Support Center, Fairbanks, Alaska as well as the address below.

Comments will be accepted until December 15, 1989. For further information contact: Don Meares, Natural Resource Specialist at the address given below or telephone (907) 474-2306.

Please direct written questions and responses to: M. Thomas Dean, Arctic District Office, Bureau of Land Management, 1150 University Avenue, Fairbanks, Alaska 99709-3844.

Sincerely yours,

M. Thomas Dean
Acting Arctic District Manager

Attachment

United States Department of the Interior
Bureau of Land Management
Alaska State Office
Branch of Mineral Assessment
6881 Abbott Loop Road
Anchorage, Ak 99507

TO: Deputy State Director for Mineral Resources (AK-980)

FROM: Chief, Branch of Mineral Assessment (AK-985)

SUBJECT: Fair Market Value Determinations in NPRA

Concerning the above subject. None of the laws concerning leasing in NPRA state specifically that a pre-sale tract evaluation will be completed for NPRA. Pre-sale tract evaluation is a methodology adopted by the Department to ensure Fair Market Value (FMV) for public minerals. The appropriate legislation governing federal minerals are:

- Minerals Leasing Act of 1920 and amendments
- Federal Lands Policy and Management Act, sec.(209)
- Outer Continental Shelf Lands Act Amendments of 1978
- Dept. of Interior Appropriations Act of 1981

The National Petroleum Reserve Alaska was transferred to BLM under the National Petroleum Reserve Production Act of 1976. Public Law 96-514 of Dec. 12, 1980 opened the Reserve for Leasing and stated that "lease sales shall be based on bidding systems included in sections 205(a)(1)(A) through (H) of the OCSLA amendments of 1978. Pre-sale and Post-sale evaluations were set-up to fulfill the following requirements in the OCSLA:

Sec. 201 defines FMV as "...the value of any mineral computed.....at a price determined by the Secretary". Sec. 202 (3) reads " the outer continental Shelf is a vital national resource reserve.....which should be made available for expeditous and orderly development..... in a manner consistent with the maintenance of competition....." Sec. 203 (a) (4) states that "Leasing activities shall be conducted to assure receipt of fair market value for the lands leased and rights conveyed by the Federal Government. ..... analyze and interpret the exploratory data and any other information which may be compiled under the authority of this act"

In addition 43 CFR 3132.5 (b) states "The United States reserves the right to reject any and all bids received for any tract, regardless of the amount offered." I am not sure of the legislative source of this regulation.

Gary

cal structures, including the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling of any additional delineation well after such discovery which is needed to delineate any reservoir and to enable the lessee to determine whether to proceed with development and production;

"(l) The term 'development' means those activities which take place following discovery of minerals in paying quantities, including geophysical activity, drilling, platform construction, and operation of all onshore support facilities, and which are for the purpose of ultimately producing the minerals discovered;

"(m) The term 'production' means those activities which take place after the successful completion of any means for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and work-over drilling;

"(n) The term 'antitrust law' means—

"(1) the Sherman Act (15 U.S.C. 1 et seq.);

"(2) the Clayton Act (15 U.S.C. 12 et seq.);

"(3) the Federal Trade Commission Act (15 U.S.C. 41 et seq.);

"(4) the Wilson Tariff Act (15 U.S.C. 8 et seq.); or

"(5) the Act of June 19, 1936, chapter 592 (15 U.S.C. 13, 13a, 13b, and 21a);

"(o) The term 'fair market value' means the value of any mineral (1) computed at a unit price equivalent to the average unit price at which such mineral was sold pursuant to a lease during the period for which any royalty or net profit share is accrued or reserved to the United States pursuant to such lease, or (2) if there were no such sales, or if the Secretary finds that there were an insufficient number of such sales to equitably determine such value, computed at the average unit price at which such mineral was sold pursuant to other leases in the same region of the outer Continental Shelf during such period, or (3) if there were no sales of such mineral from such region during such period, or if the Secretary finds that there are an insufficient number of such sales to equitably determine such value, at an appropriate price determined by the Secretary;

"(p) The term 'major Federal action' means any action or proposal by the Secretary which is subject to the provisions of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)); and

"(q) The term 'minerals' includes oil, gas, sulphur, geopressured-geothermal and associated resources, and all other minerals which are authorized by an Act of Congress to be produced from public lands as defined in section 103 of the Federal Land Policy and Management Act of 1976.". 43 USC 1702.

NATIONAL POLICY FOR THE OUTER CONTINENTAL SHELF

SEC. 202. Section 3 of the Outer Continental Shelf Lands Act (43 U.S.C. 1332) is amended to read as follows:

"SEC. 3. NATIONAL POLICY FOR THE OUTER CONTINENTAL SHELF.—It is hereby declared to be the policy of the United States that—

"(1) the subsoil and seabed of the outer Continental Shelf appertain to the United States and are subject to its jurisdiction, control, and power of disposition as provided in this Act;

"(2) this Act shall be construed in such a manner that the character of the waters above the outer Continental Shelf as high seas and the right to navigation and fishing therein shall not be affected;

"(3) the outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs;

"(4) since exploration, development, and production of the mineral resources of the outer Continental Shelf will have significant impacts on coastal and non-coastal areas of the coastal States, and on other affected States, and, in recognition of the national interest in the effective management of the marine, coastal, and human environments—

"(A) such States and their affected local governments may require assistance in protecting their coastal zones and other affected areas from any temporary or permanent adverse effects of such impacts; and

"(B) such States, and through such States, affected local governments, are entitled to an opportunity to participate, to the extent consistent with the national interest, in the policy and planning decisions made by the Federal Government relating to exploration for, and development and production of, minerals of the outer Continental Shelf;

"(5) the rights and responsibilities of all States and, where appropriate, local governments, to preserve and protect their marine, human, and coastal environments through such means as regulation of land, air, and water uses, of safety, and of related development and activity should be considered and recognized; and

"(6) operations in the outer Continental Shelf should be conducted in a safe manner by well-trained personnel using technology, precautions, and techniques sufficient to prevent or minimize the likelihood of blowouts, loss of well control, fires, spillages, physical obstruction to other users of the waters or subsoil and seabed, or other occurrences which may cause damage to the environment or to property, or endanger life or health.".

LAWS APPLICABLE TO THE OUTER CONTINENTAL SHELF

SEC. 203. (a) Section 4(a)(1) of the Outer Continental Shelf Lands Act (43 U.S.C. 1333 (a)(1)) is amended—

(1) by striking out "and fixed structures" and inserting in lieu thereof ", and all installations and other devices permanently or temporarily attached to the seabed,"; and

(2) by striking out "removing, and transporting resources therefrom" and inserting in lieu thereof "or producing resources therefrom, or any such installation or other device (other than a ship or vessel) for the purpose of transporting such resources".

(b) Section 4(a)(2) of such Act is amended by redesigning paragraph (2) as (2)(A) and by adding at the end thereof the following new subparagraph:

"(B) Within one year after the date of enactment of this subparagraph, the President shall establish procedures for setting any outstanding international boundary dispute respecting the outer Continental Shelf.".

"(1) Management of the outer Continental Shelf shall be conducted in a manner which considers economic, social, and environmental values of the renewable and nonrenewable resources contained in the outer Continental Shelf, and the potential impact of oil and gas exploration on other resource values of the outer Continental Shelf and the marine, coastal, and human environments.

"(2) Timing and location of exploration, development, and production of oil and gas among the oil- and gas-bearing physiographic regions of the outer Continental Shelf shall be based on a consideration of—

"(A) existing information concerning the geographical, geological, and ecological characteristics of such regions;

"(B) an equitable sharing of developmental benefits and environmental risks among the various regions;

"(C) the location of such regions with respect to, and the relative needs of, regional and national energy markets;

"(D) the location of such regions with respect to other uses of the sea and seabed, including fisheries, navigation, existing or proposed sealanes, potential sites of deepwater ports, and other anticipated uses of the resources and space of the outer Continental Shelf;

"(E) the interest of potential oil and gas producers in the development of oil and gas resources as indicated by exploration or nomination;

"(F) laws, goals, and policies of affected States which have been specifically identified by the Governors of such States as relevant matters for the Secretary's consideration;

"(G) the relative environmental sensitivity and marine productivity of different areas of the outer Continental Shelf; and

"(H) relevant environmental and predictive information for different areas of the outer Continental Shelf.

"(3) The Secretary shall select the timing and location of leasing, to the maximum extent practicable, so as to obtain a proper balance between the potential for environmental damage, the potential for the discovery of oil and gas, and the potential for adverse impact on the coastal zone.

Fair market value.

"(4) Leasing activities shall be conducted to assure receipt of fair market value for the lands leased and the rights conveyed by the Federal Government.

Appropriations and staff, estimates.

"(b) The leasing program shall include estimates of the appropriations and staff required to—

"(1) obtain resource information and any other information needed to prepare the leasing program required by this section;

"(2) analyze and interpret the exploratory data and any other information which may be compiled under the authority of this Act;

Environmental studies and impact statement.

"(3) conduct environmental studies and prepare any environmental impact statement required in accordance with this Act and with section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)); and

"(4) supervise operations conducted pursuant to each lease in the manner necessary to assure due diligence in the exploration and development of the lease area and compliance with the requirements of applicable law and regulations, and with the terms of the lease.

"(c)(1) During the preparation of any proposed leasing program under this section, the Secretary shall invite and consider suggestions for such program from any interested Federal agency, including the Attorney General, in consultation with the Federal Trade Commission, and from the Governor of any State which may become an affected State under such proposed program. The Secretary may also invite or consider any suggestions from the executive of any affected local government in such an affected State, which have been previously submitted to the Governor of such State, and from any other person.

Publication in Federal Register.

"(2) After such preparation and at least sixty days prior to publication of a proposed leasing program in the Federal Register pursuant to paragraph (3) of this subsection, the Secretary shall submit a copy of such proposed program to the Governor of each affected State for review and comment. The Governor may solicit comments from those executives of local governments in his State which he, in his discretion, determines will be affected by the proposed program. If any comment by such Governor is received by the Secretary at least fifteen days prior to submission to the Congress pursuant to such paragraph (3) and includes a request for any modification of such proposed program, the Secretary shall reply in writing, granting or denying such request in whole or in part, or granting such request in such modified form as the Secretary considers appropriate, and stating his reasons therefor. All such correspondence between the Secretary and the Governor of any affected State, together with any additional information and data relating thereto, shall accompany such proposed program when it is submitted to the Congress.

Leasing program, submittal to Congress.

Publication in Federal Register.

"(3) Within nine months after the date of enactment of this section, the Secretary shall submit a proposed leasing program to the Congress, the Attorney General, and the Governors of affected States, and shall publish such proposed program in the Federal Register. Each Governor shall, upon request, submit a copy of the proposed leasing program to the executive of any local government affected by the proposed program.

"(d)(1) Within ninety days after the date of publication of a proposed leasing program, the Attorney General may, after consultation with the Federal Trade Commission, submit comments on the anticipated effects of such proposed program upon competition. Any State, local government, or other person may submit comments and recommendations as to any aspect of such proposed program.

Leasing program, submittal to President and Congress.

"(2) At least sixty days prior to approving a proposed leasing program, the Secretary shall submit it to the President and the Congress, together with any comments received. Such submission shall indicate why any specific recommendation of the Attorney General or a State or local government was not accepted.

"(3) After the leasing program has been approved by the Secretary, or after eighteen months following the date of enactment of this section, whichever first occurs, no lease shall be issued unless it is for an area included in the approved leasing program and unless it contains provisions consistent with the approved leasing program, except that leasing shall be permitted to continue until such program is approved and for so long thereafter as such program is under judicial or administrative review pursuant to the provisions of this Act.

6/1/82 REPLY REFER TO:

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

3100 (530)

MAY 24 1982

Memorandum

To: State Director, Alaska

From: Assistant Director, Onshore Energy and Mineral Resources

Subject: Bid Acceptance Criteria for NPR-A Lease Sales

The attached bid acceptance criteria have been developed for all future NPR-A lease sales and will be initiated immediately to complete bid adequacy decisions for NPR-A lease sale 822. The criteria, which include a three-phase screening process and a series of rejection rules and indicators, are based on the procedures recently approved for use in the OCS program (Secretarial Issue Document: OCS Tract Evaluation Procedures for Assuring Receipt of Fair Market Value, Department of the Interior, March 11, 1982) and are consistent with those procedures established in the final Regulatory Impact Analysis for the NPR-A. The bid acceptance criteria place primary reliance on the market place through the provision to accept high bids on tracts receiving three or more bids and those tracts not selected for sampling with post-sale evaluations conducted for the remaining tracts selected by random sample to provide a mechanism to deter any tendency for bidders to exploit unusual conditions.

The three-phase screening process identifies those tracts which will be accepted without evaluation as well as those tracts selected at random for a post-sale evaluation including the calculation of MROV, DMROV, and AEOT. Bid adequacy decisions for those tracts selected at random for such an evaluation will be guided by the application of primary and secondary rejection rules and indicators. In phase one of the process, high bids on those tracts which receive three or more bids and those tracts which are not selected for evaluation will be accepted on the basis that the lease market is sufficiently competitive and that the high bid represents fair market value. Subsequent phases provide guidance for the completion of tract evaluation (phase two) and comparative tract evaluation (phase three) to quantitatively verify competitive sufficiency and receipt of fair market value. Based on these evaluations, the rejection rules and indicators will be applied to specific tract values for the completion of bid adequacy determinations.

BID ACCEPTANCE CRITERIA
FOR
NPR-A LEASE SALES

Bid acceptance and rejection decisions for NPR-A lease sales will be based on 1) a post-sale evaluation process, 2) a process which relies to a greater extent on the market place than on independent tract evaluation, and 3) use of rejection rules currently employed or conceptually approved for use in the OCS program. The acceptance process will use a three-phase screening process and specified rejection rules and indicators.

THREE-PHASE SCREENING PROCESS

Phase One: Acceptance of high bids on tracts receiving three or more bids and tracts not selected for sampling under phase two and comparative analysis under phase three.

Phase Two: Sample of tracts to be evaluated (subsequent evaluation based on calculated MROV, DMROV, and AEOT) will include:

a. 100 per cent of structures containing proven, drainage, or development tracts.

b. Sample selected on a structure basis to yield an appropriate sample size, depending on the particular sale, but no less than 30 per cent of tracts receiving bids.

c. Random sample selected on a structure basis to yield 5 per cent of the tracts in the sale receiving bids.

Phase Three: Use of comparative evaluation for sample selection or for bid acceptance/rejection and a quantitative evaluation for bid acceptance/rejection.

REJECTION RULES AND INDICATORS

Values for tracts to be used as a basis for rejection rules and indicators will be derived through two methods. Primary reliance will be placed on values derived through Monte Carlo simulation techniques (MROV, DMROV, and AEOT) and secondary reliance on values derived through adjustments to the DMROV on a regional or structural basis and comparative tract evaluations.

Primary Rules and Indicators

1. Use of the Mean Range of Values (MROV), Discounted (or delayed) Mean Range of Values (DMROV), and Average Evaluation of Tract (AEOT). The MROV represents the Government's current estimate of value for a given tract; the DMROV provides a basis to consider the effects of delay in receipt of benefits from development in the form of Federal revenues in making rejection decisions; and the AEOT provides a basis to consider the market's evaluation of the tract as indicated by the bids received.

2. In anomalous situations employ the geometric rather than arithmetic mean in calculating the AEOT. (Screening for anomalous bids will be performed in accordance with Instruction Memorandum No. 79-476, dated May 25, 1979.)

Secondary Rules and Indicators

1. Partial reliance on adjusted DMROV's on a regional or structural basis to reflect the degree of uncertainty inherent in the data used in the evaluation.

2. Partial reliance on comparative tract analysis on a regional or structural basis to ensure consistency in the bid acceptance/rejection decisionmaking process.

The criteria have been established for all NPR-A bid adequacy decisions for all future sales. Therefore, portions of the criteria do not apply to Lease Sale 822. As there are presently no proven, drainage, or development tracts offered in Lease sale 822, the provision to sample 100 percent of such tracts (phase two, step a) will not apply at this time. In addition, the percentage of tracts sampled as provided in phase two, steps b and c shall be based on that step which results in the greatest number of tracts to be evaluated.

For additional information regarding the implementation and use of the bid acceptance criteria, please contact Wink Hastings, Division of Oil and Gas (WO-530), telephone (202) 343-7753.

Robert N. Lamb

Attachment