
Northern Oil and Gas

Annual Report 1993

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**Message from the Honourable Ronald A. Irwin
Minister of Indian Affairs and Northern Development**

I am pleased to table before Parliament the *Northern Oil and Gas Annual Report* for 1993.

I would like to take this opportunity to reflect on the North, its people and its rich natural resource base.

Dynamic forces are coming into play in northern Canada. We are on the threshold of an era bringing much greater certainty in terms of the ownership and management of land and resources. We are entering into strong, forward-looking partnerships that will take the North into the twenty-first century.

With Aboriginal people, partnerships are being forged through land claim settlement agreements that resolve the previous uncertainty regarding title to lands. These agreements clearly define the ownership of land and subsurface resources. Working in partnership will provide the means through which economic benefits can be fully realized by northern Canadians.

The Canada-Yukon Oil and Gas Accord is a cornerstone of our changed relationship with the Yukon Government. Under the accord, the territorial government will have provincial-type powers to manage and regulate Yukon onshore oil and gas resources. The accord also provides for future negotiations on sharing offshore resources in the Beaufort Sea. This accord represents a significant transfer of federal responsibility to territorial jurisdiction.

Through these new relationships, the active participation of all northerners will undoubtedly result in economic renewal, attracting private sector investments and joint ventures in the exploration and development of petroleum resources. This, in turn, will create employment and business opportunities for all northerners as well as southern Canadians.

Canada's North is rich in petroleum resources, holding about one-quarter of Canada's remaining discovered petroleum reserves and approximately one-half of our potential petroleum resources. Norman Wells, for example, is one of the largest producing oil pools in Canada. Furthermore, as a result of claims settlements, northern resource-rich lands previously closed to exploration and development are being opened for licensing for the benefit of all Canadians, especially northerners.

Canada is standing on the threshold of this new era and I am ready to meet the challenges that we are facing. I look forward to working with all the partners — Aboriginal people, northerners, the territorial governments and industry. *Together we are the future of the North.*



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Canada's Northern Frontier Lands



Overview of Northern Oil and Gas Activities

The potential of the Canadian frontier North of 60° is evident. Oil and gas resources in the North are equal to conventional oil and gas resources in western Canada. A study released this year by the National Energy Board (NEB) indicates that there is more proven oil and natural gas in the Mackenzie Valley and Yukon than originally estimated. Industry's view of the energy potential of the North is apparent from the approximately one thousand wells already drilled in the mainland, Mackenzie Delta and Beaufort Sea, and the Arctic Archipelago. Norman Wells is one of the largest producing oil fields in Canada; the Mackenzie Delta and Beaufort Sea, one of the richest basins in the world.

The potential of the North has yet to be realized. External events have curtailed the level and pace of oil and gas exploration and development in the last two decades, particularly in the mainland. The withdrawal of lands from disposition pending land claim settlements and, more recently, the sharp decline in crude oil prices, the global recession and the shortage of investment capital, have significantly affected the oil and gas industry's efforts in the North.

Canadians are making efforts in the 1990s to create a more favourable climate for oil and gas exploration and development in the North.

Land claim settlements are establishing respective ownership of the land and its mineral resources. The Inuvialuit have settled their claim in the Mackenzie Delta and Beaufort Sea, the Gwich'in have settled their claim in the lower Mackenzie Valley, and the Inuit of Nunavut have settled their claim in the Eastern Arctic. Settlement of the Sahtu claim in the central Mackenzie Valley is pending.

The inventory of Crown lands available for disposition is increasing. Since the settlement of the Western Arctic Inuvialuit land claim there have been yearly calls for nomination in the Mackenzie Delta and Beaufort Sea area. A similar process is being established for the lower Mackenzie Valley.

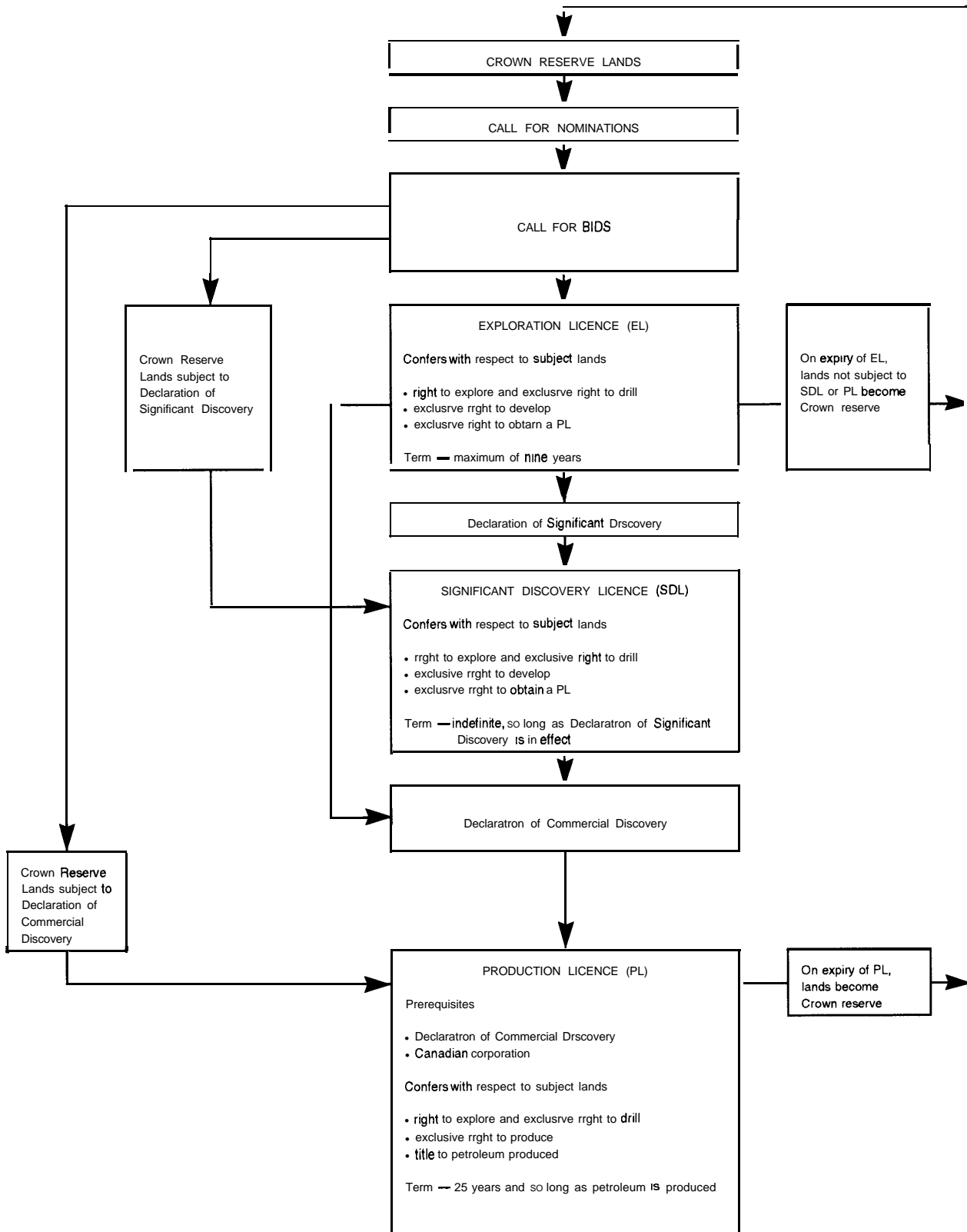
Rights disposition is predictable and transparent. The process for issuing new oil and gas exploration rights through calls for nominations and calls for bids has been regularized. Regulatory certainty allows industry to develop long-term investment plans for oil and gas exploration programs.

A more favourable investment climate has been created with promulgation of the *Canadian Ownership Requirement Repeal Act*, which removes the 50 per cent Canadian ownership requirement for frontier production licences. Consequently, sources of capital will be more readily available from foreign investors for exploration and development in the northern frontier.

Certainty for resource management in the Yukon Territory is established with the Canada-Yukon Oil and Gas Accord, signed in May 1993. Once implemented, the accord will devolve legislative authority and control over onshore oil and gas to the Yukon Government. The accord will also provide for a commitment to shared management of oil and gas resources in the Beaufort Sea.

Industry did not make a significant investment in the North in 1993. Eight previously suspended wells were abandoned: one in the mainland and seven in the Arctic Islands. Two geological programs were conducted: one in the Yukon and one in the Arctic Islands. Two geophysical programs were carried out: one at Cameron Hills and one in the Mackenzie Delta. Oil production continued at Norman Wells and gas production continued at Kotaneelee and Pointed Mountain. Panarctic continued to ship oil from Bent Horn in the Arctic Islands.

Resource Management Regime under the *Canada Petroleum Resources Act*



Oil and Gas Management

Canadian Crown lands North of 60° are richly endowed with oil and natural gas. Prudent management of these petroleum resources is an economic, social and environmental responsibility. The *Canada Petroleum Resources Act* provides the administrative framework for managing northern oil and gas resources and includes a process for granting rights to search for, develop and produce oil and gas and for setting and collecting royalties. The *Canada Oil and Gas Operations Act* provides the regulatory framework for the exploration, development and production of oil and gas resources. The act includes measures to ensure conservation of resources, protection of the environment and worker safety.

Rights Issuance

New exploration rights are issued to industry under a simple system based on a competitive bidding process. The single criterion used to assess winning bidders is usually the total cost of work proposed to be carried out.

Three types of licences are issued under the *Canada Petroleum Resources Act*. An **exploration licence** grants industry the exclusive right to explore a specific parcel of land for oil and gas for a limited period of time. If a significant accumulation of hydrocarbons is discovered, the interest holder has a right to a **significant discovery licence**. This licence confers the exclusive right to further explore a significant discovery area for an indefinite period of time. If the economic and technical conditions favour commercial production, a **production licence** allows the rights holder to produce oil and gas.

A Call for Nominations in the Mackenzie Delta and Beaufort Sea area, which opened in January 1993, failed to attract any nominations. No exploration or production licences were issued for northern areas in 1993. Two significant discovery licences were issued in the Beaufort Sea.

Consultation

The rights issuance process is carried out in consultation with the governments of the Northwest Territories and Yukon and in accordance with applicable terms of Aboriginal land claim settlements. For example, to prepare for the 1993 Call for Nominations, the Northern Oil and Gas Directorate consulted with the following agencies to set terms and conditions relating to the call:

- Northwest Territories departments of Energy, Mines and Petroleum Resources, and Renewable Resources, and Yukon departments of Economic Development, Mines and Small Business, and Renewable Resources;
- the Inuvialuit Game Council, which represents the collective Inuvialuit interest on such issues as wildlife management, conservation and environmental protection;

- the Hunters and Trappers committees of Inuvik, Aklavik and Tuktoyaktuk; and
- Fisheries and Oceans, Environment Canada, Foreign Affairs and International Trade, and the NEB.

Resource Evaluation

The criteria for proposed rights issuance are based on studies of the geological, operational, developmental and economic factors that may affect the risk of exploration in a given area. These studies include the following:

- a review of exploration maturity and other available information;
- a geological overview of exploration play distribution and potential; and
- the identification of operational constraints and access to markets.

A review of areas that may be included in future calls for nominations is carried out with the assistance of staff of the NEB.

Allowable expenditures for exploration were reviewed in 1992 to define up-to-date terms for new exploration licences. The 1993 Call for Nominations included modifications to allowable expenditures for seismic operations.

The NEB completed a study this year that provides a more comprehensive picture of recoverable oil and gas resources in areas of significant discovery. This study indicates there is more proven oil and natural gas in the southern Northwest Territories, Mackenzie Valley and Yukon than previously estimated. These proven resources will make a significant contribution to Canada's energy supply.

To date, a total of 30 significant discoveries of oil and gas have been identified in the sedimentary basins of the Northwest Territories and the Yukon Territory between latitudes 60° and 68°. Three of these discoveries have been developed and are currently being produced: the Pointed Mountain and Kotaneelee gas fields in the Liard Plateau and the Norman Wells oil field.

Rights Administration

About 7.5 million hectares of Crown land in the Mackenzie Delta and Beaufort Sea were incorporated in the 1993 Call for Nominations.

The settlement of the Gwich'in land claim will make new acreage available for disposition in the Mackenzie Valley. The pending settlement of the Sahtu claim will increase the acreage available for disposition in the mainland. Each additional land claim settlement will increase the quantity of land available for new rights issuance.

To date, 113 significant discovery licences have been issued in the North:

Mainland Territories	30
Mackenzie Delta	33
Beaufort Sea	29
Arctic Islands	20
Eastern Arctic Offshore	1

Five production licences have been issued to date. One licence — for Bent Horn on Cameron Island — produces oil regularly. Four licences — one in the Beaufort Sea and three in the southern Mainland Territories — accommodate production for test purposes.

Oil and gas leases issued under the Canada Oil and Gas Land Regulations are still held for Pointed Mountain and Kotaneelee, two gas-producing fields in the Liard Plateau — nine leases in the Pointed Mountain field in the southern Northwest Territories and five in the Kotaneelee field in the Yukon.

The Norman Wells oil field continues to produce oil and gas under a Proven Area Agreement.

Land Status at Year End, 1993

Region	Active licences*	Lands relinquished or surrendered (millions of ha)	Lands issued in licences (millions of ha)	Lands active (millions of ha)	Pending lands[†] (millions of ha)
Mainland Territories	53	0	0 [†]	0.2	0.5
Mackenzie Delta and Beaufort Sea	75	0	0 [†]	1.1	0
Arctic Islands and Eastern Arctic Offshore	23	0	0	1.3	2.5
Total	151	0	0[†]	2.6	3.0

* Includes exploration, significant discovery and production licences.

[†] Less than 0.1.

[‡] Includes areas such as Cape Bathurst and Baffin Bay.

Land Holdings at Year End, 1993

	1989	1990	1991	1992	1993
Number of licences active*	111	132	147	149	151
Lands issued in licences (millions of ha)	0.2	0.1	0.3	0 [†]	0
Lands relinquished or surrendered (millions of ha)	2.0	1.1	1.3	0.2	0
Lands active (millions of ha)	4.7	3.8	2.7	2.6	2.6

* Includes exploration, significant discovery and production licences.

[†] Less than 0.1.

Gross Oil and Gas Revenues Received in 1993 (in dollars)

	Issuance fees	Rentals	Registration fees	Royalties	Total
January	0.00	0.00	0.00	532 694.95	532 694.95
February	0.00	293.33	225.00	655 541.01	656 059.34
March	0.00	105.90	10.75	562 836.26	562 952.91
April	0.00	0.00	0.00	636 908.55	636 908.55
May	0.00	0.00	325.00	632 510.58	632 835.58
June	0.00	23 916.00	0.00	683 984.41	707 900.41
July	0.00	0.00	0.00	714 139.73	714 139.73
August	0.00	0.00	0.00	568 904.49	568 904.49
September	0.00	1 440.00	0.00	723 388.12	724 828.12
October	0.00	0.00	325.00	596 859.35	597184.35
November	0.00	0.00	0.00	561 021.91	561 021.91
December	0.00	0.00	0.00	207 073.09	207 073.09
Total	0.00	25 755.23	005.75	7 075 862.45	7 102 503.43

Active Northern Exploration Licences

EL317

Representative: Pembina
Effective date: 5 October 1986
Expiry date : n/a
Status: Under work prohibition order
Area: 175 810 ha

EL329

Representative: Amoco
Effective date: 5 September 1987
Expiry date : n/a
Status: Under work prohibition order
Area: 349 982 ha

EL343

Representative: Imperial Oil
Effective date: 1 June 1987
Expiry date: n/a
Status: Maintained under application for SDA
Area: 5 094 ha

EL344

Representative: Imperial Oil
Effective date: 1 June 1987
Expiry date: n/a
Status: Maintained under application for SDA
Area: 7 787 ha

EL355

Representative: Imperial Oil
Effective date: 1 August 1990
Expiry date: 31 July 1998
Status: One well to be drilled before 1 August 1994
Work expenditure bid: \$1 500 031
Area: 15 351 ha

EL356

Representative: Imperial Oil
Effective date: 1 August 1990
Expiry date: 31 July 1998
Status: One well to be drilled before 1 August 1994
Work expenditure bid: \$1 500 032
Area: **30 331 ha**

Active Northern Exploration Licences (continued)

EL358

Representative: Chevron
Effective date: 16 December 1991
Expiry date: 15 December 2000
Status: One well to be drilled before 16 December 1996
Work expenditure bid: \$3 200 000
Area: 140 088 ha

EL359

Representative: Shell
Effective date: 16 December 1991
Expiry date : 15 December 1999
Status: One well to be drilled before 16 December 1995
Work expenditure bid: \$1 555 880
Area: 37 322 ha

EL360

Representative: Shell
Effective date: 16 December 1991
Expiry date: 15 December 1999
Status: One well to be drilled before 16 December 1995
Work expenditure bid: \$6 556 728
Area: 36 765 ha

EL361

Representative: Shell
Effective date: 16 December 1991
Expiry date: 15 December 1999
Status: Drilling commitment fulfilled
Work expenditure bid: \$45 223 000
Area: 36 756 ha

Employment and Industrial Benefits

The provision of full and fair opportunities for Canadians to supply goods and services used in northern oil and gas activities is specifically defined in oil and gas legislation. When exploration and development are undertaken in northern Canada, the proponent must ensure full and fair access to employment, training and business opportunities for northerners.

Although activity remained low in 1993, about \$31 million was invested in the North in exploration, production and development activities. This expenditure resulted in about 124 person-years of employment in the North, and about 217 person-years of employment elsewhere, primarily in western Canada.

With the settlement of land claims in the North and a high level of industry activity in northern British Columbia, a positive environment is being established for the future of the petroleum industry in the North. The opening of new areas to exploration should lead to greater employment and business opportunities. Together with the territorial governments, the Department of Indian Affairs and Northern Development will continue to encourage equal opportunities that arise from exploration.

Expenditures and Employment Related to Petroleum Activity in Northern Canada, 1993

Estimated direct expenditures (in millions of dollars)			
Mainland Territories			27.8
Mackenzie Delta and Beaufort Sea			2.8
Arctic Islands and Eastern Arctic Offshore			0.4
Total direct expenditure			31.0
Estimated direct and indirect employment[†] (person-years of work)			
	Northern Canada	Southern Canada	Total
Mainland Territories	111.2	194.6	305.8
Mackenzie Delta and Beaufort Sea	11.2	19.6	30.8
Arctic Islands and Eastern Arctic Offshore	1.4	2.8	4.2
Total direct and indirect employment	123.8	217.0	340.8

* Compiled from Canada Benefits Review submissions.

† Based on four person-years in northern Canada and seven person-years in southern Canada, per million dollars of total expenditure.

Exploration

Two geophysical programs and two geological programs were carried out in the North in 1993. No wells were drilled.

Mainland Territories

No wells were drilled in the Mainland Territories during 1993. One geophysical program and one geological program were carried out on the mainland. Paramount Resources Limited conducted a three-dimensional seismic program at Cameron Hills in preparation for further delineation drilling. Unocal conducted a geological program in the Yukon.

Mackenzie Delta and Beaufort Sea

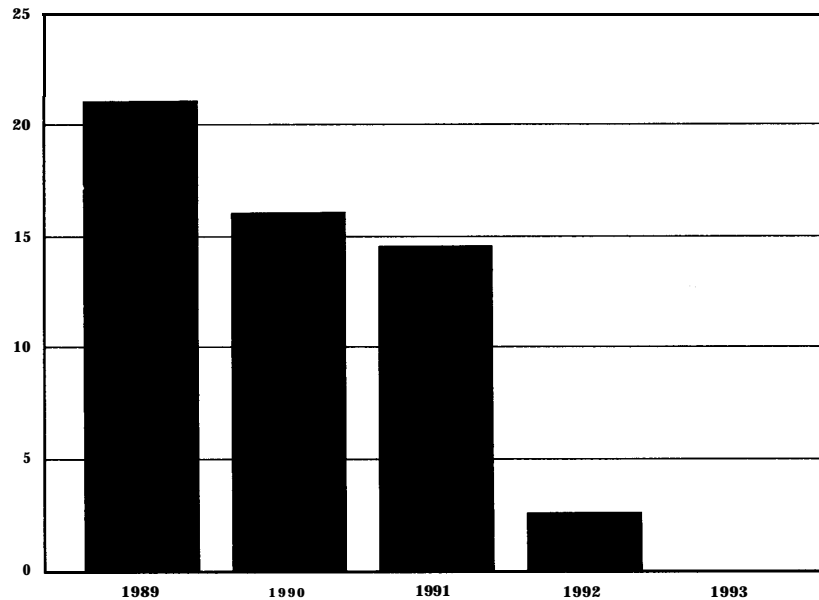
No wells were drilled in the Mackenzie Delta and Beaufort Sea this year. Shell undertook a two-dimensional seismic program in the Mackenzie Delta.

Arctic Islands

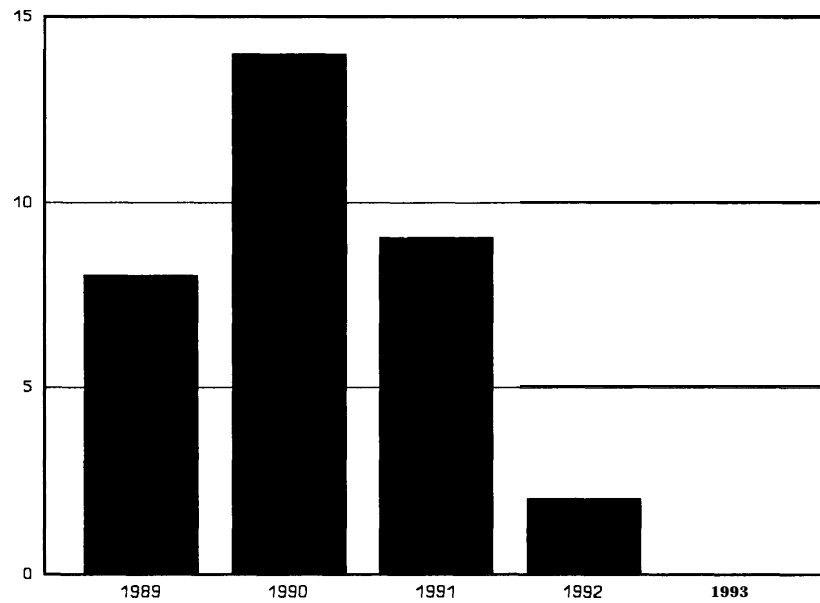
No wells were drilled in the High Arctic in 1993. Unocal conducted a geological program in the Arctic Islands.

Exploratory and Delineation Drilling in Northern Canada

Thousands of metres

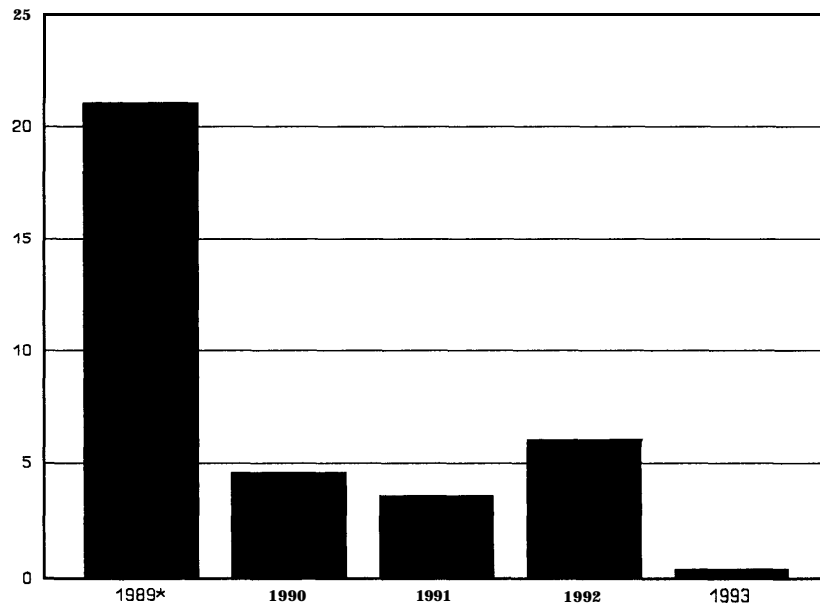


Number of Wells Terminated in Northern Canada



Reflection Seismic Shot in Northern Canada

Thousands of kilometres



*Includes three-dimensional seismic equivalent.

Development and Production

In 1993 there was a nominal decrease in oil production from Norman Wells and an increase in oil production at Bent Horn. Gas production at Kotaneelee decreased by 2.9 per cent, while gas production at Pointed Mountain increased by 14.9 per cent.

Mainland Territories

Workovers were carried out at five wells in the mainland. Four wells, in Cameron Hills, were suspended and approval was given to abandon the fifth well, NSM Arrowhead G-69.

Norman Wells

The Norman Wells field in the Northwest Territories is one of the largest oil fields in Canada, with estimated recoverable reserves of 37.5 million cubic metres. Approximately 52 per cent of these recoverable reserves has been produced. Production is expected to continue for at least the next 16 years.

In 1993, the volume of oil produced from the Norman Wells field was 1.79 million cubic metres, a decrease of 3.2 per cent from 1992. Production peaked in August with an average daily production rate of 5 386.9 cubic metres. Cumulative oil production to the end of 1993 was 19.5 million cubic metres. The volume of gas produced increased slightly from 128 million cubic metres in 1992 to 133.6 million cubic metres in 1993.

At the end of the year, there were 168 production wells and 156 injection wells (150 water injected, 6 propane injected) and 3 observation wells in the Norman Wells field.

The Norman Wells Expansion project, initiated in 1983, and the Interprovincial Pipeline NW were the first major hydrocarbon development and transportation projects in the North. The federal government holds a one-third interest in Norman Wells; Imperial Oil Limited holds the remaining two-thirds interest.

In 1992, Imperial Oil received approval to amend the Norman Wells Development Plan to include a three-year hydrocarbon miscible flood project. The project to assess the technical merits of hydrocarbon miscible flooding in the Norman Wells pool will use propane as the flooding medium. Imperial Oil started up the project in February 1993. The company also applied to drill seven injector wells and five producing wells in 1993-94. The drilling program is under review.

Imperial Oil was authorized to carry out further projects at a cost of \$5.6 million. These projects include tying in two propane injector wells, upgrading the propane injection system, improving the injection water quality and carrying out a pipe stress reduction program.

Oil and Gas Discoveries

Southern Territories

Well no.	Well name	Well no.	Well name
	Briggs Rabbit Lake No. 1	13	Pacific Amoco Tathlina N-I 8
2	Home Signal CSP Celibeta No. 2	14	Paramount et al Cameron Hills M-31
3	Sun Netla C-07	15	Paramount et al Cameron J-62
4	Canada Southern et al N. Beaver River YT I-27	16	NSM Arrowhead G-69
5	HB Pan Am S. Island R. M-41	17	EXCO et al Cameron I-16
6	Union Pan Am Trainor Lake C-39	18	Paramount et al Cameron C-50
7	Texaco Bovie Lake J-72	19	Northcor et al Liard F-25A
8	Pan Am Pointed Mountain P-53	20	Shell et al Arrowhead B-41
9	HB Cameron Hills A-05	21	Paramount et al Cameron L-47
10	Pan Am Beaver River YT G-01	22	Paramount et al Cameron A-68
11	HB Cameron Hills F-51	23	Paramount et al Swede A-73
12	CPOG et al Labiche F-08		

Mackenzie Delta and Beaufort Sea

Well no.	Well name	Well no.	Well name
	IOE Atkinson H-25	29	Dome Koakoak O-22
2	IOE Taglu G-33	30	Esso Gulf Issungnak O-61
3	IOE Mayogiak J-17	31	Esso Pex W. Atkinson L-17
4	Gulf Mobil Parsons F-09	32	Gulf et al Kiggavik A-43
5	Imp IOE Mallik L-38	33	Esso Pex Home et al Itiyok I-27
6	Imp Ivik J-26	34	Dome et al Havik B-41
7	Gulf Imp Shell Titalik K-26	35	Gulf et al Pitsiulak A-05
8	Shell Niglintgak H-30	36	Esso Home et al Kadluk O-07
9	Gulf Mobil Ya Ya P-53	37	Gulf et al Amauligak J-44
10	Gulf Imp Shell Reindeer C-36	38	Esso PCI Home et al Tuk L-09
11	Shell Kugpiq O-I 3	39	Esso et al Nipterk L-19
12	Imp Ivik K-54	40	Esso et al Tuk J-29
13	Shell Kumak J-06	41	Dome et al Adlartok P-09
14	Imp Adgo F-28	42	Esso Home PCI et al Amerk O-09
15	Gulf Mobil Ya Ya A-28	43	Esso PCI Home et al Minuk I-53
16	Sun BVX et al Pelly B-35	44	Gulf et al Amauligak 1-65A
17	Dome Imp Imnak J-29	45	Esso PCI Home et al Hansen G-07
18	Sun SOBC BVX et al Garry P-04	46	Gulf et al Ikhil K-35
19	Imp Netserk F-40	47	Esso PCI Home et al Arnak K-06
20	Gulf Mobil Kamik D-48	48	Shell et al Unak L-28
21	Dome Hunt Nektoralik K-59	49	Gulf et al Amauligak O-86
22	Hunt Dome Kopanoar M-13	50	Esso et al Nipterk P-32
23	Dome Gulf et al Ukalerk C-50	51	Amoco et al Kingark J-54
24	Dome Nerklerek M-98	52	Esso Chevron et al Isserk I-15
25	Imp IOE et al Isserk E-27	53	Shell Unipkat N-12
26	Sun CCL BVX et al Garry G-07		
27	Dome Gulf Tarsiut A-25		
28	Dome et al Hunt Kenaloak J-94		

Arctic Islands

Well no.	Well name
	Panarctic Drake Point N-67
2	Panarctic King Christian D-I 8
3	Panarctic et al Kristoffer Bay B-06
4	Panarctic et al Thor P-38
5	Dome et al Wallis K-62
6	Panarctic et al Hecla I-69
7	Panarctic et al Bent Horn N-72
8	Panarctic Tenn Sun Dome Jackson 2G-16
9	Panarctic et al Roche Pt O-43
10	Panarctic AIEG Whitefish H-63
11	Panarctic et al Char G-07
12	Panarctic et al Balaena D-58
13	Panarctic AIEG PPC Dome Skate B-80
14	Panarctic AIEG PPC Dome Maclean I-72
15	Panarctic AIEG PRC PPC Cisco B-66
16	Panarctic et al Sculpin K-08
17	Panarctic et al Cape Macmillan 2K-15
18	Panarctic Cape Allison C-47

Central Mainland and Eastern Arctic Offshore

Well no.	Well name
	Northwest Discovery No.1
2	Western Minerals Chance YT M-08
3	Socony Mobil W.M. Blackie No.1 YT M-59
4	Socony Mobil W.M. Birch YT B-34
5	Panarctic Romulus C-42
6	Ashland et al Tedji Lake K-24
7	Aquitaine et al Hekja O-71
8	PCI et al Tweed Lake M-47
9	PCI Canterra Bele O-35

In December 1992, a fire destroyed the building at the Norman Wells Refinery that processes aviation and jet fuel and gas for communities in the Mackenzie Delta and the Western Arctic. The building was reopened in May 1993.

Pointed Mountain

Production increased this year at the Pointed Mountain gas field in the Northwest Territories, near the Yukon border. The field produced 99.6 million cubic metres of gas in 1993. Compared with the 86.7 million cubic metres in 1992, this was an increase of 14.9 per cent. Cumulative production to the end of 1993 was 8.59 billion cubic metres.

Cameron Hills

Paramount Resources Limited received approval in 1993 to extend Phase One of its development plan for extended production testing over a three-year period, and to reschedule its three-dimensional seismic program. The three-well extended production testing program and the three-dimensional seismic program were completed in 1993. Following analysis of the data from these programs, Paramount submitted a new drilling program application to drill two vertical wells and one horizontal well in the winter of 1994.

Kotaneelee

Production at the Kotaneelee gas field in 1993 was 492.3 million cubic metres, compared with 506.9 million cubic metres in 1992, a decrease of 2.9 per cent. Cumulative production to the end of 1993 was 1 272 million cubic metres.

Mackenzie Delta

In 1989, Esso, Shell and Gulf received approval to ship about 260 billion cubic metres of gas from the Mackenzie Delta to the United States, over a 20-year period beginning in 1996. An environmental screening held by the NEB in 1992 has determined that there are no potential adverse effects associated with the export licence. However, the project has been suspended for now. Before the export of gas from the Mackenzie Delta, all of the facilities related to the development, production and transmission of natural gas will be subject to a review by regulatory authorities, including examination of related environmental and social impacts.

Arctic Islands

Workovers were carried out on seven suspended wells in the Arctic Islands. Approval was given to abandon all seven wells.

Bent Horn

Panarctic continued production and seasonal shipping from Bent Horn, the world's northernmost oil field. Two shipments of crude oil were made from Cameron Island. The tanker *M.V. Arctic* sailed from Cameron Island in August 1993 with a shipment of 24 400 cubic metres of oil, and in September 1993 with 23 804 cubic metres of oil. In 1993, 56 866.8 cubic metres of oil were

produced. Cumulative oil production to the end of the year totalled 321 470 cubic metres. Currently, 8 666.8 cubic metres of oil are in storage at the Bent Horn facility.

In 1992 Panarctic received approval to transport oil by truck from Bent Horn to Rea Point via an ice road. Arctic conditions, however, did not favour building an ice road in 1993. Panarctic has no plans to pursue this transportation option in 1994.

Panarctic submitted an amendment to the Bent Horn Development Plan to replace 48 storage bladders with a new steel storage tank having a capacity of 40 300 cubic metres. With favourable ice conditions, the *M.V. Arctic* or an equivalent type of tanker would be used as a shuttle to transfer multiple loads of oil to a larger vessel stationed in open water. Panarctic's proposal is still under review .

Protection of the Environment

Environmental Measures

Beaufort Sea Steering Committee

The Beaufort Sea Steering Committee (BSSC) presented its final report to the Minister in 1991. The report addressed the concerns identified by the Inuvialuit Environmental Impact Review Board regarding oil spill preparedness. Substantial progress has been made since 1991 to implement the recommendations of the BSSC.

An implementation plan was developed that identified appropriate government departments, Aboriginal organizations and industry groups responsible for implementing the committee's recommendations. Scientific workshops have successfully addressed the routine aspects of oil and gas development. An up-to-date computerized atlas that identifies sensitive ecosystems and coastal features in offshore exploration areas has been completed. Potential oily waste disposal sites in the vicinity of the Beaufort coast have been identified. A report of these sites will be available for use in case of an oil spill. Future workshops will be held with Aboriginal organizations, industry and government to track the progress of specific recommendations in the BSSC report and to identify future areas of concern. The recommendation for a government-industry-Inuvialuit coordinated exercise to respond to a mock oil spill must wait until drilling activity resumes in the Beaufort Sea.

Northern Oil and Gas Action Program

The Northern Oil and Gas Action Program (NOGAP) is a multi-disciplinary research and planning program established in 1984 to advance the federal government's ability to respond to future northern hydrocarbon development proposals. In its final year of operation, NOGAP continued to support studies that respond to the specific research and monitoring recommendations of the BSSC.

Beaufort Region Environmental Assessment and Monitoring

The Beaufort Region Environmental Assessment and Monitoring (BREAM) program is a NOGAP-funded initiative that identifies the most important research and the monitoring priorities related to future hydrocarbon development in the Beaufort Sea, Mackenzie Delta and Mackenzie Valley. BREAM will also be phased out at the end of this year.

The BREAM program will conclude by preparing a final report and an annotated guide. The report will focus on research and monitoring recommendations of BREAM, as well as of the Beaufort Environmental Monitoring Program and the Mackenzie Environmental Monitoring Program. The annotated guide will include the final reports of the series from these two programs and BREAM.

Arctic Seas Strategic Plan

The Arctic Seas Strategic Plan, developed under the auspices of the Green Plan, outlines the responsibilities of government in responding to spills in northern Canadian waters. The plan is being reviewed and rewritten.

The federal government and the government of the Northwest Territories are developing a framework for responding to environmental emergencies, outlined in *Emergency Response Framework for Government of Northwest Territories Services and Support to Lead Agencies in the Event of an Environmental Emergency in the Northwest Territories*.

Environmental Reviews

Environmental assessments were carried out on the Norman Wells Development Drilling Program, the Cameron Hills Oil Development Plan Amendment and Development Drilling Program and the well abandonment program on Melville and Lougheed islands. Four geological programs were also evaluated.

Environmental Studies Research Fund

The Environmental Studies Research Fund, under the *Canada Petroleum Resources Act*, funds environmental and social studies related to the exploration and development of oil and gas resources on frontier lands. The focus is on studies that provide information required for regional or national regulatory decision making.

Board members represent federal government departments, regional petroleum boards, petroleum industry organizations and the general public.

The program is funded from levies on interest holdings on frontier lands. In 1993, the budget for administering the fund was \$180 000. The program did not support any new studies in 1993. It is completing some 28 studies initiated over the last three years. These ongoing studies will be completed and published by the end of the 1994 calendar year. No new studies are proposed for 1994.

Ongoing studies related to northern concerns include the following:

- **Beluga Telemetry Field Program** — documents the position, dive profile and behaviour of live captured and released belugas in the southern Beaufort Sea, using satellite tracking and aircraft or marine vessel ground tracking.
- **Mackenzie Delta Permafrost and Geology Transect Study** — an integrated geoscience study of a transect of geophysical data and geotechnical boreholes at three sites along the Mackenzie Delta to document the geological, geothermal and geotechnical conditions of perennially frozen sediments.
- **Environmental Loading Studies, Canadian Standards Association Offshore Structures Code** — a study to resolve issues related to the specifications for combined environmental loading in the new Canadian Standards Association offshore platform code.

- **Bibliography on Oil Pollution Fate and Effects** — development of a computerized up-to-date bibliography of all accessible scientific literature on the way oil behaves in aquatic systems.

A published report is available for each study funded by the program. The study series currently has 106 titles in print.

Program on Energy Research and Development

The Program on Energy Research and Development (PERD) funds energy research and development directed to economic growth, industrial development, productivity and improved environmental quality. In 1993, PERD was allocated \$1.6 million to promote research and development initiatives. Two specific research programs pertaining to northern frontier exploration and development were:

- continuing pressure-ridge ice-scour experiments to assess risks of ice scouring to offshore pipelines; and
- a Canadian offshore testing program of the differential global positioning system.

PERD also undertakes and promotes research to enhance the safety of personnel, protection of the environment and improved reliability of pipelines for offshore oil and gas operations.

Acts and Regulations

The Canadian Ownership Requirement Repeal Act was proclaimed 30 June 1993.

Highlights of the act are as follows:

- elimination of the minimum 50 per cent Canadian ownership requirement for the issuance of frontier oil and gas production licences;
- elimination of ministerial review and approval of transfers of ownership in a frontier oil and gas production licence or share therein; and
- repeal of the provision that allowed individuals to hold production licences, and the related Canadian residency requirements for such individuals.

Regulatory Initiatives in 1993*

Canada Oil and Gas Geophysical Regulations	to regulate all geophysical operations on federal lands
Canada Oil and Gas Drilling Regulations — amendment	to reflect the Certificate of Fitness requirements and update provisions relating to authorization of drilling activity
Canada Oil and Gas Installation Regulations — amendment	to establish performance criteria for the various components of a superstructure to ensure that operations are carried out in a safe environment
Canada Certificate of Fitness Regulations	to define which companies can issue certificates of fitness and prescribe required criteria
Canada Oil and Gas Production and Conservation Regulations — amendment	to reference the Certificate of Fitness requirements
Frontier Lands Petroleum Land Division and Survey Regulations	to reflect more accurate methods of surveying brought about by new survey systems
Canada Oil and Gas Diving Regulations — amendments	to reference the Certificate of Fitness requirements as part of the approval process and transfer technical and administrative decisions from the Minister to a designated official
Frontier Land Registration Regulations — amendment	to ensure that the English and French versions of the regulations are equivalent
Canada Oil and Gas Operations Regulations — amendment	to increase the fee associated with obtaining an operating licence
Canada Oil and Gas Spill and Debris Liability Regulations — amendment	to review the applicability of absolute liability and the associated limits of liability that may be prescribed under the <i>Canada Oil and Gas Operations Act</i>
Canada Oil and Gas Land Regulations	to revoke redundant provisions of the current regulations
Environmental Studies Research Fund Regulations — amendment	to redefine some of the 31 regions presently defined in the regulations and exclude Georges Bank and the settled international boundary from Environmental Studies Research Fund levies
Offshore Installation Manager Regulations	to define the qualification requirements for an installation manager
Drake Point F-16 Royalty Regulations	to revoke the regulations

* Initiatives being carried forward into 1994.

Statistical Summary^a

Activity Status

	1989	1990	1991	1992	1993
Licences issued (exploration, significant discovery, production)	7	4	24	5	2
Wells spudded	11	12	9	2	0
Metres drilled	21 138	15811	15325	2 560	0
Wells terminated	8	14	9	2	0
Geophysical programs run	19	8	6	4	2
Reflection seismic (km)	21 083	4 552	3 641	5 822	340
Rig-months	14	12	12	2	0

Discovered Resource Inventory, 1993*

	Crude oil [†] (millions of m ³)	Natural gas (billions of m ³)
Mainland Territories	39.4	34.6
Mackenzie Delta and Beaufort Sea	240.0	359.5
Arctic Islands and Eastern Arctic Offshore	65.7	416.4
Total	345.1	810.5

* Discovered resource totals are estimates of original recoverable volumes and do not reflect production (totals have been rounded).

[†] Includes condensate.

Oil and Gas Production

	1989	1990	1991	1992	1993
Oil production (thousands of m ³)					
Norman Wells	1 789.0	1 841.0	1 894.0	1 850.0	1 790.0
Bent Horn	43.4	24.0	32.6	28.2	56.9
Total	1 832.4	1 865.0	1 926.6	1 878.2	1 846.9
Gas production (millions of m ³)					
Pointed Mountain	96.0	74.0	90.0	86.7	99.6
Norman Wells	129.0	126.0	130.0	128.0	133.6
Kotaneleelee	0	0	227.2	506.9	492.3
Total	225.0	200.0	447.2	721.6	725.5

^a Exploration, development, production and resource inventory statistics courtesy of the National Energy Board. Resource estimates are expressed as best current estimates.

Mainland Territories

Activity Status

	1989	1990	1991	1992	1993
Wells spudded					
Exploratory/delineation	6	11	7	0	0
Development	0	0	1	0	0
Total	6	11	8	0	0
Wells terminated*					
Exploratory/delineation	4	12	7	0	0
Development	0	0	1	0	0
Total	4	12	8	0	0
Metres drilled	9 865	14 197	12 152	0	0
Exploratory/delineation	9 865	14 197	11 517	0	0
Development	0	0	636	0	0
Rigs active	5	6	5	0	0
Rig-mont hs	5	10	10	0	0
Geophysical programs run	9	2	5	1	1
Reflection seismic (km)	1 600	181	321 [†]	1 867 [†]	55
Money spent (millions of dollars)					
Geophysical/geological	12.6	2.8	2.5	1.1	0.52
Exploratory/delineation/workovers [‡]	11.5	26.3	18.8	7.7	4.93
Development drilling	0	0	3.7	0	0
Production facilities	0	0	0	8.6	5.6
Total money spent (millions of dollars)	24.1	29.1	25.0	17.4	11.05

* In the Mainland Territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be re-entered in the following year for testing.

[†] Includes three-dimensional seismic equivalent.

[‡] Includes extended production tests.

Resource Status

	1989	1990	1991	1992	1993
Discovered resources*					
Gas (billions of m ³)	21.8	35.5	22.7	22.7	34.6
Oil (millions of m ³)	37.7	37.7	39.1	39.1	39.4
Gas and oil production					
Pointed Mountain gas (millions of m ³)	96	74	90	86.7	99.6
Norman Wells gas (millions of m ³)	129	126	130	128	133.6
Norman Wells oil (thousands of m ³)	1 709	1 841	1 894	1 850	1 790
Kotaneeleegash (millions of m ³)	0	0	227.2	506.9	492.3

* Includes new discoveries and revisions to previous estimates.

Land Status

	1989	1990	1991	1992	1993
Licences issued (exploration, significant discovery, production)	0	1	12	2	0
Active licences	25	45	51	53	53
Lands issued in licences (millions of ha)	0	0	0*	0*	0
Lands relinquished or surrendered (millions of ha)	0.4	0.4	0.5	0*	0
Lands active (millions of ha)	0.9	0.6	0.2	0.2	0.2

* Less than 0.1.

Well Workover Operations, 1993

Well name	Location (latitude, longitude)	Date Terminated	Status	Total Depth (m)
Paramount et al Cameron M-73	60°02'52"N 117°27'32"W	93-03-27	suspended	1 657
Paramount et al Cameron C-1 9	60°08'07"N 117°33'08"W	93-03-27	suspended	1 673
Paramount et al Cameron L-47	60°06'32"N 117°39'19"W	93-03-27	suspended	1 565
Paramount et al Cameron N-28	60°07'59"N 117°35'08"W	93-03-03	suspended	1 592
NSM Arrowhead G-69	60°38'24"N 122°57'03"W	93-03- 15	abandoned	2 502

Mackenzie Delta and Beaufort Sea

Activity Status

	1989	1990	1991	1992	1993
Wells spudded					
Exploratory/delineation	5		1	2	0
Wells terminated"					
Exploratory/delineation	4	2	1	2	0
Metres drilled					
Exploratory/delineation	11 273	1 614	3 173	2 560	0
Rigs active	4	2	1	1	0
Rig-months	9	2	2	2	0
Geophysical programs run	10	6	1	3	1
Reflection seismic (km)	19 483 [†]	4 371 [†]	3 320	3 955 [†]	285
Money spent (millions of dollars)					
Geophysical/geological	36.6	16.6	4.2	8.8	3.96
Exploratory/delineation/workovers	196.6	18.9	4.9	10.1	0
Total money spent (millions of dollars)	233.2	35.5	9.1	18.9	3.96

* In the Beaufort Sea, where operations are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.

† Includes three-dimensional seismic equivalent.

Resource Status

	1989	1990	1991	1992	1993
Discovered resources*					
Gas (billions of m ³)	322.7	356.6	357.0	356.0	359.5
Oil (millions of m ³)	256.4	240.7	241.4	228.0	240.0

* Includes new discoveries and revisions to previous estimates.

Land Status

	1989	1990	1991	1992	1993
Licences issued (exploration, significant discovery, production)	7	3	12	3	2
Active licences	62	64	73	73	73
Lands issued in licences (millions of ha)	0.2	0.1	0.3	0*	0*
Lands relinquished or surrendered (millions of ha)	1.4	0.7	0.8	0.2	0*
Lands active (millions of ha)	2.5	1.9	1.2	1.1	1.1

* Less than 0.1.

Arctic Islands and Eastern Arctic Offshore

*Activity Status**

	1989	1990	1991	1992	1993
Money spent (millions of dollars)					
Geophysical/geological	0	0	0	0	0.4
Exploratory/delineation/workovers	0	0	2.7	4.2	n/a [†]
Production facilities	0	0	0	0.2	0
Total money spent (millions of dollars)	0	0	2.7	4.4	n/a

* No drilling or geophysical activity to report since 1989.

[†] n/a: not available.

Resource Status

	1989	1990	1991	1992	1993
Discovered resources*					
Gas (billions of m ³)	416.4	416.4	416.4	416.4	416.4
Oil (millions of m ³)	65.7	65.7	65.7	65.7	65.7
Oil production					
Bent Horn (thousands of m ³)	43.3	24.0	32.6	28.2	56.9

* As reported in previous years.

Lund Status

	1989	1990	1991	1992	1993
Licences issued (exploration, significant discovery, production)	0	0	0	0	0
Active licences	24	23	23	23	23
Lands issued in licences (millions of ha)	0	0	0	0	0
Lands relinquished or surrendered (millions of ha)	0.17	0	0	0	0
Lands active (millions of ha)	1.29	1.29	1.3	1.3	1.3

Well Workover Operations, 1993

Well name	Location (latitude, longitude)	Date terminated	Status	Total dept h (m)
Panarctic Tenneco et al POR Drake F-16	76°25'16"N 108°35'39"W	93-04-22	plugged & abandoned	1 478
Panarctic et al Drake Point D-68	76°27'05"N 108°55'43"W	93-04-29	plugged & abandoned	5 415
Panarctic Tenneco et al POR Drake B-44	76°23'09"N 108°16'04"W	93-04-19	plugged & abandoned	1 396
Panarctic Tenneco et al Drake D-73	76°22'06"N 108°29'30"W	93-04-29	plugged & abandoned	1 360.9
Panarctic POR Homestead Drake E-78	76°27'19"N 108°29'25"W	93-04-17	plugged & abandoned	1 356.4
Panarctic Drake Point L-67	76°26'37"N 108°55'23"W	93-04-16	plugged & abandoned	3 252.5
Panarctic et al Bent Horn F-72B	76°21'27"N 103°58'15"W	93-09-27	plugged & abandoned	3 282

Sources of Information

Department of Indian Affairs and Northern Development

Many sources of information on oil and gas environmental and land use matters originate with the Department of Indian Affairs and Northern Development:

Department of Indian Affairs and Northern Development
10 Wellington Street
Terrasses de la Chaudière
Hull, Quebec
Canada K1A 0H4

To obtain specific information, please include the appropriate contact listed in the sources below with the general mailing address for the department.

Calls for Nominations and Bids

Copies of calls for nominations and bids, the dates of upcoming calls, and other related information are available from:

Chief, Rights Issuance and Policy
Northern Oil and Gas Directorate
Telephone : (8 19) 994- 1606
Fax: (819) 953-5828

Exploration, Significant Discovery and Production Licences

Information on transfer registrations and notices, exploration, significant discovery and production licences, registration regulations and maps are available from:

Manager, Information and Revenue/Registrar
Northern Oil and Gas Directorate
Telephone: (8 19) 953-8490
Fax: (819) 953-5828

Northern Exploration

Information on northern exploration history and geological/geophysical activities is available from:

Senior Geophysicist
Northern Oil and Gas Directorate
Telephone: (8 19) 953-8722
Fax: (819) 953-5828

Land Use Regulations and Environmental Operating Guideline Handbooks

The following handbooks are available on land use regulations and environmental operating guidelines in the territories:

- *Territorial Land Use Regulations*
- *Natural Resource Development in the Yukon — Requirements, Procedures and Legislation*
- *Natural Resource Development in the Northwest Territories — Requirements, Procedures and Legislation*
- *Information and Procedures — Developing the Inuvialuit Settlement Region*
- *Seismic Operations*
- *Hydrocarbon Well-sites*
- *Reclamation Procedures*
- *Access Roads and Trails*
- *Mineral Exploration*
- *Pits and Quarries*

They are available from:

Enquiries Kiosk
Communications Branch
Telephone: (8 19) 997-0380
Fax: (819) 953-3017

Northern Oil and Gas Action Program

A cumulative bibliography is available from:

NOGAP Secretariat
Telephone: (8 19) 997-8293
Fax: (819) 997-0552

Beaufort Region Environmental Assessment and Monitoring

BREAM reports are available from:

Enquiries Kiosk
Communications Branch
Telephone: (819) 997-0380
Fax: (819) 953-3017

Other Sources

National Energy Board

The National Energy Board provides:

- information on **exploration, development, production, pipeline transportation and export** from its Regulatory Support Office;
- access to released **geological and geophysical reports** from its Resource Evaluation Branch;
- access to released **well history reports and records** from its Engineering Branch; and

. copies of the **Environmental Studies Research Fund annual report and newsletter** from its Environmental Directorate.

Contact the NEB at:

National Energy Board
Cadillac Fairview Building
311-6th Ave. SW
Calgary, Alberta
Canada T2P 3H2
Telephone: (403) 292-4800
Fax: (403) 292-5503

**Geological and
Geophysical
Information**

Public viewing and sampling facilities for cores and samples, and information on wells drilled North of 60° are available at:

Institute of Sedimentary and Petroleum Geology
Geological Survey of Canada
3303-33rd Street NW
Calgary, Alberta
Canada T2L 2A7
Telephone: (403) 292-7000
Fax: (403) 292-5377

Information on wells drilled in the Baffin Bay – Davis Strait region is available from:

Core Storage and Laboratory
Atlantic Geoscience Centre
Bedford Institute of Oceanography
Dartmouth, Nova Scotia
Canada B2Y 4A2
Telephone: (902) 426-6 127
Fax: (902) 426-6186

**Program on Energy
Research and
Development**

Information concerning PERD is available from:

Director General
Office of Energy Research and Development
Natural Resources Canada
580 Booth Street
Ottawa, Ontario
Canada K1A 0E4
Telephone: (613) 995-8860
Fax: (613) 995-6146

Glossary

abandoned well

any well that has been permanently plugged

call for bids

a notice published in *The Canada Gazette* and other publications whereby the Minister calls for the submission of bids in relation to Crown reserve lands identified in a preceding call for nominations

call for nominations

a notice published in trade journals, inviting interested parties to nominate tracts of Crown reserve lands for potential inclusion in a call for bids

completed well

a well that has been drilled and equipped so that it can produce oil or gas

cubic metre of gas

equivalent to 35.301 cubic feet at 14.73 pounds per square inch of atmospheric pressure at sea level

cubic metre of oil

equivalent to 6.2898 American stock tank barrels

delineation well

a well drilled as a follow-up to a discovery well on the same geological feature to determine the extent and commercial potential of the oil or gas accumulation encountered in the discovery well

development plan

a plan that describes the approach and facilities that the proponent intends to use to recover hydrocarbon resources based on the proponent's interpretation of geology and reservoir characteristics of a field

discovery well

the first oil or gas well drilled in a new field; the well that reveals the presence of a petroleum-bearing reservoir. Subsequent wells are development wells.

exploration licence

confers the right to explore for and the exclusive right to drill and test for petroleum, and the exclusive right to obtain a production licence subject to compliance with the other provisions of the *Canada Petroleum Resources Act*

exploration well

a well drilled on a geological feature where no significant discovery has previously been made (synonymous with wildcat well)

hectare (ha)

10 000 square metres (equivalent to 2.471 acres)

hydrocarbon

a naturally occurring compound consisting primarily of atoms of hydrogen and carbon in solid, liquid or gaseous form

injection well (injector)

a well in which fluids are injected into an underground formation to increase reservoir pressure

production licence

confers the right to explore, drill, test and develop petroleum resources and the exclusive right to produce including title to the petroleum produced

reflection seismic

the primary geophysical technique used in petroleum exploration for mapping subsurface geological features. Acoustic pulses created at the surface are reflected from layers that have different acoustic properties within the earth. The pulses are recorded at the surface for processing and interpretation.

rights issuance

the process of granting rights on Crown reserve lands subject to the *Canada Petroleum Resources Act*

shut-in well

a well in which operations have been temporarily ceased

significant discovery

a discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons and suggests the existence of an accumulation that has potential for sustained production

significant discovery licence

confers the right to explore, drill, test and develop petroleum resources and to obtain a production licence

spud

to start drilling a well

suspended well

a well in which drilling or production operations have been temporarily ceased

terminated well

a well that has reached total depth and has been abandoned, completed or suspended

well workover

a re-entry of a producing, suspended or abandoned well, with a drilling or service unit to conduct downhole operations for purposes other than exploration

work expenditure

actual cost of exploration activities