Alaska

Oil & Gas Report

December 2004

Alaska Department of Natural Resources
Division of Oil & Gas
550 W 7th Ave. Suite 800
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Front cover:
Looking west across the Staines River, Eastern North Slope.
Bruce Webb

STATE OF ALASKA
Governor Frank H. Murkowski

ALASKA DEPARTMENT OF NATURAL RESOURCES
Tom Irwin, Commissioner

DIVISION OF OIL AND GAS
Mark D. Myers, Director

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Forward

This report replaces the annual “Historical and Projected Oil and Gas Consumption” report that the Division of Oil and Gas published between 1979 and 1999. The Division issued a 2000 annual report for year-end 1999 data, but did not issue a report for year-end 2000 data. Historical production for annual years 2000 and 2001 were published in the March 2003, Tables & Graphs Edition available on our web site. The 2003 Report included data ending December 31, 2002 and this report includes data ending December 31, 2003. This 2004 Report contains the division’s most recent oil production forecasts by field, and reserve estimates.

2004 Oil and Gas Report

For the period ending December 31, 2003

Alaska Department of Natural Resources
Division of Oil and Gas

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Introduction

This report is divided into five sections. Section I (Introduction) summarizes historic oil and gas production volume on Alaska's North Slope and Cook Inlet and discusses some of the methods and assumptions used in this report. Section II examines the state's oil and gas leasing programs, and exploration licensing and incentive programs. Section III presents oil and gas units in Alaska. It describes the individual units on the North Slope and in Cook Inlet and their producing reservoirs, sometimes called Participating Areas. Section IV includes tables and charts depicting historic and forecast oil and gas production through 2022. Finally, Section V presents tables describing historical royalty oil and gas production, and royalty-in-kind sales contracts by volume and by customer for each unit, participating area, or field.

Oil and Gas Reserves

Polar Resolution
PTI

Reserves begin with estimates of original oil or gas in-place (OOIP). Only a fraction of the original oil or gas in any reservoir can be extracted depending on available technology and production economics. Recoverable reserves, what is economically and technically feasible to extract vary between 15% and 85% of OOIP depending on the reservoir depth, rock and fluid type, technology, and to a lesser extent, market price. Total estimated recoverable and remaining recoverable reserves are the focus of this report, specifically Section IV. Reserves can be calculated by many methods and there is often no consensus on which method is best to apply to each reservoir at any given point in time. Three state agencies are responsible for evaluating oil and gas reserves and production: the Alaska Oil and Gas Conservation Commission (AOGCC), the Department of Revenue, Tax Division (DOR), and the Department of Natural Resources, Division of Oil and Gas (DOG). Each agency calculates reserves using slightly different methods. AOGCC emphasizes geologic and engineering factors to estimate the total recoverable resource. DOR calculations emphasize oil and gas production economics and the impact of oil prices forecasted far into future. DOG reserves are calculated from the forecast of production from existing and planned developments that may reasonably be expected to occur in the near future. These agencies cooperate and coordinate the preparation of reserves estimates and production forecasts.

Ultimate recovery estimates from large oil fields typically increase through their development years, i.e. ultimate recoveries are often greater than early predictions. In the early 1980's estimated reserves for the Prudhoe Bay Unit Initial Participating Area (PBU IPA) were between seven and nine billion barrels. By January 1986, ultimate recovery at the PBU IPA was projected to be 10.2 billion barrels; 4.4 billion produced and 5.8 billion remaining. By December 2002, estimated recovery increased to 13 billion barrels: 10.8 billion produced and 2.2 billion remaining reserves. By year-end 2003, we estimated the Prudhoe Bay field contains more than 2.8 billion recoverable barrels of oil. New investments, improved technologies, and careful costs management, all have helped to increase the portion of OOIP extracted from the Prudhoe Bay and Kuparuk fields. Further improvements in technology may increase future reserve estimates. Other factors affecting ultimate recovery are energy prices, the cost of new investment and ongoing operations, the impact of fiscal incentives, and competing development opportunities available to the state's oil and gas operators in other parts of the world.

North Slope oil reserve estimates developed by DOG are illustrated in detail in the oil forecast tables found in Section IV. As indicated above, remaining reserves in any particular North Slope production unit are defined in terms of cumulative production predicted for the next 18 years. Many of these units will

likely produce well beyond the forecast period that ends in 2022. This additional production will increase the ultimate recovery estimated in this report. Oil and gas reserve estimates for Cook Inlet fields also are based on cumulative forecast production. Reserves of undeveloped North Slope and Cook Inlet oil and gas fields are included in the forecast and, while speculative, they are based in part on the latest reports available from the producers as well as on DOG in-house interpretation.

The State of Alaska's royalty reserves are calculated by finding the product of each field's reserves with the state's royalty ownership interest in the field. On average, the state retains a 1/8th royalty interest in most of the producing oil and gas fields in Alaska. There are also third-party royalty owners in the Colville River and North Star Units on the North Slope, and Beluga River, Cannery Loop, Kenai, Sterling, Ninilchik, Nicolai Creek, Deep Creek, and West Forelands fields in the Cook Inlet. These units and fields include federal and private Native Corporation acreage. Also, the state derives royalty from numerous non-unitized oil and gas leases. The state has no royalty interest in the reserves in the East Barrow, South Barrow and Walakpa fields on the North Slope nor does the state have any royalty interest in the Swanson River, Beaver Creek, Lone Creek, Moquawkie or Birch Hill fields in the Cook Inlet.

Pump Station 4
G. Mull

Oil Production Forecast

North Slope production of oil, condensate, and natural gas liquids (NGLs), which peaked at 2.0 million barrels per day in 1988, declined to 1.0 million barrels per day in 2002 where it remains steady. By the end of the forecast period in 2022, ANS production will have droped to 513,000 barrels per day. Cook Inlet oil production peaked at 230,000 barrels per day in 1970, declined to 31,000 barrels per day in 2002 and 27,500 in 2003. Oil production in Cook Inlet is expected to continue to 2016. The projection includes oil production forecast from Swanson River and Beaver Creek even though the State gets no direct royalty share of that production. Details can be found in Section IV.

Oil Production History

First commercial production from an Alaska oil field began at Swanson River, Cook Inlet in 1959. Five other Cook Inlet fields began production between 1965 and 1972. Most recently, West McArthur River began production in 1993 and Redoubt in 2002. All Cook Inlet oil is currently shipped to the Tesoro refinery at Nikiski on the Kenai Peninsula. Oil from fields on the west side of Cook Inlet is transported by pipeline to the Drift River terminal, then transported to Nikiski. Oil from the eastside fields is shipped by pipeline directly to the refinery. By year-end 2003, the Cook Inlet has produced almost 1.3 billion barrels of oil, including 10 million barrels of NGLs.

Trans-Alaska Oil Pipeline
K. Banks

Oil production on the North Slope began in 1969 at Prudhoe Bay. Production was initially restricted to small quantities used to fuel field operations until the Trans Alaska Pipeline System (TAPS) was completed in July 1977. The operators injected surplus crude and residual oil back into the Prudhoe Bay reservoir. Similarly, oil production at the Endicott Field in the Duck Island Unit was re-injected into the reservoir until a pipeline linking Duck Island to TAPS was completed. From the beginning of Prudhoe Bay production, dissolved gas and water were separated from the crude oil and injected back into the reservoir. Over time the proportion of both produced gas and water to oil increased. Eventually, oil production was constrained by the rate at which the separating plants could process gas and water. To alleviate this constraint the gas and water handling facilities were expanded in 1986, 1991, and 1993-94.

The 1999 miscible injectant "MIX" project also adds to the field's gas handling capacity.

The North Slope has produced 14.4 billion barrels of oil and natural gas liquids (NGLs) by the end of 2003; nearly all from the large Prudhoe Bay and Kuparuk fields. NGLs produced on the North Slope are blended with oil and shipped down TAPS or used to make miscible injectant (MI) for enhanced oil recovery projects. Since 1996, NGLs have been shipped from Prudhoe Bay to the Kuparuk River Unit via the Oliktok pipeline for MI in the Large-Scale Enhance Oil Recovery (LSEOR) project at Kuparuk. Today, incremental oil production from new fields brought on line since 1995 account for about 27 percent of total yearly Alaska North Slope production.

Gas Production History

Kenai Fertilizer Plant
D. Colley

Cook Inlet gas production began in 1959 as a by-product of Swanson River oil development. As more oil and gas fields were discovered nearby markets for the gas were developed in Anchorage and Kenai to supply space heat and electricity generation. In 1968 Unocal started up the ammonia-urea plant at Nikiski to take advantage of the abundance of cheap stranded natural gas. This plant was acquired in 2000 by Agrium, Inc., of Calgary, Alberta. In 1969, Phillips and Marathon began operating the liquid natural gas (LNG) plant, also located at Nikiski. In recent years, LNG exports to Japan accounted for about 1/3 of total Cook Inlet gas production. Industrial use of Cook Inlet gas has remained fairly constant since 1983; production has increased in step with the growing residential and commercial demand for space heating and electric power generation. Cook Inlet natural gas production has remained relatively stable at an average of 213 Bcf per year from 1997 to 2001.

North Slope gas production began near Barrow in the mid-1940s. This gas initially was used to fuel a nearby military base. Gas service was extended to the village after World War II. The East Barrow and Walakpa fields were developed in 1980 to provide gas to Barrow. Gross gas production on the North Slope in 2000 was 3.2 trillion cubic feet (8.7 billion cubic feet (bcf)) per day but 93 percent of this volume was injected into oil producing reservoirs. The remaining net gas production, equal to 297 Bcf in 2003, is consumed locally on the North Slope to fuel oil field equipment, operations, and pipelines (including the first four TAPS pump stations). North Slope industrial yearly gas consumption is approximately equal to annual gas produced in Cook Inlet.

The history of Swanson River gas production differs from other Cook Inlet fields. Swanson River injected gas imported from other fields to enhance oil production. In 1992 the operator began to "blow-down" the reservoir. In recent years, the Swanson River field has become a major net gas producer in Cook Inlet but as production rates decline it may soon provide gas storage services.

History

Pre-1950's Activity

Alaska's oil has long been the subject of interest and speculation. Historically, oil seeps were observed by Inupiat Eskimos, and according to archaeological evidence, oil shale was used for fuel by the indigenous peoples of the Arctic. As early as 1853, during the Russian period, oil was reported on the west side of Cook Inlet in the vicinity of the Iniskin Peninsula and in 1882, a Russian named Paveloff took the first samples of oil. Early traders on the North Slope also reported seeps along the coast. Early explorers and prospectors staked claims to oil along Cook Inlet in 1892 and 1896. In 1896, oil claims were staked at Katalla approximately 50 miles southeast of Cordova. Oil was discovered there in 1902. An on-site refinery near Controller Bay produced a total of 154,000 barrels over the thirty years it was in operation. The refinery burned down in 1933 and was not replaced. In about 1903, Austin Lathrop drilled three wells in the Cold Bay area and entrepreneurs drilled several wells near Chignik and other coastal areas of Alaska in search of oil. In 1910, all oil lands in Alaska except Katalla were withdrawn from entry by the federal government.. Since oil had been discovered at Katalla in commercial quantities, title was considered valid. Because of the land withdrawals, no oil drilling activity took place in Alaska for the next decade with the exception of Katalla. Drilling resumed after the Mineral Leasing Act of 1920 provided for two-year prospecting permits.

Puale Bay, AK Peninsula
T. Ryherd

On the North Slope, the first geologic and topographic studies date back to 1901 and the first formal descriptions were recorded by the U.S. Geological Survey in 1919. By 1921, prospecting permits were filed, and in 1923 President Harding established by executive order the Naval Petroleum Reserve No. 4 (NPR-4), now known as the National Petroleum Reserve-Alaska (NPR-A). The Geological Survey conducted reconnaissance mapping from 1923 through 1926 and published the results in 1930.

The first exploration phase of NPR-4 started in 1943 and ended in 1953. Between 1923 and 1953, the United States Navy drilled 37 test wells and found three oil accumulations and six gas accumulations within the reserve. Only two of these discoveries were considered sizable, namely Umiat, with an estimated 50 million barrels of recoverable oil, and Gubik, with an estimated 600 billion cubic feet of recoverable gas. Gas from another of the discoveries during that period, the small South Barrow field, is being produced today for local consumption at Barrow.

Puale Bay, AK Peninsula
T. Ryherd

Statehood - 1959

At the time of statehood, both Congress and Alaskans recognized the importance of the state's natural resources, specifically, oil and gas. In the late 1950's, Congress was debating the Alaska Statehood Act. A major concern expressed was how the potential new state, which was one of the poorest in the country, could support itself since it did not have an economic base sufficient to support the new state. As a result, the Alaska Statehood Act allowed the State of Alaska to select 104 million acres of land from the federal public domain. The Act also granted to Alaska the right to all minerals underlying these selections and specifically required the state to retain this mineral interest when conveying interests in the surface estate. The mineral estate was seen as so important to Alaska's financial survival that the Statehood Act provided that if Alaska disposed of its mineral estate contrary to the Act, it would forfeit that mineral estate to the federal government.

The importance of natural resources to the state of Alaska is addressed in Article VIII of the Alaska Constitution which became operative with the formal proclamation of statehood, January 3, 1959. Art. VIII, sec. 1 states that *"[i]t is the policy of the State to encourage the settlement of its land and the development of its resources by making them available for maximum use consistent with the public interest."* The Alaska legislature realized the importance of oil and gas in Alaska's future. The Alaska Land Act of 1959 included a section specifically addressing the leasing and administration of the state's oil and gas resources It also recognized that other natural resources like coal and geothermal energy would play a major role in Alaska's future.

Cook Inlet

Modern day exploration in Cook Inlet began in 1955 when Richfield Oil Corporation began exploration on the Kenai Peninsula in the Swanson River area. Oil was discovered on July 23, 1957, at a depth of 11,000 feet and the discovery well flowed at a rate of about 900 barrels a day. This discovery began an oil rush in Southcentral Alaska.

Shortly after the Swanson River discovery, Standard Oil Company of California and Richfield formed a joint venture to explore for oil. Additional wells were drilled in the Swanson River area, and more leases were taken on both sides of Cook Inlet. Several other oil companies moved in to participate in leasing and drilling activities on the Kenai Peninsula. By 1959, 187,000 barrels of crude oil were produced annually. The state's first competitive sale was held December 10, 1959 bringing the state over $4 million in bonus bids.

Cook Inlet Platform
D. Colley

Following further development of the Swanson River and Soldotna Creek Units, annual production rose to 600,000 barrels by 1960. In 1962, Pan American Petroleum Corporation discovered the first offshore oil in Cook Inlet. This led to extensive exploration throughout the Cook Inlet region in the 1960's and 1970's. Chevron opened a refinery in 1963, and in 1969, the Tesoro refinery began operating. Cook Inlet production peaked at 83 million barrels per year in 1970 and had declined to 11 million barrels per year by 1999. Most of the larger fields were found by the mid-1960's.

The first major gas discovery occurred in October 1959 by Union Oil Company of California and Ohio Oil Company in the Kenai gas field. Gas production began the following year and continues today. Several additional large gas discoveries quickly followed and the Phillips/Marathon LNG project stared operating in 1969. The Unocal fertilizer plant began operation in 1968 and is now owned and operated by Agrium U.S., Inc. By 1984, net annual natural gas production reached 217 bcf per year, and peaked at 223 bcf in 1996.

The North Slope

The U.S. Department of the Interior, Bureau of Land Management opened North Slope lands for competitive bidding in 1958 when 16 thousand acres were offered in the area of the Gubik gas field. That same year, BLM opened four million acres in an area south and southeast of NPR-A (then named NPR-4) for simultaneous filing and subsequent drawing. From 1962-1964, industry exploration programs expanded rapidly. During this period, Sinclair and British Petroleum drilled a total of seven unsuccessful wildcat wells in the arctic foothills in search of oil.

Snow Geese
S. Schmitz

In 1964, in conjunction with the Statehood Act, the State of Alaska selected some 80 townships across the northern tier of lands between the Colville and Canning Rivers and received tentative approvals on 1.6 million acres from the federal government in October of the same year. In December 1964, the state held the first North Slope Competitive Sale. Lease Sale 13 covered 625,000 acres in the area east of the Colville River Delta. In July 1965, the state held Lease Sale 14 which included the onshore area in the vicinity of Prudhoe Bay. In Lease Sale 18, held January 1967, the offshore Prudhoe Bay tracts were offered and leased.

After drilling several dry holes in the area immediately surrounding the Prudhoe Bay structure, a rig was moved to the Prudhoe Bay State No. 1 location near the mouth of the Sagavanirktok River in early 1967. This proved successful, and in early 1968, Atlantic Richfield (ARCO) announced the discovery of what was to become the first commercial North Slope oil field at Prudhoe Bay. In 1969, Atlantic Richfield and British Petroleum agreed to jointly operate Prudhoe Bay. Prudhoe Bay Field did not begin production until 1977 after the construction of the 800-mile Trans-Alaska Pipeline.

Following the Prudhoe Bay discovery, exploration activity on the North Slope increased dramatically. Thirty-three exploration wells were completed in 1969 as industry prepared for Lease Sale 23 in September of that year. The state offered more than 450,000 acres along the Arctic coast between the Canning and Colville rivers and earned over $900 million in bonus bids on 164 tracts. The next North Slope sale was not held until 1979, however, during this time, over 100 exploratory wells were drilled on the North Slope with 19 of those wells discovering oil or gas.


Brooks Range Foothills, ANWR
B. Webb

Since 1959 the State has held 101 competitive lease sales in which it has offered millions of acres throughout Alaska. By year-end 2002, 27 exploratory wells had been drilled in the federal waters of the Beaufort Sea resulting in four discoveries. These discoveries are Kuvlum, Hammerhead, Sandpiper, and Tern Island/Liberty. Since 1999, several sales weres held in NPR-A and several exploration wells drilled.

Exploration wells drilled on North Slope state leases since the Prudhoe Bay discovery have resulted in dozens of discoveries, many of which were found in the vicinity of Prudhoe Bay. Most of the post-Prudhoe Bay discoveries are currently producing oil because of the existence of Prudhoe Bay infrastructure and their relatively close location to the Trans-Alaska Pipeline. Five of these, Lisburne, Kuparuk, Milne Point, Endicott, and Point McIntyre are major fields. Fields recently brought into production are Alpine, Northstar, Tarn, Meltwater, West Sak and Northstar. Although initial production on the North Slope was from onshore areas, six fields produce at least some of their reserves from offshore areas including Endicott, Lisburne, Prudhoe Bay, Point McIntyre, Milne Point, Niakuk, and Northstar.


Tree Row
S. Schmitz


Alaska Highway
B. Havelock

Outlook

Oil Production and Natural Gas Development

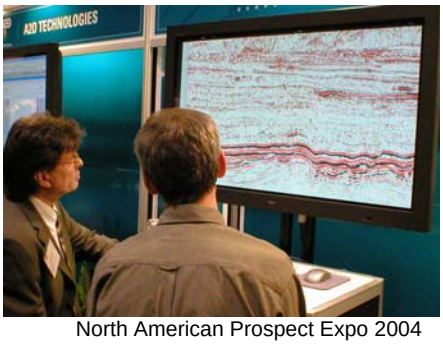
While production from the largest of North Slope fields, Prudhoe and Kuparuk is in decline, smaller and more numerous satellite oil and gas reservoirs are being developed and produced. New companies have entered the Alaska crude oil and gas upstream sector in recent years. Interest continues to grow, especially among independent exploration and production companies and in areas beyond the mature oil provinces of the North Slope and Cook Inlet. The long-term picture for oil production is one of gradual decline, supplemented with smaller field-size oil development and with gas field development in or near existing infrastructure.

While drilling activity shows slight increases in recent years and the total number of feet drilled per year has been relatively steady since the mid-eighties, total oil production has steadily declined since it peaked at two million barrels per day in 1988. Gross oil and natural gas liquid (NGL) production from state lands continues to decline. The lion's share of Alaska oil production comes from the North Slope, from the Nation's largest oilfields of Prudhoe Bay and Kuparuk. The current production rate from the North Slope is slightly under one million barrels per day. We expect that rate to hold steady at or near one million barrels per day for at least the next eight years.

Sustained drilling activity is a result of new discoveries, satellite field development in or near Prudhoe/Kuparuk infrastructure, in-field drilling, re-working of wells, side-tracking of wells to reach "behind the pipe" oil, and advances in drilling and completion efficiency (new fluids, technology, tools, materials) in the main Prudhoe and Kuparuk pools. In Cook Inlet, stepped-up gas exploration drilling is driven by decline in production from existing fields.

Incentives

Since 2001, we have seen a new surge in exploration interest with smaller, aggressive companies looking for gas, not just oil, in under-explored areas of Alaska, like the North Slope Foothills, other Interior Alaskan basins and the Alaska Peninsula region. This exploration is driven by increasing demand for energy here in Alaska, as well as across the North American continent coupled with the availability of land and prospects in Alaska. Alaska oil and gas will continue to play a fundamental if not critical role in meeting the Nation's energy needs.



North American Prospect Expo 2004
B. Havelock

While statistics show the total number of separate reservoirs in production increasing they are smaller and may not stem the overall decline of North Slope production later this decade. In an attempt to avert the decline in oil production, the Division has created new programs to attract explorers to areas of Alaska.

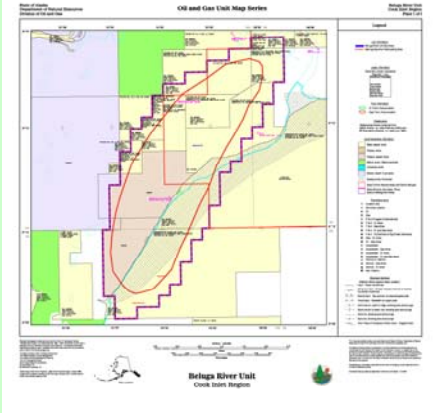
ADNR holds four regularly scheduled oil and gas lease sales per year. The Division of Oil and Gas and the Division of Geological and Geophysical Survey are working on obtaining geologic and geophysical data as well as conducting its own field work in new areas. DGGS and DO&G geologists completed field work that will help companies in evaluating hydrocarbon potential for the proposed Alaska Peninsula Oil and Gas Lease Sale tentatively scheduled for fall 2005. In addition to competitive areawide leasing, ADNR has instituted an exploration licensing program to encourage exploration in oil and gas basins outside of Cook Inlet and the North Slope. Four exploration licenses have already been issued – in the Nenana and Copper River basins, and two licenses in the Susitna basin. Recently, DO&G received

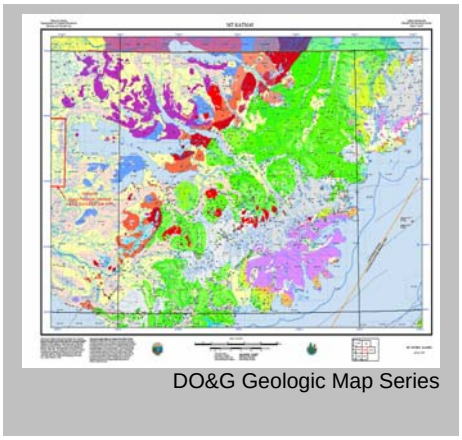
exploration license proposals for the northern portion of the Bristol Bay basin and Healy area. A short-lived shallow natural gas leasing program allowed DO&G to issue non-competitive leases to explore for and develop natural gas reservoirs, including coalbed methane, located within 3,000 feet of the surface. For additional details, see Section II.

ADNR remains committed to environmentally safe exploration and development of its oil and gas resources. The Division of Mining Land and Water and the University of Alaska completed a study on tundra travel which resulted in a longer exploration season on the North Slope. The Division of Oil and Gas has worked closely with new Cook Inlet and North Slope explorers including Pelican, Alliance, Pioneer Oil & Gas, Pioneer Natural Resources, AVCG, Kerr-McGee, and Armstrong to facilitate their exploration activities, and the Department has made a special effort to disseminate information to new companies seeking to invest in Alaska. Steps have been taken to streamline permitting, including revising the Alaska Coastal Management Program and creating a large project permit office in the ADNR. ADNR has been studying a natural gas pipeline to the Lower 48 states in an effort that includes economic modeling of gas sales and pipeline options; negotiations with North Slope gas producers and companies like TransCanada; and accelerated processing of pipeline Rights of Way applications. ADNR is also committed to ensuring that companies have access to existing facilities and pipelines, and that pipeline tariffs are just and reasonable.


Alaska Natural Gas Pipeline Corridor

The Division has several exploration incentives available, including drilling and seismic credits, and royalty reduction. For additional information on programs and incentives, see Section II and contact Pat Galvin, Leasing Petroleum Land Manager, 907-269-8775 or email: Patrick_Galvin@dnr.state.ak.us


DO&G Unit Map Series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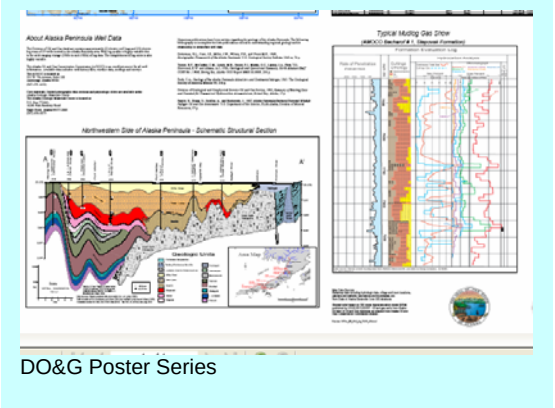
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