activities
1970

north of 60

oil and gas

northern economic development branch
department of indian affairs
and northern development
government of canada
OIL AND GAS, NORTH OF 60

A report of Activities in 1970, of the Oil and Gas Industry
In the Yukon Territory and Northwest Territories

1970

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Compiled by
Oil and Gas Section
Oil and Mineral Division
Northern Economic Development Branch

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

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Minister of Indian Affairs and Northern Development
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INTRODUCTION

All aspects of oil and gas operations in the Yukon and Northwest Territories are administered by the Department of Indian Affairs and Northern Development, specifically by the Oil and Mineral Division. It is the intent of the Department to provide a regulatory climate that will best encourage and provide for the orderly exploration and exploitation of oil and gas thereby achieving benefits of a local nature to the specific areas involved and to the people of Canada in general through the attendant revenues accruing to the Crown.

The Minister and officers of the Department of Indian Affairs and Northern Development as of July 1, 1971, who are responsible for administering oil and gas resources in the Northwest Territories and Yukon Territory, and northern offshore areas, are:

Minister – The Hon. Jean Chrétien, P.C., M.P.
Deputy Minister – H.B. Robinson
Assistant Deputy Minister – A.D. Hunt (Northern Development)
Acting Director Northern Economic Development Branch – A.J. Reeve
Chief, Oil and Mineral Division – Dr. H.W. Woodward
Administrator, Oil and Gas – R.R. McLeod
Supervisor, Geological Operations Unit – S.A. Kanik
Supervisor, Geological Evaluation Unit –
Supervisor, Land Unit – P. Sullivan
Chief Petroleum Engineer – Dr. H.J. Berry
District Conservation Engineers –
– A.C. Anderson for Queen Elizabeth Islands
– M.D. Thomas for N.W. Sector
– C.H. Olson for N.E. Sector
– G.E. Blue for S.W. and S.E. Sectors at Yellowknife

OVERVIEW OF 1970 ACTIVITIES

The demand for oil and gas rights in Canada’s North which followed the Prudhoe Bay discovery had virtually ended in 1970, largely because the greatest part of the potential areas had been acquired in the immediately preceding period by established oil companies and newcomers attracted by the prospects of large discoveries. The acreage remaining available was largely in areas of thin or severely disturbed sediments, or in deep water areas of relatively unknown potential. As a consequence total holdings of land increased by only three million acres during the year, although the minor part of it held in the form of leases increased by over 38% as the result of the maturation of older permits.

It was evident that the incentives provided by Canada Oil and Gas Land Regulations some ten years earlier were no longer required to attract exploration commitments in the North. It was equally evident that despite the commitments which were necessary to obtain the rights to explore, a complete evaluation would be impossible during the first sequence of exploration, and vast acreages would have to be returned to the Crown only partly explored.
New regulations were being prepared more suited to a second cycle of exploration by which the Canadian public would receive a greater reward. A preliminary draft of such terms was undertaken in consultations with the Department of Energy, Mines and Resources, which is responsible for the administration of the Regulations in Canada Lands off the east and west coast, in Hudson Bay and Hudson Strait.

To ensure that this action would not trigger a rush to convert older permits prematurely to lease in order to acquire the Crown reserves created thereby under advantageous existing terms by virtue of Land Order 1-1961, it was deemed necessary to revoke the Land Order for reconsideration together with the new Regulations.

Despite the strong negative response from industry the exploration effort continued to increase as had been expected, and brought two significant discoveries in widely separated areas. The first came early in the year at Atkinson Point on the mainland, 35 miles northeast of the village of Tuktoyaktuk. There on January 14, Imperial Oil Limited, a long time pioneer in the Canadian North, discovered oil at a depth of 5,700 feet in Cretaceous sandstone. Medium gravity, sweet crude flowed to the surface on a drillstem test, although further wells drilled on the peninsula were abandoned, the discovery is considered to be significant, and the discovery well was completed for production testing.

The second discovery occurred under less auspicious circumstances on King Christian Island, some 550 miles northeast of Point Atkinson. Here, on October 25, while pipe was being pulled from a depth of 2,010 feet, the Panarctic King Christian D-18 well blew out, caught fire and destroyed the rig. The well formed a crater, and fissures up to 500 feet in length opened up to release gas which took fire. The well flowed gas only, at a rate estimated at between 7 and 50 million cubic feet per day. A second rig was flown in and within a month spudded-in a relief well to begin relief operations which were to become a classic of its kind and to result in the successful control of the well two months later.

The wild well was the second major gas discovery in the Arctic Archipelago, and the second for Panarctic. The fact that it was, like the first, a blow-out caused the government some concern. As a consequence an official enquiry into the circumstances leading to the blow-out at the King Christian well was initiated under the authority of the Oil and Gas Production and Conservation Act. A senior petroleum engineer was appointed under the Act to conduct the enquiry. His report was being audited at year's end.

Particular concern has been felt about certain operations of the oil industry, largely as a result of recent events, which have focussed the world's attention on this industry.

At one stage in the development of the industry, a blow-out was an expected and hoped for result of the drilling of any prospective oil well. This was the famous "gusher" which was at one time the symbol of success and sudden wealth in the oil business. Today it is the symbol of ill-luck or bad management in the conduct of drilling and completion operations. The change has been brought about by good management, improvements in equipment and techniques, and conservation regulations aimed at preventing the dangers, waste, and destruction that often resulted before a "gusher" could be brought under control.

As a result of early lessons, techniques and equipment were developed by prudent and forward-looking elements of the oil industry and in many jurisdictions, the use of these techniques and the required equipment was made mandatory for all operators by the passage of so-called conservation acts and regulations designed to ensure that good practices were followed. Indeed, it was in connection with this industry that "conservation" first came to have real meaning and a wide practical application. Such regulations have reached
what is probably their most advanced form in Canada, possibly because public ownership of 
 oil and gas resources in western Canada provided governments with a greater incentive to 
 act. Whatever the reasons, Canada has been fortunate in having such legislation for many 
 years, both at the provincial and federal level.

The Canada Oil and Gas Drilling and Production Regulations provide good example of 
 such legislation. Made pursuant to the Territorial Lands Act in 1961 to replace earlier 
 Regulations under that Act, they were also made pursuant to the Public Land Grants Act 
 and consequently they apply to all Canada Lands outside of the provinces. They are 
 administered by the Department of Indian Affairs and Northern Development, in the Yukon 
 Territory, Northwest Territories, and Canada Lands under the seacoast waters of the 
 Beaufort Sea, the Arctic Ocean, and the waters between and adjacent to the islands of the 
 Arctic Archipelago; and by the Department of Energy, Mines and Resources in Canada 
 Lands under the waters off the East and West Coasts, Hudson Bay and Hudson Strait.

These Regulations require all licencees to notify the District Conservation Engineers 
 before commencing any drilling operations, and to obtain his approval of the program. 
 Adequate casing and blow-out prevention equipment is mandatory, and broad discretion is 
 given to the Conservation Engineers to ensure that proper practices are followed at all times 
 and that only safe and proved equipment is used. To effect this, he may require the 
 replacement or reconditioning of any tubing, casing or equipment, and may order 
 operations to be discontinued until required action is taken. Daily reports must be made of 
 all operations conducted at all wells prior to and including the day of suspension, 
 completion or abandonment.

The Regulations made full provision for the prevention of waste, and require 
 precautions to prevent contamination of the environment by drilling fluid, or oil or waste 
 from tank or wells.

If a well becomes a menace to life or property, the Regulations empower the Minister 
 to take over the management and at the expense of the licencee, to take such steps and 
 employ such persons as are necessary to correct the situation.

In the absence of production these regulations were more than adequate, however, in 
 anticipation of production on a large scale, the Oil and Gas Production and Conservation 
 Act had been passed by Parliament and given Royal Assent on June 27, 1969. This Act 
 broadens the statutory base for Regulations covering oil and gas operations in the Yukon 
 and Northwest Territories, and provides for very broad additional powers for the Minister in 
 respect of production and transportation of oil and gas under his jurisdiction. It provides 
 also for an Oil and Gas Committee, under the direction of the Minister, to hold enquiries 
 and hear appeals in connection with oil and gas matters. An amendment to extend this Act 
 to all Canada Lands outside the provinces, including those under the jurisdiction of the 
 Minister of Energy, Mines and Resources was given Royal Assent on June 11, 1970.

In addition to the special acts and Regulations covering the production and 
 conservation of oil and gas, special regulations under the Territorial Lands Act for the 
 preservation of the northern environment intended to protect Territorial Lands from 
 operations not specifically covered by other legislation were in the course of preparation at 
 year's end. They will call for entry permits to be obtained in advance for all operations on 
 Territorial Lands which might be damaging to the environment, and will establish conditions 
 to keep damage to a minimum. An amendment to the Territorial Lands Act was passed on 
 June 26, 1970 to ensure full authority for the Regulations.
Interest continued in the problems of transportation of oil and gas from the North. Two pipeline research consortia were active during the year. Mackenzie Valley Pipeline Research Limited, a consortium of 16 oil and gas production and pipeline companies which had begun the building of research facilities at Inuvik in 1969 brought these into operation in February of 1970. A second pipeline research facility was prepared at San Sault, on the Mackenzie near Fort Hope by the Northwest Project Study Group a consortium of six production and gas pipeline companies.

One of the primary aims of the latter group is to investigate the transportation of gas through permafrost areas and other difficult northern terrain including muskeg. The handling of refrigerated natural gas is a feature of their experiment.

From the first realization of the magnitude of the Prudhoe Bay find, it has been considered likely that solution gas from the field would find its most likely way to market in the U.S.A. by a pipeline through Canada.

Reacting to the possibility of an early need for pipelines, the Department prepared guidelines for the construction and operation of northern pipelines and these were announced jointly by the Department of Indian Affairs and Northern Development, and the Department of Energy Mines and Resources on August 13, 1970. The guidelines emphasized the protection of the environment and set out the “corridor concept” by which initially only one gas trunk line and one oil trunk like would be permitted to be built in a “corridor” set up in consultation with Government and industry to provide either “common carrier” service, or service at a negotiated price for all oil or gas tendered to the respective lines with subsequent lines restricted as far as possible to the same route.

With the view widespread that economic transportation from the Arctic would be possible upon the discovery of large reserves, the hunt for oil and gas reserves picked up momentum.

The favourable result of Panarctic’s search in the Arctic Archipelago encouraged the participants, in the venture and, when in response to the needs, further financing was necessary, all participants were eager to provide it. The Government of Canada as one of these participants, announced that the Government would invest an additional 13.5 million in the enterprise, further to its original 9 million, thus maintaining its interest in the same proportion as that of the private interests in this venture.

In conformity with the general optimism, and in spite of increasing requirements to protect the environment the level of all types of exploration increased markedly, placing Canada North of 60 second only to Alberta in exploratory effort in 1970. Details of this effort are portrayed in the text, tables, graphs and maps which form the body of this report.

POTENTIAL OF THE BASINS

Geologic Summaries

In Canada, north of Latitude 60° the areas outside the provinces contain 1,458,784 square miles, of this a total of 465,000 square miles are underlain by sedimentary rocks (Map No. 1) ranging from Cambrian to Tertiary that are considered to be potentially productive of oil and gas. The vast Territories sedimentary regions can be divided conveniently into several geological provinces each characterized by specific features of the contained sediments or structures in which they are involved. Hence a summary of the sedimentary geological provinces is given which focuses attention to their location and potential of these geological provinces, and a selected list of relevant geological references is
included. The reports listed for the Sverdrup Basin and the Franklinian Geosyncline are in large part also applicable to other basins in the Arctic Archipelago. All geologic references are listed in Appendix V.

**Interior Plains**

The Interior Plains are also commonly referred to as the Western Canada Sedimentary Basin. In this context the Liard Plateau and Mackenzie Plains are included in this geological province. The sediments range from Lower Paleozoic to Cretaceous and thicken westward into the Cordilleran Geosyncline.

Porous sandstones and carbonates are present in many formations within the sedimentary column. Gas discoveries have been made at Rabbit Lake, Netla, Celibeta, Island River, Trainor Lake, Beaver River and Pointed Mountain. The Norman Wells oil field is located on the Mackenzie Plains west of the Franklin Mountains.

**Arctic Lowlands**

The Arctic Lowlands consist of several basins lying between the Franklinian Geosyncline and the Canadian Shield on the mainland. It is not known whether they are structural or depositional in origin. Sediments consist of carbonates and clastics, and range from Cambrian to Mesozoic and Tertiary. Thickness of sediments probably does not exceed 10,000 feet and the principal rocks are carbonates of Ordovician and Silurian age.

**Franklinian Geosyncline**

The Franklinian Geosyncline encompasses sedimentary basins in the Arctic Archipelago that include the Ellesmere fold belt, Cornwallis and Parry Island fold belts. Most of the structures are generally characterized by long, wide, symmetrical folds. Sediments range from Cambrian to Permian and thicknesses may range up to 20,000 feet.

Much of the early exploration in the Arctic was concentrated in this geologic province, in 1962–64 three wells were drilled and abandoned. They are:

No. 1 Dome et al Winter Harbour
Lobitos et al Cornwallis Resolute Bay L–41
Dom. Explorer et al Bathurst Caledonian R. J–34

In 1970, Panartic Oils Ltd. drilled only one well, Panarctic Towson Point F–63 in this basin.

**Sverdrup Basin**

The Sverdrup Basin may contain one of the thickest sequences of sediments in North America. Composite thicknesses are in the order of 60,000 feet and range in age from late Paleozoic to early Tertiary. The principal rocks are Pennsylvanian, Permian and Triassic. Reservoir rocks consist of thick sections of limestone reefs and sandstone. The Bjorne formation of Triassic age contains oil impregnated sands on Melville Island, significant evidence of hydrocarbons in the sediments of the Arctic Islands.
Photograph No. 1 – Examining rock outcrops in Northern Canada
The major structures are large symmetrical folds that include Tertiary beds. In certain areas of the Basin, piercement domes, evaporite diapirs, sills and dykes are mapped. These secondary structures may from trapping mechanisms for hydrocarbon accumulation.

During 1969 and 1970 Panarctic Oils Ltd. drilled a total of seven wells in the Sverdrup Basin. One of the wells, Panarctic Drake Point L–67 is a completed gas well. A second gas discovery at Panarctic King Christian D–18A was made early in 1971.

Foxe Basin

The Foxe Basin is generally less than 300 feet in elevation and underlain by flat lying Paleozoic rocks. Recent work indicates that the outcrops are Ordocician and bear distinct similarity to rocks on Cornwallis Island. The detailed stratigraphy is unknown, therefore the thickness can only be surmised to be 3,000 to 4,000 feet.

Hudson Bay Basin and Lowlands

Sedimentary rocks in the Hudson Bay area, which include the large Islands, are of Ordovician, Silurian, Devonian, and Mesozoic age. The Paleozoics are correlated with rocks in Manitoba while many of the fossils can be compared to fauna of the same age in Ontario. Magnetometer and seismic surveys in the Bay indicate that between 5,000 and 10,000 feet of sediments may be present.

Structurally the sediments dip basinward while the carbonate rocks on Southampton and Coates Islands appear to be essentially flat lying.

Arctic Coastal Plains and Continental Shelf

The Arctic Coastal Plains geographically are located along the northwest fringe of the Arctic Archipelago and geologically include the Continental Shelf. The area is overlain by Tertiary and Pleistocene sediments and dip oceanward. Very little is known about the sequence of sediments but in northern Yukon up to 30,000 feet of Mesozoic rocks are present. On the Continental Shelf, it is expected that Tertiary sediments overlie the Mesozoic so the combined thickness could be considerable greater.

The Continental Shelf (see Map No. 1) extends between two to three hundred miles west of the islands and although a potential oil and gas province, the permanent polar-ice conditions may place severe restrictions on exploration in offshore areas.

Eagle Plain

The Eagle Plain is one of several complex structural basins in the northern Yukon. The area from the Ogilvie Mountains to the Arctic Coastal Plains is underlain by a thick succession of sedimentary rocks representing most of the geologic systems. The principal rocks of interest are late Paleozoic to Mesozoic which consist of porous carbonates and thick sequences of sandstone. Oil and gas were discovered in two wells and oil in one well, all in rocks of Pennsylvanian age.

Geologic structures in the Eagle Plain are parallel to the mountain ranges such as the Richardson, Old Crow and Keele Ranges. They consist of broad north-south trending folds, many on echelon patterns. Strong regional unconformities separate rocks of each system thus producing many potential stratigraphic traps for hydrocarbons. Several periods of
deformation have added to the complexities of the geology in the intermontane basins of northern Yukon.

**Area and Volume of Sediments**

In sedimentary areas, which are relatively unexplored by drilling, there are various ways in which an estimate of the possible oil and gas potential may be made. One of the more commonly used methods is that of estimating the volume of sediments within the basins and comparing these with other sedimentary basins of the world in more advanced stages of development.

The area of the islands underlain by sedimentary rocks is about 350,000 square miles. Since measured and estimated stratigraphic sections are widely dispersed, an approximation for the average thickness was taken to be 10,000 feet. For purposes of computing the volume of sediments, only the areas between the 1,000 feet isopachous lines were used, and the thickness sedimentary sections were used, and the thickest sedimentary sections were taken to 16,000 feet. Below 16,000 feet, very few wells are productive from the older sediments, although younger sediments at this depth may provide excellent reservoirs. On this basis the volume of sediments in the Northwest Territories and Yukon is approximately 332,000 cubic miles.

A comparison of the sedimentary areas and volumes in the Western Provinces and in the Yukon, Northwest Territories and Arctic Islands is given in Table No. 1.

**TABLE NO. 1**

**Volume of Sediments**

<table>
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<tr>
<th>Area</th>
<th>Area (Sq. Miles)</th>
<th>Volume of Sediments (Cu. Miles)</th>
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<tbody>
<tr>
<td>Manitoba and Saskatchewan</td>
<td>176,623</td>
<td>168,072</td>
</tr>
<tr>
<td>Alberta</td>
<td>236,893</td>
<td>341,715</td>
</tr>
<tr>
<td>British Columbia</td>
<td>50,688</td>
<td>115,318</td>
</tr>
<tr>
<td>Yukon</td>
<td>43,000</td>
<td>64,500</td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>204,794</td>
<td>267,133</td>
</tr>
<tr>
<td>Arctic Islands</td>
<td>350,000</td>
<td>663,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,061,998</strong></td>
<td><strong>1,620,238</strong></td>
</tr>
</tbody>
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**Oil and Gas Discoveries**

Norman Wells is the only producing oil field North of the 60th parallel. The field was discovered in 1920, but intensive commercial development did not take place until World War II. During 1970 oil was produced at an average rate of 2614 barrels daily and refined locally.

Imperial Oil discovered oil at their Atkinson H-25 well in January 1970. A company announcement stated that "Oil flowed to the surface from the 5700 foot level. Further testing is required to evaluate this field". Offsetting wells, nearest one about 3-1/2 miles away, were dry and abandoned.

To date, gas has been discovered in 9 separate areas on the Northwest Territories Mainland and in two wells in the Arctic Islands. Pointed Mountain is the only gas field
Photograph No. 2 – Gas bubbling in Northern Lake in N.W.T.
currently under development; a fourth well Pan Am Pointed Mountain 0–46 is drilling a northern extension to the field. The field will go on stream on November 1, 1972, when a pipeline to be built during the winter of 1971–72 will tie in into the Fort Nelson–Beaver River gas pipeline.

In the Arctic Islands, significant gas discoveries were made by Panarctic Oils Ltd. at Drake Point on Sabine Peninsula and on King Christian Island. These gas discoveries will be evaluated in the near future, to determine the areal extent of the reservoirs.

Significant gas discoveries were made on the Eagle Plain and a northern extension to the Beaver River gas field in the Yukon. The Beaver River gas field will go on stream on November 1, 1971.

In the Eagle Plain, four gas wells were drilled and suspended after the discovery of oil and gas at the Western Mineral Chance, Y.T. No. 1 (M–08) well in 1960. Lack of potential markets have deterred the development of these wells. (See Appendix II for complete text of Oil and Gas Discoveries).

Reserves

A. Crude Oil Reserves

The geological basins comprising the Territories and Arctic Islands are only in the initial stages of exploration, so definitive crude oil reserves have little meaning at this time. However, the “Potential Reserves of Crude Oil Recoverable by Conventional Methods”, compiled by the Canadian Petroleum Association, and released in April, 1969, are considered authoritative. The Canadian Petroleum Association report states that the potential crude oil reserves for “all of Canada recoverable by conventional means is 120.8 billion barrels, of this total, 43.45 billion barrels is assigned to the Arctic Islands and Coastal Plain area; and (by interpolation) approximately 15 billion barrels are calculated for the rest of the Northwest Territories and the Yukon Territory. Thus, about 60 billion barrels of oil, or 50% of the total potential of Canada was computed to be located North of 60.

The Association, is an annual report outlining the reserves for Canada, states that at December 1, 1970 proved reserves assigned to the Northwest Territories (Norman Wells field) were 45.21 million barrels”.

The “Potential Reserves” of Canada as reported by the Canadian Petroleum Association is the most authoritative estimate available.

In the April 1969 report, the “Potential Raw Gas Reserves” for Canada are given as 724.8 trillion cubic feet. The potential reserves computed for the Arctic Islands are 260.7 trillion cubic feet; those for the rest of the Northwest Territories and the Yukon Territory (by interpolation) are calculated at approximately 90 trillion cubic feet.

Recent reports of reserves are given by the Canadian Petroleum Association as 1.006 tcf Proved and 1.403 tcf Proved and Probable for the Pointed Mountain gas field. The report did not assign any gas reserves to the Yukon portion of the Beaver River gas field, to 12 individual gaswell discoveries in the Yukon and Northwest Territories or to the two gas discoveries in the Arctic Islands.
REFINING OPERATION

Refining Capacity

As noted in a previous section the only operating refinery located north of 60 is at Norman Wells and is operated by Imperial Oil Ltd. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. An extensive modernization program to increase refining capacity to more than 2,000 barrels per day was commenced in 1969 and should be completed in 1971. In addition, other facilities such as barrel-filling, wharf-loading and water-purifier will be enlarged and improved.

ACTIVITIES – 1970

Land

As may be seen in the land map (Map No. 1), Figure No. 1, and in Table No. 2, 1970 was characterized by additional filings in the Arctic Islands, Davis Strait and on the mainland of the Northwest Territories. Periferal acreage was surrendered in seacoast areas on the Continental Shelf and along the eastern margins of the Interior Plains basins.

TABLE NO. 2
Number of Permits and Leases and Relevant Acreage – 31 December 1970

<table>
<thead>
<tr>
<th>Area</th>
<th>PERMITS</th>
<th>LEASES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Acreage</td>
</tr>
<tr>
<td>N.W.T. Mainland</td>
<td>2,353</td>
<td>107,746,820</td>
</tr>
<tr>
<td>Y.T. Mainland</td>
<td>627</td>
<td>26,722,941</td>
</tr>
<tr>
<td>Arctic Islands (1)</td>
<td>3,180</td>
<td>156,263,213</td>
</tr>
<tr>
<td>off-shore (N of 70)</td>
<td>2,032</td>
<td>100,575,187</td>
</tr>
<tr>
<td>on-shore (N of 70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arctic Coast Marine (2)</td>
<td>908</td>
<td>48,274,444</td>
</tr>
<tr>
<td></td>
<td>9,100</td>
<td>439,582,505</td>
</tr>
</tbody>
</table>

(1) All areas North of 70°
(2) All areas South of 70° covered by seacoast waters.

The net result was that the number of Permits terminated exceeded the number of N.W.T. issues in the mainland areas of the Territories by 72 permits and in the Yukon by 48 permits. A small decline in total acreage was evident in the Arctic North of 70, primarily from termination of sizable holdings on the outer Continental Shelf in the Beaufort Sea and Queen Elizabeth Islands.
Map 2
OIL & GAS LAND ACQUISITIONS
NORTH OF 60°

Canada Lands are administered by the Department of Indian Affairs and Northern Development northward of the heavy line. Offshore areas elsewhere administered by the Department of Energy, Mines and Resources.

Legend:
- Acquired prior to 1968
- Oil Well
- Gas Well

Scale of Miles:
100 200 300
Fig. 1
ACREAGE HELD UNDER OIL & GAS PERMIT
YUKON TERRITORY AND NORTHWEST TERRITORIES
Interest continued in the Davis Strait and Baffin Bay areas where industry acquired 176 permits covering 9,378,008 acres.

As a result of the maturing permits in the southern mainland areas, the number of leases held by industry increased by more than one million acres in 210 leases. This increase in lease holdings contributed to the decline in the number of mainland permits. The trend of leasing illustrated in Figure No. 2 is expected to continue throughout 1971 and accelerate in 1972 and in later years.

No major changes in the overall industry holdings in the primary sedimentary areas are anticipated before mid-year 1972, however, new developments could substantially affect the holdings in seacoast areas, particularly those in Foxe Basin, the Davis Strait and Baffin Bay. No public offerings of oil and gas rights were made during 1970.

Rental increased for oil and gas leases in the Northwest Territories by $2,800,000 and by $150,000 in the Yukon Territory, during the calendar year 1970 over the previous year. Rentals and special rental fees should increase in 1971 to a new high of about 5 million dollars.

Oil and Gas Regulations

The only amendment to the Canada Oil and Gas Land Regulations in 1970, was the revocation of Land Order 1-1961. Under this order, a permittee following the lease selection, was granted an exclusive 60-day option to acquire leases on the Crown Reserve lands in the permit area. These leases carried a sliding-scale royalty in addition to the royalties prescribed in the Regulations. Under the amended Regulations Crown Reserves must be disposed of under the terms of Section 58, and Land Orders Nos. 2-1961, and 1-1962.

Permit Term and Work Requirement Zones are illustrated in Figure No. 3. Note that permit terms for water permits west of Longitude 90° are slightly different from those east of 90°. In Figure No. 4 the Permit Term and Deposit Requirement are graphically described. There have been no changes since 1968.

Land Order No. 1-1961 prior to Revocation set out a schedule of Additional Rates by Areas. These are shown in Figure No. 5. Figure No. 6 is a Flow Diagram of Disposal of Oil and Gas Rights. It also illustrates the primary disposal of permits and leases, and shows the methods of acquiring leases by tender.

Exploration

Figures 7, 8, 9 and 10 graphically depict exploration activities North of 60 in 1970. Expenditures on oil and gas exploration in the Northwest Territories and Yukon Territory exceeded 126 million dollars in 1970, an increase of about 40 million dollars over the previous year. Exploratory and development drilling expenditures increased 45%, up to 55 million dollars, while total geological and geophysical increased 55% to over 58 million dollars. Expenditures for seismic exploration exceeded similar work in every province and the combined Atlantic and Pacific offshore areas.

Figure No. 7 indicates that expenditures increased by 40% in 1969 and again by 40% in 1970. Indications to mid-year 1971 are that these expenditures will again increase in 1971, best estimates are that they may approximate 150 million dollars. By 1975 expenditures related to oil and gas activities should reach 200 million dollars per year.
Photograph No. 3 - Camp for geologists carrying out surface work in the Yukon Territory
Fig. 3
PERMIT TERM AND WORK REQUIREMENT ZONES NORTH OF 60°

- $2.65/Ac.
- $2.70/Ac.
- $2.90/Ac.

Scale in miles

ALASKA
65°

PERMIT TERM
12 YEARS

PERMIT TERM
10 YEARS

PERMIT TERM
9 YEARS

100
200
300

0
### Yukon Territory - Northwest Territories

**Permit Terms and Deposit Requirements — Per Acre**

<table>
<thead>
<tr>
<th>Permits Located Between Latitudes</th>
<th>3 Years</th>
<th>Renewal Terms</th>
<th>Total Work Requirements</th>
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<tr>
<td>60° - 65°</td>
<td></td>
<td>$2.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Years</td>
<td>$2.90</td>
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</tr>
<tr>
<td>65° - 68°</td>
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<td>$2.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 Years</td>
<td>$2.90</td>
<td></td>
</tr>
<tr>
<td>68° - 70°</td>
<td></td>
<td>$2.90</td>
<td></td>
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<tr>
<td>North of 70°</td>
<td>6 Years</td>
<td>$2.65</td>
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<table>
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<tr>
<th>Marine Permits Located</th>
<th>6 Years</th>
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<tbody>
<tr>
<td>South of 70° N West of 90° W</td>
<td>$2.65</td>
<td></td>
</tr>
<tr>
<td>South of 70° N East of 90° W</td>
<td>$2.70</td>
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<table>
<thead>
<tr>
<th>Permits Located North of 70° Issued Prior to 1968</th>
<th>8 Years</th>
<th>$2.65</th>
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<tbody>
<tr>
<td>Marine Permits South of 70° Issued Prior to 1968</td>
<td>6 Years</td>
<td>$2.70</td>
</tr>
</tbody>
</table>
Fig. 5
ADDITIONAL ROYALTY RATES BY AREAS
PRIOR TO REVOCATION OF LAND ORDER NO. 1-1961

- AREA "E"
  - Oil 5 - 20%
  - Gas 5%

- AREA "D"
  - Oil 5 - 10%
  - Gas 5%

- AREA "C"
  - Oil 5 - 20%
  - Gas 5 - 10%

- AREA "B"
  - Oil 5 - 30%
  - Gas 5 - 15%

- AREA "A"
  - Oil 5 - 40%
  - Gas 5 - 15%
FLOW DIAGRAM OF DISPOSAL OF OIL AND GAS RIGHTS

PRIMARY DISPOSAL OF OIL & GAS RIGHTS (EARLY EXPLORATION STAGE)

SECONDARY DISPOSAL OF OIL & GAS RIGHTS (LATE EXPLORATION STAGES)

NO ACCEPTABLE OFFERS

LEASE
1. CASH TENDER
2. WORK TENDER
3. CASH & WELL TENDER

ACCEPTABLE TENDERS

OIL & GAS LEASES

TERMINATION OF LEASES

APPLICATION FOR OIL & GAS LEASES

PERMIT
1. CASH BONUS TENDER
2. WORK BONUS TENDER

APPLICATION TO TENDER ON CROWN RESERVES

INVITATION TO TENDER ON CROWN RESERVES

TERMINATION OF PERMITS

CROWN RESERVE FOR DISPOSAL BY PUBLIC TENDER

IF NO TENDERS MAY BE OFFERED FOR FILING

APPLICATION FOR PERMIT

PERMIT

TERMINATION OF PERMIT

APPLICATION FOR OIL & GAS LEASES

OIL & GAS LEASES

TERMINATION OF LEASE

TERMINATION OF LEASES

CROWN RESERVE
Photograph No. 4 — Seismic drill crew at work in the Reindeer area — N.W.T.
Seismic crew months, depicted in Figure No. 8, is an excellent barometer on the magnitude and drilling activity for the next two years. In 1970, oil companies conducted 235 crew months of seismic work on land and marine areas, an increase of 50% over the previous year. This would indicate that drilling activity should increase substantially in 1971 and 1972.

Figures 9 and 10 illustrate the number of wells drilled and amount of footage drilled during the past 10 years. Note that footage has more than tripled since 1968. This is also reflected in the expenditure increase for drilling, in that there has been an eight fold increase in drilling expenditures during the same interval.

Operations

Significant acquisitions of acreage by application were made by several companies during 1970. Imperial Oil applied for over 6.1 million acres in Cumberland Sound, off Baffin Island. This was followed by Buttes Resources for 1.5 million acres in Jones Sound. On Victoria Island, Atlantic Richfield Oil Co., acquired 2.5 million acres. Scattered acreage in small lots was acquired in many areas by a variety of companies and individuals.

Permits were surrendered or cancelled along the periphery of many basins on the Mainland and Arctic Islands. The largest single surrender six million acres was made by the Hunt Bros. of permits located off the Continental Shelf in the Beaufort Sea.

Surface geological and photogeological surveys totalling 135 geological crew months were carried out on Canada lands North of 60. Participation surveys by V. Zay Smith and Associates, Geophoto Services Limited and J.C. Sproule contributed significantly to the total surface exploration program. Imperial Oil Ltd. continued surface exploration in the northern Yukon Territory and Northwest Territories, while Panarctic Oil Ltd. and Atlantic Richfield Oil Company continued major mapping programs on the Arctic Islands.

Seismic activity was general over many of the geological basins in the north. Detailed seismic work was carried out by many companies in the southern part of the Northwest Territories and on the Peel Plateau. Imperial Oil Enterprises, Gulf Oil Canada Ltd. and Shell Oil Canada continued to carry out large reflection programs along the Arctic Coastal Plain and in the general Mackenzie Delta areas. Three companies carried out several programs south and east of the Old Crow village on the Peel Plateau.

Major seismic programs were initiated by Elf Oil Canada and Deminex on Banks Island, while Panarctic Oils Ltd., BP Oil and Gas Exploration and Sun Oil Company undertook large scale reflection programs over the central and western Arctic Islands.

Drilling activity was highlighted by large and extensive drilling programs in the Tuk-Delta areas and Arctic Islands. In the Tuktoyaktuk areas Imperial Oil Enterprises continued to drill stratigraphic tests. One of the wells, Imperial Atkinson H-25 recovered oil. Imperial Oil in a press release stated that “Oil flowed to the surface from the 5700 foot level. Further testing is required to evaluate this field”. The company drilled two wells approximately three and a half and seven miles from the discovery well without finding oil or gas.

In the Arctic Islands Panarctic Oils Ltd. drilled and completed or abandoned seven wells during 1970. One of the wells, Panarctic Drake Point L-67 was suspended as a completed gas well on February 26, 1970. On King Christian Island a well King Christian D-18 was spudded on October 14, 1970 and drilled to a depth of 2,010 feet when gas blew out, caught fire and destroyed the rig. A second rig was flown in and spudded a relief well
Photograph No. 5 – Seismic camp in Arctic Islands
Fig. 7

OIL & GAS EXPLORATION EXPENDITURES

- Total Recorded Expenditures (includes well drilling expenditures)
- Well Drilling Expenditures
- Estimated Expenditures

NOTE: Figures are for year expenditures were actually incurred.
Total annual expenditures include well drilling costs.

Million Dollars


$1.402.105
$6.057.690
$12.932.529
$3.393.885
$10.039.915
$33.454.372
$10.039.915
$71.316.056
$27.542.609
$36.046.791
$108.975.986
$53.023.110

SCALE CHANGE
Fig. 8
EXPLORATION ACTIVITY
YUKON TERRITORY AND NORTHWEST TERRITORIES

GEOLOGICAL CREW MONTHS
1970

SEISMIC CREW MONTHS
1970
Fig. 9

WELLS DRILLED

YUKON TERRITORY - NORTHWEST TERRITORIES

Number of Wells Drilled to end 1970, 504
Fig. 10
FOOTAGE DRILLED
YUKON TERRITORY AND NORTHWEST TERRITORIES

<table>
<thead>
<tr>
<th>Year</th>
<th>Footage Drilled (Thousand Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>102,756</td>
</tr>
<tr>
<td>1961</td>
<td>74,337</td>
</tr>
<tr>
<td>1962</td>
<td>60,851</td>
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<tr>
<td>1963</td>
<td>62,643</td>
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<tr>
<td>1964</td>
<td>113,088</td>
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<tr>
<td>1965</td>
<td>119,583</td>
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<tr>
<td>1966</td>
<td>123,061</td>
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<tr>
<td>1967</td>
<td>125,811</td>
</tr>
<tr>
<td>1968</td>
<td>131,877</td>
</tr>
<tr>
<td>1969</td>
<td>274,401</td>
</tr>
<tr>
<td>1970</td>
<td>364,731</td>
</tr>
</tbody>
</table>
on November 26, 1970. At the year’s end the well was near its total depth of 2,090 feet and preparations were made to put out the fire and kill the gas flow. Proposed drilling operations for 1971 will be continued with four rigs; one medium sized rig will be flown to the King Christian location and a third medium sized rig will be moved to Fosheim Peninsula.

In the Yukon Territory, Imperial Oil drilled and abandoned a 14,000 foot wildcat well at Blow River, on Eagle Plain, Western Minerals drilled a 14,500 foot well but it had to be abandoned without finding hydrocarbons.

The number of “wells drilled” and seismic “crew months” worked will increase during 1971. Extensive seismic programs will be carried out in the Beaufort Sea and with ice breaker assistance in the Viscount Melville Sound and Norwegian Bay areas. The continuation of wildcat drilling in the Arctic by Panarctic, Sun Oil and BP, the wildcat drilling in the Delta areas by the major companies, the participation drilling program by Horn River Resources will increase the number of wells drilled to at least 80 in 1971. Drilling activities and seismic programs will increase substantially in the other areas and total exploration expenditures may exceed 150 million dollars in 1971.

Participation and Research Projects

Approximately 20 participation and research-type projects were initiated or continued during 1970. Expenditures incurred for these projects qualify for work credits and when approved can be applied to permits in certain designated areas. Major programs in these categories during 1970 were:

1) *Arcticquest* is a geological and geophysical program designed to solve fundamental geologic problems in order that exploring companies can proceed with individual surveys having a background of stratigraphic control and geophysical technique in unexplored areas. The program will systematically explore the regions between the mainland and Banks Island, new techniques in geophysics may be developed. The information derived should provide an insight into the sedimentary and structural conditions for companies planning additional geophysical or drilling programs. Eleven separate programs are being carried out which consist of eight marine seismic projects, a surface project, an aeromagnetic program, and a study relating to the environment.

2) *Polarquest* is a 4 to 5 year program of reconnaissance surveys in the Arctic and surrounding waters. Programs in 1970 consisted of regional geology, aeromagnetic, gravity, environmental studies, and a collection of bathymetric data. These surveys will provide the basic information which would be used to evaluate the sedimentary basins and allow for detail planning by the permittees on their specific areas of interest. In 1971 Polarquest will undertake two extensive common-depth-point marine seismic programs in the inter-island areas of the Eastern Sverdrup Basin and in the Parry Channel. In addition, surface surveys will be undertaken over most of the Arctic Islands.

3) *Sigma Seismic Programs* – Sigma Geophysical Limited carried out 2 large reconnaissance seismic programs, one was in the area between latitude 65° to 68° east of the MacKenzie River, the second program was centered between latitude 62° and 65° west of the MacKenzie River. Information from these surveys is made available to all interested parties. The permittees acquiring this information by the purchase of data may apply their expenditures to permits encompassed by the area covered by the surveys.
4) Arctic Petroleum Operators Association

The Association is composed of 24 oil companies who hold permits in the Beaufort Sea area. The objectives are to develop the necessary operating technology for the Arctic to engage in studies related to ecological and conservation programs and to act as liaison between other research agencies relative to Arctic operations. Since its inception in January 1970, 16 APOA projects have been completed or are currently underway. The total cost of the projects is approximately 1.5 million dollars. Some of the major programs are preparing drilling guidelines for the Arctic and offshore areas; carrying out a feasibility study for light-weight drilling rig specifically for the Arctic; assisting with an oil spill contingency plan and studying characteristics and movement of ice in the Beaufort Sea.

EXPLORATION-ITEMS OF INTEREST

Oil and Gas Production and Conservation Act

The need for an Oil and Gas Production and Conservation Act to provide statutory authority for control of oil and gas production, prevention of waste and safety of operations in the North was recognized in the Oil and Gas Production and Conservation Act that became law on June 27, 1969. This Act, confined initially to the Yukon and Northwest Territories was extended to cover all of Canada outside of the provisions on June 11, 1970.

Norman Wells Agreement and Refinery Operations

The Canadian Government entered into an agreement with Imperial Oil Limited on June 30, 1944 for the purchase of oil products produced at its Norman Wells refinery, the Company's only operating refinery located North of 60. This refinery has a calendar day capacity of 1,500 barrels and a stream day capacity of 1,600 barrels. An extensive modernization program to increase capacity to more than 2,000 barrels a day was begun in 1969. In 1970 Imperial Oil planned to spend 2.5 million dollars on its manufacturing and marketing facilities in the Northwest Territories. The refinery in Norman Wells is being modernized, refinery input increased, more storage tanks added, and additional barrel filling facilities constructed. In an effort to guarantee the purity of the coolant water being returned to the Mackenzie River, an effluent separator will be installed.

Gas Purchase Agreement

The Westcoast Transmission Company and Amoco Canada Limited have signed a contract for dedication of the company's developed gas reserves in the Beaver River Field straddling the British Columbia – Yukon and at Pointed Mountain in the south-west sector of the Northwest Territories.

The reserves proved and those developed in the Beaver River – Pointed Mountain area are needed by Westcoast Transmission to help in meeting additional market requirements expected over a 25-year period. A 24-inch gas pipeline extending north for 110 miles from the present terminus of Westcoast Pipeline Company at Fort Nelson to the Beaver River gas pool has been completed during the past winter. The gas dehydrator plant and a gas gathering system in the Beaver River Field will be completed and on stream by November 1, 1971. Initial gas deliveries from Beaver River may exceed 200 MMcfd. A second contract for the construction of a gas dehydrator plant at Pointed Mountain and a connecting pipeline to Beaver River has been let. This section of the gas gathering facilities will be on stream by November 1, 1972.

When the development programs are completed it is likely that royalties from gas sales in the tri-corner of British Columbia, Yukon Territory and the Northwest Territories area will exceed one million dollars by 1975.
Land Use Regulations

In June, 1970, amendments to the Territorial Lands Act were passed by Parliament and these will permit the implementation of Territorial Land Use Regulations.

The latter regulations, currently being drafted, will provide authority for designating Land Management Zones in the Yukon Territory and Northwest Territories. Within these zones all resource exploration and development operators will be required to take out land-use permits. The land use permits will stipulate the required measures to be followed by the operator to protect and prevent unnecessary disturbance of the affected terrain and ecosystems.

The Land Use Regulations will be Administered by the Water, Forest and Land Division of the Northern Economic Development Branch.

Mackenzie Valley Pipelines

One of the major markets for Prudhoe Bay Oil is the north-central United States. The most direct route from Prudhoe Bay in Alaska and the Mackenzie Delta area of Canada to the United States mid-west area is along the Mackenzie Valley, and a pipeline built along this route would provide transportation for oil and gas from northern Canada. Accordingly, a consortium of 16 oil exploration companies and two oil pipeline companies was formed to determine the technological and economic feasibility of constructing a 48-inch crude oil pipeline from the north slope of Alaska, up the Mackenzie Valley and on to Edmonton where it would connect with existing oil pipelines.

The initial research facility, a looped 2,000-foot test section of 48-inch pipe in an area of continuous permafrost near Inuvik, Northwest Territories has been completed. Oil at 160°F is being circulated through this section. Company officials indicate that it is technically feasible to construct oil pipelines over permafrost areas without causing excessive damage. It has been decided to continue the test facility at Inuvik until the end of 1971. Extensive research is also being undertaken, with regard to route selection and construction methods, with emphasis on protection of the ecology and environment.

Northwest Project Study Group

A group of oil companies and gas pipeline transmission companies have formed a consortium to build test and research facilities at Sans Sault Rapids on the Mackenzie River, in the Northwest Territories to study the feasibility of a proposed gas pipeline to central Canada and the mid-western United States. The Arctic test facility now under construction is part of the 12 billion dollar project to be undertaken by the Northwest Project Study Group.

Construction and operation of the facilities at Sans Sault is estimated to cost 3.5 million dollars. Under the program, engineers will:

1) Test gas pipelines in permafrost under operating conditions.
2) Test foundations for above ground structures.
3) Test effect of a gas pipeline on surface covered.
4) Study surface drainage problems.
5) Test various materials, equipment and methods of pipeline construction.
William Brothers Canada Limited of Calgary are engineers for the research project and will supervise all testing at this Arctic test facility, which is expected to be in operation for at least two years.

Supply Depot Established in the Arctic Islands

A group of four companies headed by Cardwell Supply Limited established a large supply and maintenance depot at Resolute in the Arctic Islands. In 1970 the company moved close to 5,000 tons of cargo, which included fuel, cement and drilling materials for various oil companies undertaking drilling programs in the Arctic Islands. Facilities at Resolute are housed in air-supported structures which can be expanded readily if additional space is required by other oil companies. Kaps Oil Transport Limited established a supply depot for Elf Oil and Deminex Oil Limited at Johnson’s Point on Banks Island. Supplies are moved by barge down the Mackenzie River and Beaufort Sea to Banks Island during the ice-free periods in August or September.

Fort Simpson – Inuvik Toll Road

A Calgary based company received government approval to construct and maintain a 750-mile winter toll-road in the Mackenzie River Valley to provide access to exploration areas in the Norman Wells and Mackenzie Delta – Tuk areas.

The company, Western Electronics Limited, began construction of the road shortly after freeze-up. It is expected that a 50 foot right-of-way will be opened to Norman Wells by the end of the year and the road completed to Inuvik in 1971. The company hopes that the winter road will provide a base for an all-weather road along the Mackenzie River.

Pipeline Guidelines for Northern Canada

Canadian government guidelines for construction and operation of northern oil and gas pipelines were announced jointly on August 13, 1970 by the Honourable Jean Chrétien, Minister of Indian Affairs and Northern Development, and the Honourable J.J. Greene, Minister of Energy, Mines and Resources.

The guidelines relate to pipelines tapping oil and gas resources North of the 60th degree of latitude in the Yukon Territory and the Northwest Territories and from Alaska. They establish requirements ranging from environmental protection, pollution control and Canadian ownership and participation, to training and employment of residents of the north. Initially, only one trunk line each for oil and gas will be permitted in the north within a “corridor” to be established at a future date.”

Revenues

While no sales of oil and gas rights were held in 1970 revenues governing the Northern operations during the calendar year approximated 4.5 million dollars. (See Table 5 and Figure 12) Revenues from all sources for the fiscal year are shown in Table No. 4 and Figure No. 11. Figure No. 13 depicts the annual value of work bonus for oil and gas work bonus blocks and permits. Cumulative value of work bonus to the end of 1970 is approximately 59 million dollars.
Fig. 11

YUKON TERRITORY-NORTHWEST TERRITORIES

CASH BONUS BIDS, FEES, FORFEITURES, ROYALTIES, RENTALS & SALE OF MAPS FROM OIL & GAS

FISCAL YEAR

GROSS REVENUE-

MILLION DOLLARS

$5,075.01 Y.T.
$1,836,797.29 N.W.T.

$176,214.56 Y.T.
$1,106,910.42 N.W.T.

$27,014.80 Y.T.
$849,958.88 N.W.T.

$413,601.21 Y.T.
$774,477.75 N.W.T.

$25,495.00 Y.T.
$852,773.07 N.W.T.

$19,749.89 Y.T.
$6,252,548.55 N.W.T.

$92,098.05 Y.T.
$1,680,277.40 N.W.T.

$185,069.82 Y.T.
$1,902,349.70 N.W.T.

$1,055,316.52 Y.T.
$8,348,862.17 N.W.T.

$40,999.50 Y.T.
$2,592,321.29 N.W.T.

$204,586.35 Y.T.
$3,658,171.63 N.W.T.
Fig. 12
YUKON TERRITORY - NORTHWEST TERRITORIES

GROSS REVENUE - OIL & GAS
FROM
CASH BONUS BIDS, FEES, FORFEITURES
ROYALTIES, RENTALS & SALE OF MAPS

CALANDER YEAR

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<th>Year</th>
<th>Bonuses $</th>
<th>Other Revenue $</th>
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<td>95,000</td>
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<tr>
<td>1966</td>
<td>3,119,000</td>
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<tr>
<td>1967</td>
<td>3,717,000</td>
<td>7,600,000</td>
</tr>
<tr>
<td>1968</td>
<td>1,470,000</td>
<td>8,600,000</td>
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<tr>
<td>1969</td>
<td>512,190.07</td>
<td>9,219,000</td>
</tr>
<tr>
<td>1970</td>
<td>5,710,556.25</td>
<td>7,600,000</td>
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</tbody>
</table>
Fig. 13

VALUE OF WORK BONUS TENDERS—OIL & GAS
YUKON TERRITORY AND NORTHWEST TERRITORIES

NOTE: Cumulative Value End of Dec. 1969

$58,896,608.91
## TABLE 4
(BY FISCAL YEAR)

### NORTHWEST TERRITORIES

<table>
<thead>
<tr>
<th>Year</th>
<th>Licence Fee</th>
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### YUKON TERRITORY

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### GRAND TOTAL REVENUES

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**Fiscal year 1970-71 (9 months actual)**

(1) ESTIMATED

(2) PERMIT Renewals – Special Renewals
### TABLE 5
(By Calendar Year)

#### NORTHWEST TERRITORIES

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<thead>
<tr>
<th>Year</th>
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#### YUKON TERRITORY

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<th>Royalties</th>
<th>Forfeiture</th>
<th>Cash Bonus</th>
<th>Misc.</th>
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#### GRAND TOTAL REVENUES

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(1) ESTIMATED

(2) PERMIT Rentals – Special Renewals ($1,208,794.00)
APPENDICIES

Information, and Names and addresses of agencies with Federal responsibilities for Northern resources, list of publications, instructions for exploration is compiled and collated in the following appendices:

Appendix I — Publications and Sources of Information.
    Information and Procedures concerning operation on Canada Lands.

Appendix II — Oil and Gas Well Discoveries.

Appendix III — Wells Completed or Abandoned in 1970 and Maps showing location.

Appendix IV — Reporting Forms for Oil and Gas.

Appendix V — Selected Geologic References.
APPENDIX I

PUBLICATIONS

A. Maps

Many maps dealing with the northern resource activities are published by the Division and are available from the Oil and Gas Land and Exploration Section, Calgary, Alberta, or from the Chief, Oil and Mineral Division, Ottawa. The Oil and Mineral Division publishes a list of maps which may be obtained from either of the above sources.

B. The following reports may be obtained from the Queen’s Printer or the Oil and Gas Land and Exploration Section, Calgary; pre-payment is required.

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<td>No. 1 (1920-1960)</td>
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<td>Oil and Gas Statistical Report</td>
<td></td>
</tr>
<tr>
<td>“Technical Reports Available for Inspection 1971”.</td>
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Technical Reports released from confidential status are available for public inspection only in the office of the Oil and Gas Land and Exploration Section of this Department in Calgary.

OTHER SOURCES OF INFORMATION

Information on northern resource activities can be obtained from the Chief, Oil and Mineral Division, Department of Indian Affairs and Northern Development, 400 Laurier Ave. West, Ottawa. All cores and samples from wells drilled on Canada lands are stored at the Institute of Petroleum and Sedimentary Geology, 3303-33rd St. N.W., Calgary 44, Alberta. Specialized and technical literature pertaining to Northern Canada can be purchased or pursued at the following government agencies:

(a) Northern Co-ordination Division Library, Department of Indian Affairs and Northern Development, 400 Laurier Avenue West, Ottawa, Ontario.
(b) Department of Energy, Mines and Resources

1. Geological Survey of Canada — Ottawa, Ontario and Vancouver, B.C.
   Institute of Petroleum and Sedimentary Geology — Calgary, Alberta.

2. Marine Sciences Branch, Bedford Oceanographic Institute — Dartmouth, N.S.


(c) Defence Research Board, Scientific Information Service

(d) Ministry of Transport


3. Telecommunications and Electronics Branch — Edmonton, Alberta and Ottawa, Ontario.

4. Civil Aviation Branch — Winnipeg, Manitoba.

(e) Arctic Institute of North America — Montreal, Quebec.

(f) National Research Council — Ottawa, Ontario.

1. Dominion Observatories Branch — Ottawa, Ontario.

(g) The following brochures published by this Department may be available in some Public Libraries:

   i Guide to Northern Non-Renewable Resources

   ii Communication and Transportation Facilities Queen Elizabeth Group — Arctic Islands

   iii Resource Management Division — Responsibilities and Administration

   iv Oil and Gas Canada Lands — Volume No. 2

   v Oil and Gas Canada Lands — Edition No. 3

   vi Oil and Gas in the Yukon and Northwest Territories — Edition No. 4 — 1967

   vii Oil and Gas — North of 60 — 1968

   viii Oil and Gas — North of 60 — 1969

   ix Prospectus — North of 60

INFORMATION AND PROCEDURES CONCERNING OPERATIONS ON CANADA LANDS

Certain federal agencies are concerned with exploration on Canada lands and must be
notified prior to the commencement of any exploration activity. The operator or permittee – not the contractor, is responsible for providing the requisite advance notice of planned programs to these agencies by writing directly to them.

For offshore programs the agencies that must be informed with respect to each program, in addition to the Oil and Mineral Division, are: the appropriate Maritime Commander in the Department of National Defence, the Aids to Navigation Division of the Ministry of Transport; and, in the case of seismic programs, the appropriate Regional Director of the Department of Fisheries and Forestry. In the case of the Hudson Bay region, operators must also inform the National Research Council of proposed operations. Circumstances may be such that other agencies should be notified as well, and these are listed on the following pages, together with the names of persons who can be of assistance. For example, since operators are responsible for any damage they may cause to underwater commercial cables, it is recommended that they contact the Canadian Hydrographic Service for cable-lay data covering the area over which the work is to be performed. Similarly, Customs and Excise should be contacted by the importing company if vessels or equipment are to be brought in from abroad.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

1. Pursuant to Section 52, “Notices of Commencement of Exploratory Work” must be filed 15 days prior to commencement of proposed programs on the Mainland and Arctic Islands, and 45 days prior to commencement of exploratory work on offshore areas with the,

   District Oil Conservation Engineer
   Oil and Mineral Division,
   112 – 11th Avenue S.E.,
   Calgary 21, Alberta.

   Phone: 403-264-0201

2. Information and assistance may be obtained from:

   Chief,
   Oil and Mineral Division,
   Northern Economic Development Branch,
   Department of Indian Affairs and Northern Development,
   400 Laurier Avenue West,
   Ottawa, Ontario.

   Name: Dr. H.W. Woodward,
   Phone: 613-992-0223

3. Advice on operational matters may be obtained from:

   Operations Geologist,
   Oil and Mineral Division,
   Northern Economic Development Branch,
   Ottawa, Ontario.
   Name: S.A. Kanik
   Phone: 613-992-0921
4. Information and advice on the Land Use Regulations may be obtained from:

Head,
Water and Land Use Management,
Water, Forests and Land Division,
400 Laurier Avenue West,
Ottawa, Ontario.

Name: G.B. Armstrong
Phone: 613-996-2998

DEPARTMENT OF FISHERIES AND FORESTRY

Resource Development Branch

Advance notice of 90 days is required before the start of a marine seismic survey involving the use of high explosives, in the event that qualified observers are needed. Nominal advance notice is required before the start of a seismic survey in which a source of acoustical energy other than high explosives is to be used. This Department must also be informed of any offshore drilling program prior to its commencement.

Written notices should be sent to the appropriate Regional Director of Fisheries with a copy to:

Director,
Environmental Quality,
Department of Fisheries and Forestry,
Sir Charles Tupper Building,
Ottawa, Ontario.

Name: K.C. Lucas
Phone: 613-997-8041

Information regarding the Department’s requirement can also be obtained from:

Deputy Director,
Resource Development Service.

Name: E.W. Burridge
Phone: 613-997-4526

The address of the Regional Director responsible for all fresh water lakes in the Northwest Territories is:

C. McEwan,
114 Gary Street,
Winnipeg 1, Manitoba.

Phone: 204-946-8101

For all fresh water lakes in the Yukon Territory is:
Information concerning wildlife such as the locations of migratory bird sanctuaries and National Wildlife Areas may be obtained from:

Director,
Canadian Wildlife Service,
Department of The Environment,
400 Laurier Avenue West,
Ottawa, Ontario.

Attention: N.G. Perret
Phone: 613-992-5305

CANADIAN METEOROLOGICAL SERVICE

Requests for information and assistance on meteorological and sea-ice data, climatology, weather forecasting, meteorological instruments and research may be directed to:

Administrator,
Canadian Meteorological Service,
Ministry of Transport,
315 Bloor Street West,
Toronto 181, Ontario.

Name: J.R.H. Noble
Phone: 416-966-6539

Information may also be obtained through the Meteorological Liaison Officer in Ottawa. This position is filled on a rotation basis and the name of the officer is subject to change. Inquiries in Ottawa may be directed to:

Meteorological Liaison Officer,
Ministry of Transport,
No. 3 Temporary Building,
Ottawa, Ontario.

Name: D.J. Wright
Phone: 613-992-4217

DEPARTMENT OF NATIONAL DEFENCE

Maritime Commanders

The appropriate Office of Maritime Command requires 45 days advance notice in writing of any exploration program proposed for the offshore. Relevant information will be supplied the operator on a need-to-know basis. Approval must be obtained from the Department before the commencement of work.

Operations in Baffin Bay, and Arctic waters east of longitude 105° West are handled by the office of:
MINISTRY OF TRANSPORT

Aids to Navigation Division

At least 60 days notice is required by this Division before the commencement of any offshore exploration program, in order that appropriate local Notices to Shipping and national Notices to Mariners may be issued. These Notices are subsequently copied into related foreign publications. The Division also indicates the requirement for any aids to navigation devices that may be necessary for the program.

Advance notice of 90 days is required in any case where a drilling program involves the territorial sea, in order for approval to be granted under the Navigable Waters Protection Act.

All communications on these matters should be directed to:

Chief, Aids to Navigation,
Marine Works Branch,
Ministry of Transport,
Ottawa, Ontario.

Phone: 613-992-2736

In addition, there are a number of Departmental officers who may be contacted in the field should the need arise. Their titles and addresses are given below:

District Marine Agent,
Ministry of Transport,
P.O. Box 310, Uppertown,
Quebec 4, Quebec
(This office handles Hudson Bay)

District Manager,
Ministry of Transport,
P.O. Box 155,
Hay River, N.W.T.

Phone: 403-874-2331

Marine Operations Branch

This agency directs the operations of the Canadian Coast Guard which has major responsibilities in two areas of concern to offshore operations: support of shipping in ice-congested waters, and marine search and rescue.
If operations are being contemplated for areas where ice may be a problem and where ice-breaker or other support may be desired, there should be consultation with the Director of Marine Operations as long in advance as possible. This is particularly important in the case of Arctic and Hudson Bay operations where the planning of ice-breaker disposition is usually done six months in advance of the season.

Further information and assistance may be obtained from:

Director,
Marine Operations Branch,
Ministry of Transport,
Ottawa, Ontario.

Name: A.H.G. Storrs
Phone: 613-992-4209

Marine Regulations Branch

This Branch includes the Steamship Inspection Division and the Nautical and Pilotage Division. The responsibilities of the former Division include inspection and certification of vessels under the Canada Shipping Act, oil pollution by vessels, and safety of life at sea. The responsibilities of the latter Division include registration of shipping, pilotage, marine accident investigation and inquiries, salvage, marine personnel and navigational safety matters. This last includes the establishment of restricted navigation areas and the routing of ships.

Further information and assistance may be obtained from:

Director,
Marine Regulations Branch,
Ministry of Transport,
Ottawa, Ontario.

Name: R.R. Macgillivray
Phone: 613-992-8892

Information with regard to safety of life at sea and acceptable standards of seaworthiness may be referred to:

Chairman,
Board of Steamship Inspection,
Marine Regulations Branch.

Name: W.E. Harrison
Phone: 613-992-1312

DEPARTMENT OF COMMUNICATIONS

Telecommunications Regulation Branch

The responsibilities of this agency include the development of technical standards, the selection and coordination of radio frequencies, and the licensing of all classes of radio stations except broadcasting.
An operator contemplating the use of radio communications in his offshore activities should make application for licensing of any radio station in Canada or on board any Canadian vessel involved at least six weeks before the proposed in-service date of the communication facility. Details as to the licensing requirements and the necessary application forms may be obtained from the Regional Superintendent, Telecommunications Regulation Branch, Department of Communications:

Oil companies in Western Canada may contact:

Radio Superintendent,  
Telecommunications Regulations Branch,  
Department of Communications,  
Federal Building,  
Edmonton, Alberta.

Name: L.E. Nelson  
Phone: 403-424-0251 (Extension: 334)

If need be, the following persons in Ottawa may be contacted for assistance:

Director,  
Telecommunications Regulation Branch,  
Department of Communications,  
Ottawa, Ontario.

Name: W.J. Wilson  
Phone: 613-992-0840

Advice in determining communication requirements and the necessary applications for licence may also be obtained from:

Chief,  
Radio Authorization and Enforcement Division,  
Department of Communications,  
Ottawa, Ontario.

Name: A.G.E. Argue  
Phone: 613-992-3427

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Marine Sciences Branch

In addition to providing the commercial-cable lay data, the Canadian Hydrographic Service publishes charts of Canadian coastal waters, and information concerning these may be obtained from:

Canadian Hydrographic Service,  
Marine Sciences Branch.

Attention: W.J. Covey  
Phone: 613-994-9155
Information concerning charts showing Canada's Territorial Sea and Fishing Zone Limits and related data may be obtained from:

Canadian Hydrographic Service,
Marine Sciences Branch.

Attention: E.J. Cooper
Phone: 613-994-5411

Information on physical oceanography may be obtained from:

Canadian Oceanographic Data Centre,
Marine Sciences Branch.

Attention: C.M. Cross
Phone: 613-992-9104

Information on tides may be obtained from:

Tides and Water Levels,
Marine Sciences Branch.

Attention: G.C. Dohler
Phone: 613-992-9122

Information on hydrographic surveys and control data in the western Arctic regions may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
512 Federal Building,
Victoria, British Columbia.

Name: M. Bolton
Phone: 604-338-3188

Information on hydrographic surveys and control data in the eastern Arctic may be obtained from:

Regional Hydrographer,
Canadian Hydrographic Service,
Atlantic Oceanographic Laboratory,
Bedford Institute,
Dartmouth, Nova Scotia.

Name: R.C. Melanson
Phone: 902-426-3497

Surveys and Mapping Branch

Information on the systems, methods and equipment utilized in positioning and surveying with respect to exploration work may be subject to review by this agency. Moreover, legal surveys must be made in accordance with instructions of the Surveyor General.
Inquiries concerning surveying may be directed to:

Surveyor General,
Legal Surveys Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: R. Thistelthwaite
Phone: 613-994-9174

Information concerning coastal control surveys may be obtained from:

Geodetic Survey Division,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: C.E. Hoganson
Phone: 613-994-5079

When requesting control survey data, the enquiries should define the area involved by latitude and longitude. In the case of a large area, it is important to state priorities within the area to facilitate processing.

Resource Management and Conservation Branch

The Resource Management and Conservation Branch is responsible for the administration of the federal interests in the mineral resources off Canada’s east and west seacoasts and in the Hudson Bay and Hudson Strait regions.

All correspondence should be addressed to:

Director,
Resource Management and Conservation Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: D.G. Crosby
Phone: 613-994-5065

Surveys and Mapping Branch

Air photographs covering all portions of Canada may be obtained from:

National Air Photo Library,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: G.H. Whitcher
Phone: 613-994-5433

Topographic maps, indices charts, atlases and numerous other map publications may be obtained from:
Map Distribution Office,
Surveys and Mapping Branch,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Attention: G.A. Clemmer
Phone: 613-994-9663

Geological Survey of Canada

The Geological Survey of Canada carries out systematic geological and geophysical surveys in the sedimentary basins of Canada, including parts of the regions offshore from the east and west coasts, in Hudson Bay, and in the Arctic Islands.

Inquiries with regard to the operations and publications of the Geological Survey should be made to:

Director,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: Y.O. Fortier
Phone: 613-994-5817

or to:

Director,
Institute of Sedimentary and Petroleum Geology,
Geological Survey of Canada,
Department of Energy, Mines and Resources,
Calgary 44, Alberta.

Name: D.J. McLaren
Phone: 403-284-0110

Polar Continental Shelf Project

The Polar Continental Shelf Project is a continuing investigation of the continental shelf fringing the Arctic coast of Canada, together with adjacent parts of the Arctic Ocean basin, the islands of the Canadian Arctic Archipelago and the waters between them, and other areas of special interest.

Inquiries regarding surveys and scientific studies in Arctic areas may be directed to:

Co-ordinator,
Polar Continental Shelf Project,
Department of Energy, Mines and Resources,
Ottawa, Ontario.

Name: E.F. Roots
Phone: 613-996-3388
NATIONAL RESEARCH COUNCIL

Space Research Facilities Branch

Operators planning offshore activities in the Hudson Bay region must inform the following agency of the National Research Council well in advance since rockets are fired on a year round basis from the Churchill Research Range:

Head,
Range Section,
Space Research Facilities Branch,
National Research Council,
Ottawa 7, Ontario.

Name: Z.R. Charko
Phone: 613-993-9385

Operators active in the Hudson Bay region are also required to co-ordinate their field activities with:

General Superintendent,
Churchill Research Range,
National Research Council,
Fort Churchill, Manitoba.

Name: T.W. McGrath
Phone: 204-856-3010

Rockets are also launched from time to time from the facilities at Resolute Bay, N.W.T. and operators with exploration work planned for this vicinity are urged to co-ordinate their activities with the National Research Council.

DEPARTMENT OF NATIONAL REVENUE

Customs and Excise

The Port Administration Division administers that portion of the Canada Shipping Act that relates to the coasting trade. In this connection, any company importing ships or specialized plant and equipment for exploration work on Canada’s seacoasts may obtain information, assistance and such other contacts as may be necessary in Customs and Excise from:

Director,
Port Administration Division,
Customs and Excise,
Department of National Revenue,
Ottawa, Ontario.

Name: M.A. Gallup
Phone: 613-992-4952

DEPARTMENT OF MANPOWER AND IMMIGRATION

Canada Immigration Division

Inquiries should be directed to:
Department of Manpower and Immigration,
Home Services Branch,
Canada Immigration Division,
Admission Section,
Ottawa, Ontario.

Attention: Mr. G.E. White
Phone: 613-992-3305

The Calgary and Edmonton offices of the Department of Manpower and Immigration can answer any queries regarding entry into the Northwest Territories. The Vancouver office can respond to queries for entry into the Yukon Territory.

At Tuktoyaktuk, a local R.C.M.P. officer is also a representative of the Department of Manpower and Immigration and can clear entry into Canada via Tuk.

At Inuvik, the Customs Department is also Departmental representative for Manpower and Immigration and can be contacted by telephone if prior arrangements are necessary. There is no representative at Aklavik; in the event that a seismic crew prefers to land at Aklavik, arrangements must be made with the Inuvik representative.

COMMUNICATIONS

Information in the brochure, “Communications and Transportation Facilities, Queen Elizabeth Group, Arctic Islands”, is being updated and will be available in a comprehensive report entitled “Operational Guide for Oil and Gas Companies in the North”. This publication is now in preparation and should be available by December, 1971. In addition to information concerning communication and transportation, the report will contain information covering all aspects of exploration in the North.
COMMUNICATION SYSTEMS OF WESTERN ARCTIC

LEGEND
- Tropospheric Scatter System
- Micro-Relay Network
- Land Line System
- Radiotelephony
- Single Side-Band
- Projected Tropospheric Scatter Syst.

OIL & MINERAL DIVISION Dec 31, 1970
APPENDIX II

OIL AND GAS WELL DISCOVERIES

YUKON TERRITORY

Canada Southern et al N. Beaver R. Y.T. 1-27  
1-27-60-10-124-00  
Suspended gas well  
September 29, 1964

Canoe River Change Y.T. J-19  
J-19-66-10-137-30  
Suspended gas well  
February 17, 1968

Pan Am Beaver Y.T. G-01  
G-01-60-10-124-15  
Shut-in Gas well  
August 13, 1969

Socony Mobil et al Chance Y.T. G-08  
G-08-66-10-137-30  
Suspended oil well  
March 31, 1965

Socony Mobil et al Blackie No. 1 Y.T. M-59  
M-59-66-00-137-00  
Suspended gas well  
March 27, 1964

Socony Mobil et al Birch, Y.T. B-34  
B-34-66-10-136-45  
Suspended gas well  
June 8, 1965

Western Minerals Chance Y.T. No. 1 M-08  
M-08-66-10-137-30  
Suspended oil and gas well  
January 31, 1960

NORTHWEST TERRITORIES

Briggs Rabbit Lake No. 3 B-07  
B-07-61-00-118-45  
Suspended gas well  
March 9, 1957

Briggs Rabbit Lake No. 1 0-16  
0-16-61-00-118-45  
Suspended gas well  
March 17, 1955

CPOG et al LaBiche F-08  
F-08-60-40-124-30  
Suspended gas well  
March 27, 1970

HB Cameron Hills A-05  
A-05-60-10-117-30  
Suspended gas well  
April 16, 1968

HB Pan Am S. Island R. M-41  
M-41-60-10-121-00  
Suspended gas well  
March 23, 1964

Home Signal Celibeta H-78  
H-78-60-10-122-00  
Suspended gas well  
March 13, 1960

JOE Atkinson H-25  
H-25-69-50-131-45  
Suspended oil well  
February 23, 1970

Pan Am Pointed Mountain P-53  
P-53-60-30-123-45  
Shut-in gas well  
March 10, 1967

Pan Am Pointed Mountain K-45  
K-45-60-30-123-45  
Shut-in gas well  
May 8, 1968
Pan Am Pointed Mountain G-62
G-62-60-30-123-45
Shut-in gas well
June 20, 1969

Sun Nelta C-07
C-07-60-50-122-45
Suspended gas well
April 5, 1961

Texaco Bovie Lake J-72
J-72-60-20-122-45
Suspended gas well
April 20, 1966

Union Pan Am Trainor Lake C-3
C-39-60-20-120-30
Suspended gas well
March 15, 1965

ARCTIC ISLANDS

Panarctic Drake Point L-67
L-67-76-30-108-30
Suspended gas well
February 26, 1970

Panarctic King Christian D-18-A
D-18-77-50-101-00
Suspended gas well
March 15, 1971
APPENDIX III
WELLS COMPLETED OR ABANDONED IN 1970

NORTHWEST TERRITORIES

<table>
<thead>
<tr>
<th>NAME OF WELL</th>
<th>SPUNDED</th>
<th>COMPLETED</th>
<th>STATUS</th>
<th>TOTAL DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>AmHess Gulf Redknife E-55</td>
<td>12-1-70</td>
<td>4-2-70</td>
<td>D &amp; A</td>
<td>4,087'</td>
</tr>
<tr>
<td>Amoco Murphy Cormack N-33</td>
<td>1-2-70</td>
<td>14-3-70</td>
<td>D &amp; A</td>
<td>6,258'</td>
</tr>
<tr>
<td>Amoco et al Poplar River I-32</td>
<td>5-2-70</td>
<td>13-3-70</td>
<td>D &amp; A</td>
<td>4,988'</td>
</tr>
<tr>
<td>Atkinson et al Island River J-44</td>
<td>23-1-70</td>
<td>25-2-70</td>
<td>D &amp; A</td>
<td>7,083'</td>
</tr>
<tr>
<td>Banner et al Little Growl N-11</td>
<td>3-3-70</td>
<td>5-4-70</td>
<td>D &amp; A</td>
<td>7,438'</td>
</tr>
<tr>
<td>Banff et al Oscar Creek H-71</td>
<td>22-8-70</td>
<td>5-9-70</td>
<td>D &amp; A</td>
<td>1,416'</td>
</tr>
<tr>
<td>Banff et al Oscar Creek J-48</td>
<td>13-9-70</td>
<td>22-9-70</td>
<td>D &amp; A</td>
<td>1,510'</td>
</tr>
<tr>
<td>Banff et al Rat Pass K-35</td>
<td>21-10-70</td>
<td>13-12-70</td>
<td>D &amp; A</td>
<td>6,004'</td>
</tr>
<tr>
<td>Canada Southern Celibeta N-39</td>
<td>15-3-70</td>
<td>20-3-70</td>
<td>D &amp; A</td>
<td>1,003'</td>
</tr>
<tr>
<td>Canso et al Grumbler J-13</td>
<td>23-2-70</td>
<td>12-3-70</td>
<td>D &amp; A</td>
<td>2,854'</td>
</tr>
<tr>
<td>CPOG Chevron Gull Creek A-63</td>
<td>14-2-70</td>
<td>28-2-70</td>
<td>D &amp; A</td>
<td>3,095'</td>
</tr>
<tr>
<td>CPOG Chevron Kakisa G-31</td>
<td>4-3-70</td>
<td>19-3-70</td>
<td>D &amp; A</td>
<td>3,710'</td>
</tr>
<tr>
<td>CPOG Chevron Tathlina K-24</td>
<td>23-3-70</td>
<td>6-4-70</td>
<td>D &amp; A</td>
<td>3,451'</td>
</tr>
<tr>
<td>Cdn-Sup et al Jean Marie E-07</td>
<td>31-12-69</td>
<td>18-1-70</td>
<td>D &amp; A</td>
<td>3,153'</td>
</tr>
<tr>
<td>Cdn-Sup et al Jean Marie J-52</td>
<td>23-1-70</td>
<td>6-2-70</td>
<td>D &amp; A</td>
<td>2,200'</td>
</tr>
<tr>
<td>CDR et al Mills Lake N-74</td>
<td>3-2-70</td>
<td>9-2-70</td>
<td>D &amp; A</td>
<td>1,810'</td>
</tr>
<tr>
<td>NAME OF WELL</td>
<td>SPUDDED</td>
<td>COMPLETED</td>
<td>STATUS</td>
<td>TOTAL DEPTH</td>
</tr>
<tr>
<td>-----------------------</td>
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<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>CS Noel</td>
<td>25-2-70</td>
<td>3-3-70</td>
<td>D &amp; A</td>
<td>1,672’</td>
</tr>
<tr>
<td>Laferte River N-15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS Noel</td>
<td>4-3-70</td>
<td>12-3-70</td>
<td>D &amp; A</td>
<td>1,568’</td>
</tr>
<tr>
<td>Laferte River J-03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elf Cape Norem A-80</td>
<td>20-4-70</td>
<td>27-8-70</td>
<td>D &amp; A</td>
<td>9,744’</td>
</tr>
<tr>
<td>Elf Horton River G-02</td>
<td>9-11-69</td>
<td>22-1-70</td>
<td>D &amp; A</td>
<td>8,130’</td>
</tr>
<tr>
<td>Gobles et al Celibeta D-66</td>
<td>30-1-70</td>
<td>18-3-70</td>
<td>D &amp; A</td>
<td>8,552’</td>
</tr>
<tr>
<td>GPD Noel et al Mills West M-65</td>
<td>24-3-70</td>
<td>31-3-70</td>
<td>D &amp; A</td>
<td>1,548’</td>
</tr>
<tr>
<td>GPD Noel et al Mills West M-65A</td>
<td>31-3-70</td>
<td>8-4-70</td>
<td>D &amp; A</td>
<td>1,848’</td>
</tr>
<tr>
<td>Gulf East Reindeer C-38</td>
<td>4-5-70</td>
<td>25-6-70</td>
<td>D &amp; A</td>
<td>8,506’</td>
</tr>
<tr>
<td>Gulf East Reindeer P-60</td>
<td>17-3-70</td>
<td>23-4-70</td>
<td>D &amp; A</td>
<td>6,300’</td>
</tr>
<tr>
<td>Gulf et al Trout River D-14</td>
<td>15-2-70</td>
<td>2-3-70</td>
<td>D &amp; A</td>
<td>2,259’</td>
</tr>
<tr>
<td>Gulf et al Redknife H-28</td>
<td>21-1-70</td>
<td>6-2-70</td>
<td>D &amp; A</td>
<td>2,330’</td>
</tr>
<tr>
<td>HB Shell W Cameron F-24</td>
<td>24-1-70</td>
<td>21-2-70</td>
<td>D &amp; A</td>
<td>6,234’</td>
</tr>
<tr>
<td>HB Petitot C-60</td>
<td>16-2-70</td>
<td>21-3-70</td>
<td>D &amp; A</td>
<td>7,315’</td>
</tr>
<tr>
<td>HB Great Plains Simpson D-25</td>
<td>25-2-70</td>
<td>11-3-70</td>
<td>D &amp; A</td>
<td>3,432’</td>
</tr>
<tr>
<td>Husky et al Willowlake H-10</td>
<td>27-2-70</td>
<td>27-3-70</td>
<td>D &amp; A</td>
<td>3,270’</td>
</tr>
<tr>
<td>Husky et al Sibbeston G-69</td>
<td>3-1-70</td>
<td>28-1-70</td>
<td>D &amp; A</td>
<td>3,570’</td>
</tr>
<tr>
<td>Husky et al Willowlake O-27A</td>
<td>29-1-70</td>
<td>22-2-70</td>
<td>D &amp; A</td>
<td>2,920’</td>
</tr>
<tr>
<td>Husky HB et al Willowlake G-32</td>
<td>14-3-70</td>
<td>5-4-70</td>
<td>D &amp; A</td>
<td>2,745’</td>
</tr>
<tr>
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</tr>
<tr>
<td>NAME OF WELL</td>
<td>SPUDDED</td>
<td>COMPLETED</td>
<td>STATUS</td>
<td>TOTAL DEPTH</td>
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<tr>
<td>----------------------</td>
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<td>-------------</td>
</tr>
<tr>
<td>Horn River et al</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay River B-52</td>
<td>8-12-70</td>
<td>22-12-70</td>
<td>D &amp; A</td>
<td>2,027'</td>
</tr>
<tr>
<td>Horn River et al</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabbit Lake H-01</td>
<td>11-12-70</td>
<td>22-12-70</td>
<td>D &amp; A</td>
<td>3,085'</td>
</tr>
<tr>
<td>IOE Arrowhead L-49</td>
<td>26-1-70</td>
<td>5-2-70</td>
<td>D &amp; A</td>
<td>2,120'</td>
</tr>
<tr>
<td>IOE Atkinson H-25</td>
<td>14-12-69</td>
<td>26-2-70</td>
<td>Oil Well</td>
<td>5,941'</td>
</tr>
<tr>
<td>IOE Atkinson M-33</td>
<td>1-5-70</td>
<td>3-6-70</td>
<td>D &amp; A</td>
<td>6,327'</td>
</tr>
<tr>
<td>IOE Amoco Bovie M-05</td>
<td>6-1-70</td>
<td>18-1-70</td>
<td>D &amp; A</td>
<td>1,900'</td>
</tr>
<tr>
<td>IOE Chevron Celibeta D-31</td>
<td>8-2-70</td>
<td>19-2-70</td>
<td>D &amp; A</td>
<td>2,200'</td>
</tr>
<tr>
<td>IOE Ellice O-14</td>
<td>19-11-69</td>
<td>17-2-70</td>
<td>D &amp; A</td>
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<td>TOTAL FOOTAGE DRILLED IN 1970 – 364,731'</td>
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Map 36

WELLS COMPLETED OR ABANDONED IN 1970

LEGEND

• Gas Well  o Suspended  130' Total Depth
• Oil Well  • Dry and Abandoned

Number of Wells Drilled in 1970-73, Footage Drilled in 1970-73

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<th>Footage Drilled in 1970-73</th>
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<tr>
<td>55 Banff et al Rat Pass</td>
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<td>56 Gulf East Reindeer</td>
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<tr>
<td>57 Gulf East Reindeer</td>
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<td>58 IOE Atkinson</td>
<td>5,041'</td>
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<td>59 IOE Atkinson</td>
<td>6,327'</td>
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<td>60 IOE Etlice</td>
<td>9,531'</td>
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<tr>
<td>61 IOE Natognaek</td>
<td>4,977'</td>
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<tr>
<td>62 IOE Natognaek</td>
<td>6,402'</td>
</tr>
<tr>
<td>63 IOE Nuvorak</td>
<td>3,798'</td>
</tr>
<tr>
<td>64 IOE Blow River Y.T.</td>
<td>14,000'</td>
</tr>
<tr>
<td>65 Shell Aklovik</td>
<td>8,179'</td>
</tr>
<tr>
<td>66 Elf Horton River</td>
<td>8,130'</td>
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</table>

Map of wells completed or abandoned in 1970, with locations marked on a map of the Arctic region.
Map 3D

WELLS COMPLETED OR ABANDONED IN 1970

LEGEND

Solar: Gas Well  S: Suspended  8,454' Total Depth
O: Oil Well  ⭐: Dry and Abandoned

Number of Wells Drilled in 1970: 73, Footage Drilled in 1970: 364,731

SCALE "1" = 50 MILES

67 Elf Cape Nome  9,744'
68 Panarctic Towson Point  5,123'
69 Panarctic Drake Point  10,671'
70 Panarctic Drake Point  8,454'
71 Panarctic Drake Point  3,198'
72 Panarctic Hecla  11,865'
73 Panarctic Hoodoo  11,072'
APPENDIX IV

The Oil and Mineral Division is a member of the “Federal-Provincial Committee on Energy Statistics” and the “Mine Ministers Subcommittee on Oil and Gas Statistics” and together with the four western provinces and D.B.S. has standardized all its oil and gas reporting forms. This standardization has removed duplication between government agencies and more important, industry can now process all oil and gas reporting forms from the western provinces and the Yukon and Northwest Territories on computer machines without change of programs.

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<td>IAND*52-90-1**</td>
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<td>IAND*52-90-2</td>
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<td>IAND*52-90-3**</td>
<td>Application to Amend a Drilling Authority</td>
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<td>IAND*52-90-4**</td>
<td>Application to Change a Well Name</td>
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<td>IAND*52-90-5**</td>
<td>Application to Abandon a Well or Suspend Drilling</td>
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<td>IAND*52-90-6**</td>
<td>Application to Alter Condition of a Well</td>
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<td>Work-over Report No.</td>
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<td>Application to Commingle Production before Measurement</td>
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<td>Data for Back Pressure Test on</td>
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<td>Data for Back Pressure Test on</td>
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<td>Natural Gas Wells – Vitter’s Method</td>
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<td>M.P.R. – Oil – Calculations</td>
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<td>Geologic Surface Survey &amp; Airphoto Analysis – Expenditures</td>
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<td>Land Geophysical Operations – Expenditures</td>
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<td>Marine Geophysical – Expenditures</td>
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<td>Drilling &amp; Structure Test Drilling Program – Expenditures</td>
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<td>Notice of Commencement of Exploratory Work</td>
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<td>IAND*52-92</td>
<td>Application for Authority to Drill Structure Test Hole</td>
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<td>Report on Abandonment of Structure Test Holes</td>
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<td>IAND*52-103**</td>
<td>Application for Oil and Gas Lease</td>
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<td>IAND*52-183</td>
<td>Monthly Accident Summary</td>
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*To be completed by Operator.
**To be completed in triplicate; all other forms to be completed in duplicate.

All forms, except IAND 52-83 and 52-103, are submitted to the District Oil Conservation Engineer, Calgary 21, Alberta.

Forms IAND 52-83, 52-90-23 to 52-90-26 and 52-103 are submitted to the Oil and Mineral Division, 400 Laurier Avenue West, Ottawa 4, Ontario.
The following forms have been issued pursuant to the “Canada Oil and Gas Land Regulations” and the “Canada Oil and Gas Drilling and Production Regulations”. These forms are to be completed when applicable during the production stage of oil and gas wells, and refinery operations.

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<td>Monthly Gas Gathering Statement</td>
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<td>Monthly Crude Oil and Condensate Purchasers' Statement</td>
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<td>IAND 52-116-6</td>
<td>Monthly Gas Plant Statement</td>
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<td>Monthly Gas Processing Plant Products Statement</td>
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<td>Monthly Liquefied Petroleum Gas Purchasers Statement</td>
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<td>IAND 52-116-12</td>
<td>Statement of Nomination and Estimated Requirement for Crude Oil, Condensate and Pentanes Plus</td>
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**NOTE:**
(a) All forms to be completed by the Operator.

(b) Forms 6511-37 and 6511-38 are completed by the Operator in triplicate. He forwards the first two copies to the Oil and Mineral Division and the third to the District Oil Conservation Engineer, Department of Indian Affairs and Northern Development, Calgary, Alberta. The other forms listed above are completed in duplicate. The original is submitted to the Oil and Mineral Division in Ottawa and one copy to the District Conservation Engineer in Calgary.
APPENDIX V

Selected geological references applicable to geological provinces in northern Canada are listed below. References are Geological Survey of Canada publications unless otherwise noted.

NORTHWEST TERRITORIES

Memoir 273  
The Lower MacKenzie River Area  
G.S. Hume

Memoir 322  
Stratigraphy of Middle Devonian and Older Palaeozoic Rocks of the Great Slave Lake Region Northwest Territories.  
A.W. Norris

Bulletin 95  
Carboniferous and Permian Rocks, Southwestern District of Mackenzie  
P. Harker

Bulletin 159  
Study of pegmatite bodies and enclosing rocks, Yellowknife-Beaulieu region, District of Mackenzie  
R. Kretz

Bulletin 163  
A Middle Cambrian Plagiura-Poliella fannule from southwest District of Mackenzie  
B.S. Norford

Bulletin 170  
Middle Triassic (Anisian) ammonoid from northeastern British Columbia and Ellesmere Island  
F.H. McLearn

Bulletin 185  
Barremian Textulariina, Foraminiferida from Lower Cretaceous beds, Mount Geodenough section, Aklavik Range, District of Mackenzie  
T.P. Chamney

Paper 58-2  
Uppermost Jurassic and Cretaceous Rocks of Aklavik Range, Northeastern Richardson Mountains  
J.A. Jeletzky

Paper 58-11  
Great Slave and Trout River Map Areas  
R.J.W. Douglas

Paper 59-11  
Horn River Map Area  

Paper 61-1  
Summary Account of Carboniferous and Permian Formations Southwestern District of Mackenzie  
P. Harker
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<td>J.A. Jeletzky</td>
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<td>Mountains between the Headwaters of Blow and Bell Rivers</td>
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<td>Geological Notes — Northern District of Keewatin</td>
<td>W.W. Heywood</td>
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<td>61-29</td>
<td>Upper Devonian Formations</td>
<td>H.R. Belyea, et al</td>
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<td>62-15</td>
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