ALASKA LEGISLATURE COMMITTEE FILES 1985-1986 8672

3531 HRES COMINCO RED DOG PROJECT--OVERVIEW

4107

The accommodation complex is a carefully designed, well-built construction. It contains 208 single rooms and 16 suites within four residential modules. Recreational facilities include a billiard room, library, indoor swimming pool with sauna, gymnasium, games area and weight-lifting room. There is a common dining-room and lounge area. Some eight channels of television are available via satellite in both English and French.

The opportunity to work long hours at high rates of pay and the quality of the room and board are the main advantages attracting workers to Polaris. The standard work week is 11 or 12 hours a day, six days a week. Work schedules are on a rotation basis, and employees are flown to their homes following each work rotation. Southern employees work 10 weeks at the mine and then have two weeks off.

Northern native employees have the option of working for six weeks followed by four weeks off. This rotation is designed to allow the Inuit to continue with traditional pursuits such as hunting and fishing.

The High Arctic is a very difficult location in which to construct and operate a mine and concentrator. Cominco has had to adapt its construction approach and operating practices to suit the harsh environment and isolated site. The experience to date at Polaris demonstrates the success of our innovative approach to northern development. This northern Canadian frontier is largely unexplored and prospects for new mineral finds in the immediate area around Polaris are high. Cominco's success with the Polaris Mine project and operation may well be a model for future northern development. **— Jim Drake**

Jim Drake

Jim Drake, who is General Superintendent Polaris Operations, started with Cominco as an engineer-in-training at Kimberley in 1973. After nine months there, he worked for 2½ years at the Con Mine in Yellowknife on the Robertson Shaft project. In 1976 he went to Spain to work at Rubiales for three months — and ended up staying for five years. He has been at Polaris since 1981.

The Federal Elbe loading concentrates during Polaris' first production season in September, 1982. The 1983 sealift had a new twist.

Roundabout resupply saves dollars

Little Cornwallis Island, N.W.T. — For the Polaris Mine, resupply, like Christmas, comes but once a year — in the brief Arctic summer when sea lanes open through the ice for ships to reach Little Cornwallis Island.

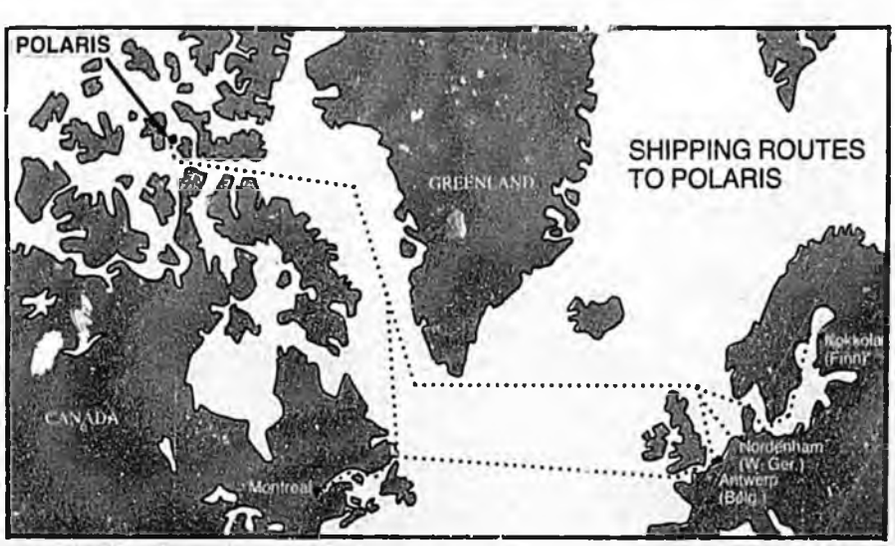
In 1983 the second annual sealift of materials to the mine was different from the first summer. Most of the goods for Polaris were shipped to Europe first. They went from Montreal across the North Atlantic to Antwerp in Belgium for transshipment into another vessel bound for the Canadian Arctic. The dogleg route is about double the 4,800 km of the conventional route from Montreal to Polaris, but resulted in savings of about $1 million.

The circuitous route (see map) was taken because Polaris has a contract for shipment of concentrates in the MV *Arctic*, a Canadian icebreaking carrier which also ships zinc-lead concentrates from the Nanisivik Mine on Baffin Island.

With the *Arctic* delivering her first shipment from Nanisivik to Antwerp in July, the Polaris purchasing group in Toronto determined that it would be cheaper to send supplies for Polaris to Europe for transfer to the MV *Arctic* than to ship direct from Montreal to Little Cornwallis Island. The *Arctic*'s northbound trip is part of the Cominco contract; why not fill her holds with cargo instead of ballast?

A total of 1,250 tonnes of supplies for Polaris were purchased in Canada and shipped in the MV *Lady Franklin* from Montreal to Antwerp. Among the supplies were containers of canned food, hardware, parts, chemicals, tires, lubricants, lumber and 11 mine vehicles.

Another 3,000 tonnes of goods were purchased in Europe and delivered to the Port of Antwerp. Both cargoes were loaded aboard the *Arctic* in July, 1983. The *Arctic* arrived at Polaris on



August 10, 1983. The supplies were unloaded and the *Arctic* departed for Antwerp on August 15 loaded with 2,271 tonnes of lead concentrate and 24,230 tonnes of zinc concentrate. The *Arctic* made two more calls at Polaris to load concentrates before the end of October.

Total concentrate shipments from Polaris in 1983 were 43,531 tonnes of lead and 196,910 tonnes of zinc. Besides the *Arctic*, five other ships called to take off the year's production of concentrates: the *Federal Hudson* on August 31 and September 21 to Nordenham, West Germany, and Antwerp; the *Finntimber* on September 1 to Kokkola, Finland; the *Federal St. Laurent* on September 11 to Antwerp; the *Federal Huron* on September 13 to Nordenham and Kokkola; and the *Columbialand* on October 10 to Antwerp.

Polaris was also supplied with 15,600,000 litres of fuel oil to satisfy the mine's energy needs for a year. The tankers *Gulf Gatineau* and *Gulf MacKenzie* called at the end of August and the end of September respectively.

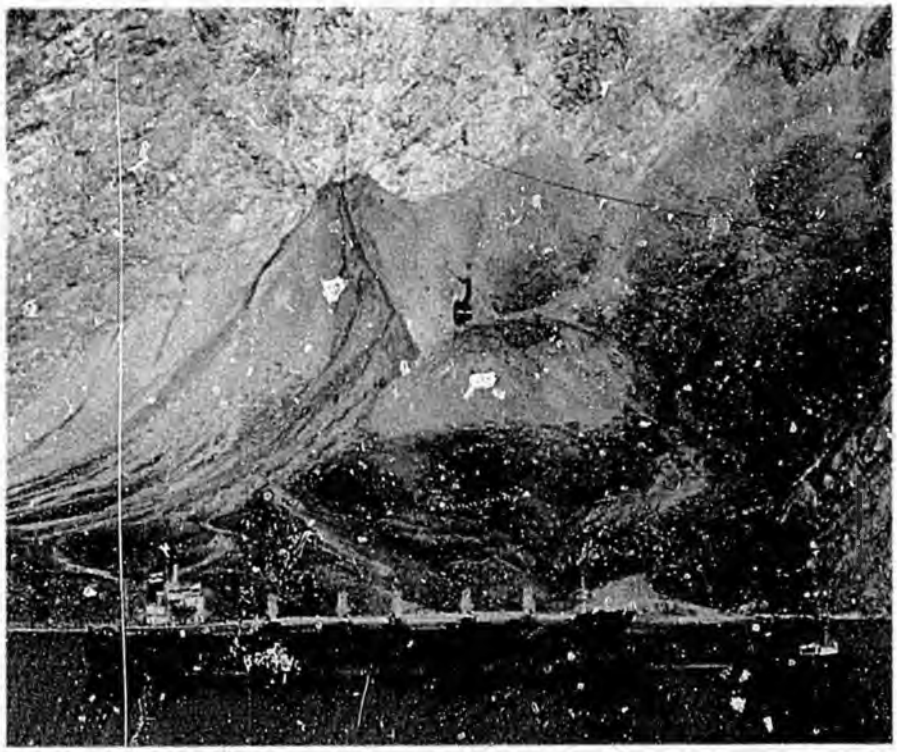
Over 300 tonnes of Polaris-bound supplies, which did not go to Antwerp to connect with the MV *Arctic* in July, were shipped in the *Federal Pioneer* out of Montreal. The *Pioneer* supplied other northern settlements on its way to Polaris. Included in her cargo for Polaris were a year's supply of frozen meat and ice-cream — a case of exporting ice to the Arctic.

What does it mean?
Polaris

Little Cornwallis Island, N.W.T. — The northernmost metal mine in the world was named for its location beneath the pole star, Polaris, and near the magnetic north pole in Canada's High Arctic.

The pole star, or North Star, is the nearest star to the North Pole visible to the naked eye. Medieval Norse navigators learned to steer by the pole star that remained constant in the northern sky.

Over the eons, a succession of stars have passed near enough to the North Pole to serve as markers. But Polaris has been the pole star for at least 2,000 years, and will come even closer to the pole over the next hundred years. Three thousand years ago, the pole star would have been Beta Ursa Minoris; 12,000 years ago, it was Vega.



With a cablecar suspended above, a bulk carrier docks at Maarmorilik to load zinc and lead concentrates for smelters in Europe.

Black Angel: A Mine in a Mountain

Can a mine high on a mountainside in a remote part of Greenland be both a financial and a social success?

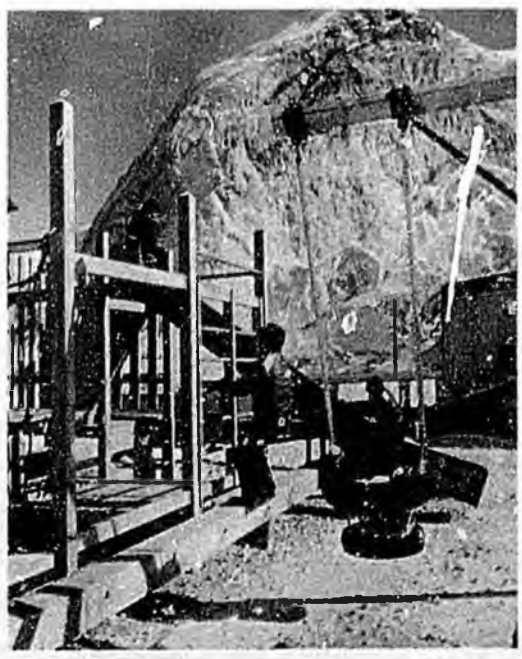
Now ten years after start-up, the Black Angel zinc-lead-silver mine has demonstrated that native Greenlanders, who comprise nearly half of the workforce of 348, have been a key factor in this remarkable operation.

The mine, located 500 km north of the Arctic Circle on the northwest coast of Maarmorilik, is Greenland's first large-scale industrial installation. The operation forms a complete community of its own, unlike the fly-in, fly-out camp system proposed for Red Dog in Alaska.

Evidence of lead and zinc minerals was found many years ago in rock debris along the shoreline of Maarmorilik fjord. In 1963 the region was examined by a prospecting party supported in part by Cominco Ltd. The first large-scale exploration work was carried out from June to September in 1966. Many difficulties were encountered, not the least of which was that the lead and zinc bearing minerals were located on nearly vertical cliffs. Mountaineers were used and exploration crews encountered storms, permanently frozen rock and other difficulties.

The mine and mill began producing in October 1973.

The operation is owned by Greenex A/S, a Danish company wholly-owned by Vestgron Mines Limited of



These children are part of the mine community at Maarmorilik.

Canada. Cominco Ltd. controls Greenex A/S through a 62 per cent interest in Vestgron. Hank Giegerich, President and General Manager of Cominco Alaska, was project engineer at Black Angel for two years from 1972.

Another engineer who would become Vice-President of Cominco's northern operation, John Willson, served at Black Angel as Project Superintendent and later Manager, Black Angel Operation, until 1974. Knud Sprunk-Jansen, Managing Director of Greenex A/S participates in the Red Dog management committee to which he brings experience of both Arctic mining and the concerns of local hunters and fishermen.

The mine's facilities include a concentration plant, townsite, concentrate storage facilities, docks and ship-loading equipment, electric power and seawater desalination plants. The mill equipment was transferred to the Greenland site from a Cominco American Incorporated mine in Montana and reassembled on site. The grinding equipment uses seawater as process water.

Although the mine is on tidewater navigation is closed from December to June due to ice conditions. Greenex has an agreement with the community board of Uummannaq concerning ice breaking in order to protect the traditional hunting and fishing life.

The mine is inside the Black Angel mountain which takes its name from the clear outline of an angel with outstretched wings darkening the side of the mountain. The mountain has an altitude of 1100m and the mine portal is located at the 600m level. The entire mountain is permanently frozen. The mine portal is reached by two cableways with a span of 1500m stretching across the fjord to the concentrator and town site on the opposite edge of the fjord.

The ore is treated in a standard concentration plant and the concentrates stored for shipping.

Since 1979 Greenland has had home rule under the kingdom on Denmark. The Danish Ministry for Greenland is still responsible for several areas but more and more are being transferred to the Greenlandic home rule government in Nuuk.

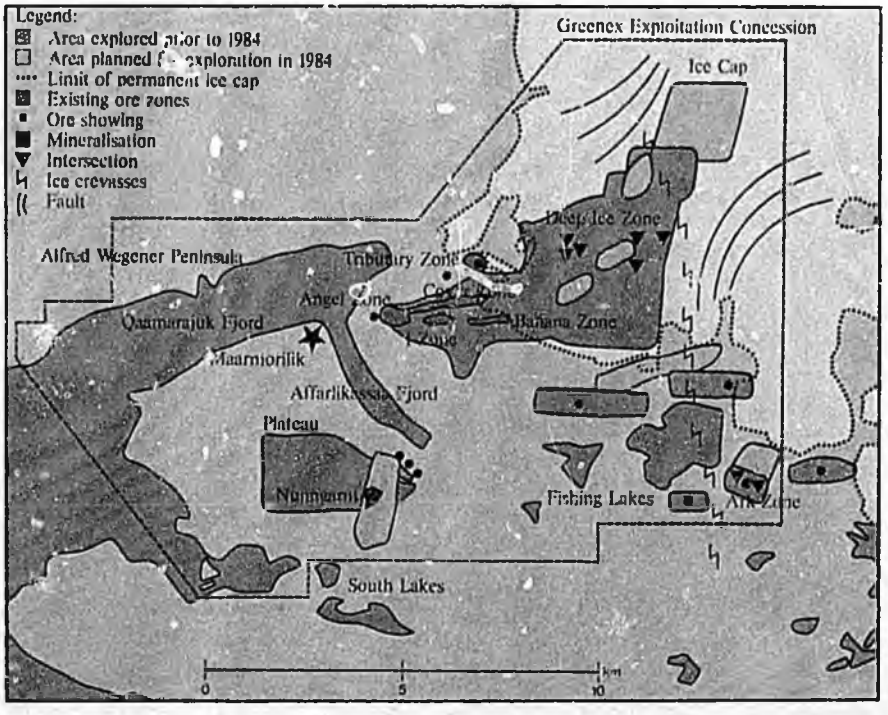
A joint committee for mineral and oil resources in Greenland was established on July 1, 1979. Five if its 10 members are appointed by the Danish government, the remaining five by Greenland Home Rule. The committee follows developments in the mineral and oil resources sector; in addition, it submits its recommendations in matters of resources on which a decision must be made jointly by the Danish government and Greenland Home Rule. Chairman of the committee is Premier Jonathan Motzfeldt. The Ministry for Greenland has an agency responsible for the central administration of mineral and oil resources. The agency also acts as secretariat for the joint committee.

In 1971, Greenex got an exclusive concession from the Minstry for Greenland after extensive negotiations. As a consequence of the introduction of Home Rule and of the complexity of the operation, Greenex's head office moved to Maarmorilik from Copenhagen on June 1, 1984. The administrative office in Copenhagen will be transferred during 1984, leaving four or five persons in Copenhagen.

Environmental control is an important element of the agreement with the Danish Government. It requires the company to follow strict pollution control measures to safeguard the environment. Prior to the start of operations, the waters, flora and fauna near the mine were studied to assess their natural state. Tests are made periodically to ensure that metal elements and chemicals resulting from mine activity are within acceptable limits.

The townsite includes bunkhouses, apartments, townhouses, kitchen, dining and laundry units, a recreation centre and medical centre with resident doctor. Electric power is provided by three diesel units.

The mine relied on Canadian mining specialists until 1975 when Greenex replaced them with Danish and Greenlandic personnel. Greenex also draws on graduates from Scandinavian mining schools and technical universities. Employees are encouraged to take internal and external educational courses offered through the company.



Location of the Black Angel Mine, operated by Greenex A/S, on the west coast of Greenland 500 km inside the Arctic Circle. The plan of the property (above) shows ore zones and explored areas.

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Cominco Ltd. Annual Report 1983

Cominco

Cominco Ltd.

Summary of Business Activities and Corporate Objectives

Cominco Ltd. is an integrated natural resource company with principal activities in mineral exploration, mining, smelting and refining. It is one of the world's largest mine producers of zinc and lead.

Cominco is Western Canada's second largest chemical fertilizer producer. Principal chemical and fertilizer products are ammonia, urea, potash, ammonium nitrate, ammonium phosphate, ammonium sulphate, sulphuric acid and sulphur dioxide.

Cominco also produces silver, gold, copper, tin, cadmium, bismuth, indium, diamonds, coal, steel products, fabricated metals, high-purity metals and compound semiconductors and components for thin film electronics and other high technology industries.

Cominco's primary objective remains steady, long-term growth. To accomplish this it seeks to strengthen its position in zinc and lead and to expand its activities in selected other base metals, precious metals, coal, chemicals and fertilizers. Cominco endeavours also to diversify its markets and geographic base.

In managing the growth of its business, Cominco continues to meet rigorous standards of environmental sensitivity, to provide customer satisfaction and to reward employees fairly and initiative. Emphasis is placed on the health and safety of its employees and the protection of the environment.

Cover:

Cominco became a copper producer with the opening of the Valley Mine in British Columbia in 1988. The cover photograph, taken from the northwest corner of the open pit mining area, shows the former Bethlehem Copper Corporation concentrator where ore from the mine is processed. Photo at left shows ore being hauled 4.1 miles (6.6 km) from the mine to the concentrator.

Highlights of 1983

(All dollar amounts in millions except per share figures)

		1983	1982
Financial	Loss (1982 before extraordinary item)	$ 39.3	$ 49.3
	— per common share	$ 2.60	$ 3.16
	Dividends on common shares	$ 8.2	$ 24.4
	— per common share	$ 0.40	$ 1.30
	Capital expenditures	$ 106.3	$ 230.4
Production and sales	Production of concentrates in tons *(tonnes)*		
	zinc	666,000	722,700
		(604,200)	*(655,700)*
	lead	313,600	386,800
		(284,500)	*(351,000)*
	copper	84,000	28,800
		(76,200)	*(26,200)*
	Sales of metals in tons *(tonnes)* (includes metal content of concentrates sold)		
	zinc	434,600	379,000
		(394,300)	*(343,800)*
	lead	300,000	257,100
		(272,200)	*(233,200)*
	copper	33,600	17,900
		(30,500)	*(16,200)*
	Production of chemicals and fertilizers in tons *(tonnes)*	2,804,000 *(2,544,000)*	2,497,000 *(2,265,000)*
	Sales of chemicals and fertilizers in tons *(tonnes)*	2,895,000 *(2,626,000)*	2,536,000 *(2,300,000)*

Contents

Terms used

In this report, all dollar amounts are Canadian unless otherwise noted. All tons are short tons, with metric tonnes appended in italics and in parentheses. A tonne is 1,000 kilograms, or 2,204.6 pounds.

Annual Meeting

The Annual and a Special General Meeting of shareholders of Cominco Ltd. will be held on Thursday, April 19, 1984, at 11:00 a.m., in the Park Ballroom, Four Seasons Hotel, Vancouver, B.C.

Report of the Directors to the Shareholders

M. N. Anderson
Chairman and
Chief Executive Officer

The economic recovery experienced by some industries in 1983 has been slow to influence demand and prices for most of Cominco's principal products.

The loss for the year was $39.3 million or $2.60 a common share on sales of $1,374.7 million. The loss in 1982, before including an extraordinary gain of $18.1 million, was $49.3 million or $3.16 a common share on sales of $1,234.7 million.

Cominco is recovering from the deep recession that proved to be especially difficult for the mining and fertilizer businesses. The rise in demand and in prices has been mainly in consumer-linked commodities and products, and as a result zinc has performed well. The other base metals Cominco produces, such as lead and copper, are in oversupply and demand and prices have not improved. As well, fertilizer markets had a poor year as a result of government programs to regulate production of crops, high interest rates, low prices and surplus supplies.

We have adapted to this harsh economic environment to ensure long-term competitiveness in our traditional base metal and fertilizer markets, and we are developing in new, fast-growth areas. We are renewing our strengths as a low-cost producer.

Our program emphasizes the efficient use of capital and technology, of our strong mineral resources and plants, and of the skills of our talented workforce.

During the year, $100 million was raised through the issuance and sale of additional common shares at a price of $45.625 a share.

Interest costs were lowered by prudent deferments of capital expenditures, and through lower inventory levels. However, energy costs continued to escalate, largely as the result of governments using energy pricing as a means of raising revenues. High natural gas costs, high water license fees for the generation of our own hydroelectric power and high property taxes have become major concerns.

Costs were rigorously controlled through the year and significant gains made in productivity. Production tonnages in general were the same as or greater than in the previous year, while the total number of employees decreased by 3 per cent. Reductions in personnel since 1982 have resulted in ongoing savings of over $50 million each year.

The six-month shutdown at Pine Point, caused by a combination of low metal prices and high operating costs, ended following temporary cost-reducing agreements reached with governments, employees and others.

The Polaris zinc-lead mine in the Canadian High Arctic concluded its first full year of operation by producing more concentrates than its rated capacity. The Valley copper mine in British Columbia was officially opened during the year, and an increase in production from the present 23,000 tons *(21,000 tonnes)* of ore a day will be considered when market conditions permit.

At the Trail metallurgical complex, the start of production in the zinc electrolytic and melting plant in 1983 marked the completion of the first major phase of the modernization and expansion program started in 1977. The result has been an increase in productivity and greatly improved working conditions.

Planning continued on the proposed Red Dog zinc-lead-silver mine in Alaska which may ultimately become a primary source of concentrates for the Company. An environmental impact statement and engineering plans for the mine site facilities were prepared. The project is a joint venture of Cominco and NANA Regional Corporation, Inc., an Alaskan native organization. During the year alternative road routes from the mine site to the coast were studied, as were plans for a deep water port at a point on the coast north of Kotzebue.

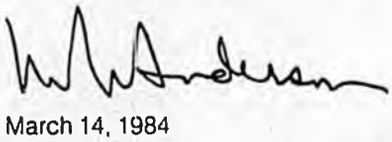
Plans to put the Buckhorn gold mine in Nevada into production were announced in September. This low-grade heap-leach project is expected to reach full production in the second quarter of 1984.

The already strong zinc market is expected to continue throughout 1984. The improved lead market at year-end may lead to higher prices. The outlook for copper is that weak prices will continue until inventories in the Western World are reduced through higher consumption. Demand for our chemical and fertilizer products is expected to improve, and at increased prices.

In the longer term, we will be challenged by a slower rate of growth in demand for our primary products, and we intend to win new markets for them. The mining industry has entered a new era, characterized by the emergence of strong competition from producers in less developed countries, particularly in copper. New opportunities exist for sales of our technical services, and for joint ventures.

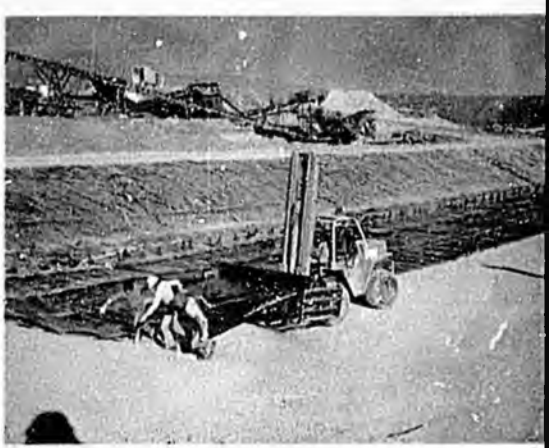
Mr. John Stenason left the Board after 12 years of service as a Director, and Mr. Stuart Eagles, President, Canadian Pacific Enterprises Limited, was appointed to the Board.

On behalf of the Directors and Officers, I wish to thank our employees who worked with enthusiasm and dedication in a most difficult year toward our goal of excellence. The best measures of their success are the reduced costs, increased productivity and improved safety performance achieved in 1983.

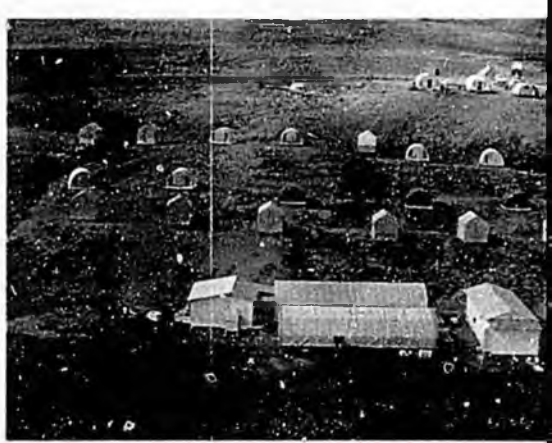


March 14, 1984

Cominco's strong mineral resources: a key part of the Company's future. △



Carlin, Nevada: heap-leaching ponds under construction at the new Buckhorn operation. △



Red Dog, Alaska: in summer, the exploration camp on the property in the NANA region of northwestern Alaska. △

◁ *Trail, B.C.: continuous-cast zinc "logs" at the new electrolytic and melting plant are sawn into one-tonne "jumbos" for shipment to customers.*

The Year in Review

Revenue and Earnings

Cominco incurred a loss of $39.3 million in 1983, an improvement of $10 million over the $49.3 million loss in 1982. Losses occurred in the first three quarters of the year, with a small profit achieved in the fourth quarter. Operating results improved, highlighted by a marked reduction in the loss from the mining and integrated metals business segment. In spite of a very difficult year in U.S. fertilizer markets, the operating profits from chemicals and fertilizers were only slightly below 1982 levels.

Revenue from sales of products and services increased to $1,374.7 million in 1983, compared with $1,234.7 million in 1982. In 1983 sales volumes increased revenues by $119.2 million, and sales prices accounted for an additional $20.8 million.

The cost of products and services in 1983 was $1,015.2 million, an increase of $82.9 million over 1982, due principally to costs attributable to increased sales volumes. Operating costs during the year were marginally lower than 1982 as a result of continuing programs to increase productivity and reduce costs.

Distribution costs of $161.8 million increased $22.2 million over 1982 levels, due mainly to the increased volume of products sold. General and administrative expenses decreased $3.9 million, principally due to the continuing programs to reduce costs. Reduced borrowings and a decline in interest rates during the year resulted in a decrease of $9.0 million in interest expense charged to earnings. Depreciation and depletion expense increased $13.8 million as a result of including charges for a full year of operation at the Polaris Mine, for the Valley Mine which started up in the year and for projects associated with the Trail modernization program, particularly the new zinc plant.

The loss for 1983 has been reduced by a credit for income taxes. Current income taxes of $5.9 million have been reduced by investment and research and development tax credits of $1.7 million. A tax credit of $32.6 million, arising from deferment of claims for capital cost and other allowances for tax purposes, will be realized in future years when the Company returns to profitability.

Equity in net earnings of associated companies decreased to $2.3 million from $5.2 million in 1982. This reduction is attributed mainly to a $3.1 million decrease in the Company's share in earnings of Fording Coal Limited. Lower earnings by that company were a result of a negotiated coal price reduction of 15 per cent and an 82-day shutdown due to a strike.

Liquidity and Capital Resources

The Consolidated Statement of Changes in Financial Position on page 25 shows 1983 sources of funds totalling $149.7 million. Funds from operations were $31.6 million, an increase of $39.6 million over 1982. Proceeds from the disposal of assets contributed $8.9 million. Additional long-term debts in the year amounted to $8.8 million. In April 1983, Cominco received $100.0 million from the issue of 2,191,780 Common Shares. The proceeds were used to reduce short-term borrowings.

Funds used during 1983 were $183.7 million compared with $304.0 million in 1982. Combined capital expenditures on facilities and mineral properties at $106.3 million represent significant savings compared with $230.4 million in 1982. Capital projects in the year were severely curtailed, with expenditures being directed mainly towards sustaining production capacity and completing projects under construction in 1982. Major projects funded during the year included $25.7 million on modernization projects at Trail, B.C., $5.5 million on the new continuous rolling mill at Western Canada Steel Limited's Vancouver plant, $9.2 million on the Buckhorn gold property in Nevada and $7.7 million on the Red Dog zinc-lead-silver deposit in Alaska.

Payments of $46.7 million were made on long-term debt during the year, an increase from 1982. Total dividend payments were $24.6 million, including $13.9 million to preferred shareholders and $2.5 million to minority shareholders of subsidiary companies. Common share dividends of $8.2 million, or $0.40 a share, were distributed in 1983, sharply down from the 1982 level of $24.4 million, or $1.30 a share. Dividends of $2.00 a share on Series A Preferred Shares, $1.98 a share on Series C Preferred Shares and $3.25 a share on Series D Preferred Shares were paid in 1983.

Working capital declined during the year to $187.0 million from $221.0 million at the end of 1982. Lines of credit available to Cominco and its consolidated subsidiaries totalled $489.8 million, of which $347.7 million remained unutilized at year-end.

W. G. Wilson, President

Cominco sold its entire 17.2 per cent interest in Tara Exploration and Development Company Limited in January 1984. Proceeds from the sale amount to approximately $22.5 million. The loss resulting from the sale had been fully provided for in Cominco's accounts as amortization of the original purchase price had reduced the carrying value to the amount received.

Early in 1984 federal legislation providing incentives for the financing of research and development was enacted. As a result, the rights to tax benefits on research and development expenditures of $5 million incurred in 1983 were sold to another company in February, 1984 as Cominco was unlikely to utilize the tax benefits in the foreseeable future. A gain of $450,000 on this sale was recorded in the 1983 accounts.

Operations

The operations of Cominco Ltd. and its subsidiaries are divided into three industry segments as follows:

1 ***Mining and integrated metals**, comprising principally the mining, processing, smelting and refining of zinc, lead, copper, silver and gold;*

2 ***Chemicals and fertilizers**, comprising principally the production of sulphuric acid, sulphur dioxide, potash, ammonia, urea, phosphates and nitrates;*

3 ***Other operations**, comprising principally electronic materials, fabricated metal products and the generation and distribution of electric power.*

The revenues and operating profits (losses) of each segment are shown in Note 14 of the Notes to Consolidated Financial Statements. Operating profits (losses) are before providing for unallocated costs and expenses, including interest expense, general mineral exploration and income and resource taxes.

Mining and Integrated Metals

Revenues and Operating Profit (Loss)

	Revenues		Operating Profit (Loss)	
	1983	1982	1983	1982
			(millions)	
Sullivan Mine	$103	$ 79	$ 19	$ 13
Pine Point Mines	52	88	(15)	(10)
Polaris Mine	61	29	6	2
Black Angel Mine	66	65	16	14
Magmont Mine	24	24	2	3
Con Mine	36	37	8	7
Valley Mine[1]	54	25	7	(5)
Trail Metallurgical Operations	402	328	(35)	(44)
Nonproducing mines and properties	—	—	(14)	(18)
	$798	$675	$ (6)	$(38)
First Quarter			$(11)	$(18)
Second Quarter			(1)	(7)
Third Quarter			1	(14)
Fourth Quarter			5	1
			$ (6)	$(38)

[1] 1982 figures are for the Jersey Mine which was closed in June, 1982

At Trail, B.C. Cominco operates an integrated smelter and refining complex producing various refined metal products, principally zinc, lead and silver. In addition to processing concentrates from Company mines, it also purchases and refines concentrates from mines in southern British Columbia, the northwest United States and offshore.

The Sullivan Mine at Kimberley, B.C. and Pine Point Mines in the Northwest Territories are the chief sources of zinc and lead concentrates for the metallurgical operations at Trail. Other mines operated by Cominco and its subsidiaries are the Polaris Mine, N.W.T. (zinc, lead); the Black Angel Mine, Greenland (zinc, lead, silver); the Magmont Mine, Missouri (lead, zinc, copper); the Con Mine, N.W.T. (gold); the Buckhorn Mine, Nevada (gold); and the Valley Mine, B.C. (copper).

The Industry

Demand was weak for most metals at the beginning of the year due to the continuing effects of the world recession. The recovery which began slowly in the fourth quarter of 1982 was uneven and first affected North American zinc markets with improved consumer demand for automobiles, housing and durable goods. Demand for lead and copper was not affected to the same extent and Western World inventories of these commodities increased during the year. Demand for lead improved in the fourth quarter as battery manufacturers increased their lead consumption because of severe winter conditions in North America.

At year-end, total Western World zinc stocks were near the normal level of six weeks' consumption, and lead stocks amounted to seven weeks' consumption compared with the normal level of five weeks'. Copper stocks at eleven weeks' consumption at the end of the year were almost twice the normal level.

The Western World's consumption of refined zinc increased in 1983 by 7 per cent over 1982, while lead and copper consumption stayed at about 1982 levels. Exports of refined zinc and lead to China and to the U.S.S.R. were considerably higher in the year.

Mine production of zinc and lead in the Western World declined in 1983 by 0.5 per cent and 3.3 per cent respectively from the 1982 levels, but supplies of both concentrates were ample throughout the year. Mine production of copper decreased by 3 per cent in the year, and as the year progressed a shortage of concentrate began to develop. Despite the decline in Western World mine output during the year, refined production of zinc increased by 6.8 per cent to 5.09 million tons *(4.62)*, refined copper production increased 1.5 per cent to 7.97 million tons *(7.23)* and refined lead production at 4.35 million tons *(3.95)* was up one per cent from the previous year.

Quoted refined zinc prices were weak during the first half of the year but strengthened in the second half.

reflecting improved demand. North American lead prices remained weak until demand increased late in the year; however, lead prices on the London Metal Exchange were sluggish throughout the year reflecting world oversupply conditions. After strengthening during the first half of the year, copper prices weakened steadily during the second half of the year (see price charts on page 11).

Summary of Results

The revenues and operating results of Cominco's mining and integrated metals business segment improved over 1982 mainly because of higher prices for zinc, silver and gold, and increased sales volumes of copper and zinc concentrates and zinc metal. Realized silver and gold prices were substantially higher in 1983 than in 1982 but declined in the fourth quarter to prices that were below their respective 1982 year-end levels. Operating results also benefited from continuing programs to increase productivity and to reduce operating costs.

Higher prices for gold and silver and earnings from the new Valley Mine were the main contributors to improved operating results in the first and second quarters. In the third and fourth quarters, increased sales volumes of zinc and lead metals and higher prices for zinc contributed to the improved results.

The Company sold 261,600 tons *(237,300)* of zinc concentrate compared with 215,700 tons *(195,700)* 1982; and 169,600 tons *(153,900)* of lead concentrate compared with 142,200 tons *(129,000)* sold in 1982.

The sales volume of copper concentrate in 1983 was 76,300 tons *(69,200)*, containing 33,600 tons *(30,500)* of copper.

Sales of refined zinc rose 9 per cent to 279,100 tons *(253,200)* in 1983, compared with 255,900 tons *(232,100)* in 1982. Refined lead sales rose 22 per cent and totalled 179,000 tons *(162,400)*, compared with 147,200 tons *(133,500)* in 1982. At year-end, Cominco's inventories of refined zinc were normal and lead inventories were below normal.

Sales of gold were 89,700 ounces *(2,790 kilograms)*, down from 104,100 ounces *(3,238 kilograms)* sold in 1982. Sales and production were affected by an eight-week strike at the Con Mine. Cominco sold 11,316,000 ounces *(351,970 kilograms)* of silver, compared with 10,004,000 ounces *(311,159 kilograms)* in 1982. The increase in sales was a result of the higher silver content in custom concentrates and lower consumption of silver for anodes by the new zinc electrolytic and melting plant. Year-end inventories of gold and silver were minimal.

In January, 1984, Cominco (UK) Limited relinquished its ring dealing privileges on the London Metal Exchange because the financial risks involved were not warranted in view of that company's earnings level.

Sullivan Mine

The Sullivan zinc-lead-silver mine at Kimberley, B.C. celebrated its 75th year of production in 1983. This mine is a principal supplier of zinc and lead concentrates to the metallurgical plants at Trail.

Sullivan ore production in 1983 was 2,224,000 tons *(2,017,000)*, 9 per cent below the 1982 level. There was an eight-day strike which affected this total. About 38 per cent of production came from mechanized mining in 1983, resulting in an improvement in productivity.

Zinc concentrate production at 136,000 tons *(123,400)* increased above the 1982 level due to improved zinc grades, while lead concentrate production at 139,300 tons *(126,400)* fell below the 1982 level because of lower lead feed grades and reduced ore production.

		1983	1982
Ore milled	tons	2,224,000	2,446,000
	(tonnes)	*(2,017,000)*	*(2,219,000)*
Zinc			
Average grade		3.6%	3.2%
Concentrate	tons	136,000	131,000
	(tonnes)	*(123,400)*	*(118,800)*
Concentrate grade		49.3%	49.4%
Lead			
Average grade		4.6%	5.0%
Concentrate	tons	139,300	170,600
	(tonnes)	*(126,500)*	*(154,800)*
Concentrate grade		62.2%	61.4%
Silver			
Average grade	oz/ton	1.6	1.9
	(g/tonne)	*(55)*	*(65)*
No. of employees at year-end		941	959

Pine Point Mines

Cominco owns 69.1 per cent of the shares of Pine Point Mines Limited, which has zinc-lead mines and a concentrator at Pine Point, N.W.T., on the south shore of Great Slave Lake. All of the zinc concentrate produced at Pine Point is treated at Cominco's metallurgical plants at Trail. Most of the lead concentrate is sold to an associated company, Mitsubishi Cominco Smelting Company Limited (45 per cent owned), which operates a lead smelter in Japan.

Pine Point operations were shut down from January 2 to June 15 because of the severe decline in metal prices and the higher operating costs associated with the increasing strip ratio. Resumption of operations was made possible by the improved outlook for metal prices at mid-year, and by obtaining temporary cost-saving concessions from major service sectors.

Pine Point's salaried staff were the first to contribute by accepting a continued salary freeze in force since July, 1981. The unionized employees, who had continued to receive pay increases established by the two-year collective agreement negotiated in 1981, accepted a 10 per cent pay cut on May 1, 1983. This agreement provided that the reduced wages would remain in effect until metal prices increased sufficiently to allow Pine Point to break even on a cash basis. The contractual base rate was restored to its previous level in two stages in November 1983 and January 1984 as zinc prices increased; staff salaries were increased about the same time.

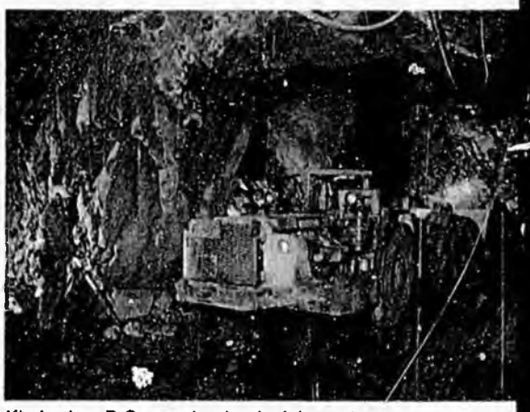
Financial assistance was obtained from the Federal and Territorial Governments for mine development and temporary concessions were negotiated for freight rates, smelter treatment charges and power tariffs. By early 1984 most of this assistance had been discontinued.

Concentrate sales were $51.7 million compared with $87.9 million in 1982. Concentrate production was 129,700 tons *(117,700)* of zinc and 32,100 tons *(29,100)* of lead.

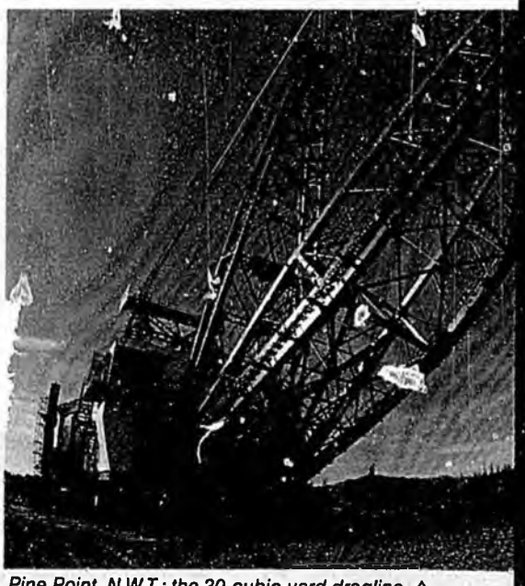
Rising mining costs and lower metal prices necessitated the removal of uneconomic ore from reserves, including ore accessible only by underground mining methods. The 1983 exploration program located 780,000 *(708,000)* tons of ore grading 4.2 per cent zinc and 1.1 per cent lead in two current production areas. This amount was less than the tonnage milled during the year.

		1983	1982
Ore milled	tons	985,000	2,445,000
	(tonnes)	*(894,000)*	*(2,218,000)*
Zinc			
Average grade		8.1%	7.3%
Concentrate	tons	129,700	287,400
	(tonnes)	*(117,700)*	*(260,700)*
Concentrate grade		56.9%	57.3%
Lead			
Average grade		2.7%	3.0%
Concentrate	tons	32,100	84,500
	(tonnes)	*(29,100)*	*(76,700)*
Concentrate grade		73.8%	76.5%
No. of employees at year-end (490 at mid-year start-up)		544	583

Tadanac silver bar: production and sales of Cominco's silver increased in 1983. △



Kimberley, B.C.: mechanized mining methods at the Sullivan Mine resulted in important productivity gains. The mine has been in production since 1909. △



Pine Point, N.W.T.: the 30-cubic-yard dragline removes overburden at the largest mine in the Territories. △

◁ *Polaris, N.W.T.: ice floes in Crozier Strait in the High Arctic provide a majestic foreground to Canada's most northerly metal mine. The operation completed its first full year in 1983.*

Polaris Mine

The Polaris zinc-lead mine, the world's most northerly metal mine, on Little Cornwallis Island, N.W.T., completed its first full year of production in 1983. The entire concentrate production is shipped during the brief Arctic summer when the sea lanes are navigable.

Most of the zinc concentrate is sold to European smelters. The remainder is tolled at a custom smelter in Europe, and the resulting metal is sold by Cominco. The lead concentrate is sold to smelters in Europe.

In 1983, revenues from the sale of concentrates and metal were $61 million, yielding an operating profit of $6 million. At year-end, 63,200 tons *(57,300)* of zinc concentrate and 21,300 tons *(19,300)* of lead concentrate were held in inventory at the mine.

The mine was designed to produce 195,000 tons *(177,000)* of zinc concentrate and 45,000 tons *(41,000)* of lead concentrate annually. The actual production in 1983 was considerably greater, with both mill throughput and feed grades being higher than forecast. Production was 239,300 tons *(217,100)* of zinc concentrate, and 56,300 tons *(51,100)* of lead concentrate. The average milling rate was 2,500 tons *(2,300)* a day, well above the designed capacity of 2,300 tons *(2,100)* a day.

The shipping season from Polaris to Europe in 1983 extended from August to late October, about two weeks longer than in 1982. Nine shipments were made, aggregating 202,300 tons *(183,500)* of zinc concentrate and 45,600 tons *(41,400)* of lead concentrate. In 1983, sales equivalent to 165,100 tons *(149,800)* of zinc concentrate, including tolled metal, were taken into revenue, of which 43,900 tons *(39,800)* were from the 1982 shipping season and the remainder from 1983 shipments. Lead concentrate tonnage taken into revenue was 38,700 tons *(35,100)*, of which 9,200 tons *(8,300)* was from 1982 shipments and 29,500 tons *(26,800)* was from 1983 shipments.

As a result of the continuing diamond drilling program at the mine, 8.4 million tons *(7.6 million)* of ore were upgraded from the inferred to the measured and indicated class of reserves during the year, increasing the total of this latter class by more than one-third.

There were 43 northerners employed in a total work force of 237 at year-end. The number of Inuit employed during the year reached a high of 29 at mid-year and was 18 at year-end.

		1983	1982
Ore milled	tons	914,000	518,000
	(tonnes)	*(829,000)*	*(470,0..*
Zinc			
Average grade		16.8%	17.0%
Concentrate	tons	239,300	142,400
	(tonnes)	*(217,100)*	*(129,200)*
Concentrate grade		60.9%	57.3%
Lead			
Average grade		5.2%	7.0%
Concentrate	tons	56,300	45,900
	(tonnes)	*(51,100)*	*(41,600)*
Concentrate grade		76.2%	72.6%
No. of employees at year-end		237	244

Black Angel Mine

Cominco owns 62.5 per cent of the shares of Vestgron Mines Limited, which, through its wholly owned subsidiary Greenex A/S, owns and operates the Black Angel zinc-lead-silver mine and concentrator at Maarmorilik, Greenland. Zinc and lead concentrates are transported from the mine during the June-November shipping season. Most of the zinc concentrate produced is sold to European refineries. The remainder is tolled at a custom smelter in Europe, and the resulting metal is sold by Cominco. The lead concentrate is sold to smelters in Europe.

Revenues in 1983 were $66 million, up $1 million from 1982. Operating profit increased by $2 million to $16 million. Increased revenues from higher zinc prices were offset by reduced quantities of zinc concentrate and zinc metal sold. Sales volumes of lead concentrate were higher than in 1982, but these gains were offset by lower prices.

The implementation of a stringent efficiency program, with effective cooperation between the workforce and management, held operating costs to about the same level as in the previous year despite the thinning orebody and lower grades.

Underground exploration continued to locate ore but overall reserves declined by 200,000 tons *(181,000)*. In the primary area of interest east of the mine, 24 holes totalling 65,499 feet *(19,964 metres)* were drilled without significant mineralization being located. Surface exploration expenditures were $3.3 million compared with $2.5 million in 1982.

Greenex employed 357 workers at the beginning of 1983 and 347 at year-end. Of the employees at Maarmorilik, 153 were Greenlanders, an increase of 21 over 1982.

		1983	1982
Ore milled	tons	744,000	744,000
	(tonnes)	*(675,000)*	*(675,000)*
Zinc			
Average grade		12.3%	12.6%
Concentrate	tons	150,300	154,900
	(tonnes)	*(136,300)*	*(140,500)*
Concentrate grade		58.1%	56.9%
Lead			
Average grade		3.6%	4.5%
Concentrate	tons	33,800	41,300
	(tonnes)	*(30,700)*	*(37,500)*
Concentrate grade		70.5%	70.7%
Silver	oz/ton	0.8	1.0
	(g/tonne)	*(28)*	*(35)*
No. of employees at year-end		347	357

Con Mine

The Con gold mine is in Yellowknife, N.W.T. Ore produced at the mine is milled and refined there and the gold is sold in Canada.

The amount of ore processed in 1983 was lower than in 1982 because of a two-month strike at mid-year. The adverse cost effects of lower production were more than offset by higher gold prices, resulting in a profit of $8 million in 1983, compared with $7 million in 1982. Revenues fell to $36 million from $37 million in 1982.

A decision to deepen the Robertson Shaft by 810 feet *(247 m)* to 6,235 feet *(1,900 m)* was made late in the year. The deepened shaft will provide four more working levels and the opportunity to explore further at greater depth. The $9 million project is scheduled for completion in 1985.

Final commissioning of the new arsenic recovery plant was delayed because of difficulties in reaching process and product specifications. Engineering revisions have been made and the plant is expected to operate at design capacity in 1984.

		1983	1982
Ore milled	tons	209,200	234,200
	(tonnes)	*(189,800)*	*(212,400)*
Gold			
Average grade	oz/ton	0.36	0.36
	(g/tonne)	*(12)*	*(12)*
Production	ounces	70,500	79,500
	(kg)	*(2,193)*	*(2,471)*
No. of employees at year-end		317	309

Valley Mine

The Valley copper mine in the Highland Valley, B.C., began operations on January 17, 1983, two months ahead of schedule. Its concentrates are sold directly to smelters in Japan. The ore, processed at the former Bethlehem Copper Corporation mill, proved more

amenable both to grinding and to copper recovery than preliminary tests had indicated, resulting in production being consistently above expectations. However, copper prices were low in 1983, peaking in May at 81.8 US cents a pound on the London Metal Exchange and falling to 66.1 US cents a pound at year-end. Revenues were $54 million and the operating profit was $7 million.

The Valley Mine, if developed to its full potential, could sustain an operating level of 90,000 to 110,000 tons *(80,000 to 100,000)* of ore a day, five times the present level of operation. The mine is situated on Canada'a largest known porphyry copper deposit. The measured and indicated ore reserve is estimated to be 509 million tons *(460 million)* with an average grade of 0.475 per cent copper. Valley has additional inferred ore reserves of 272 million tons *(248 million)* at the same grade. A phased expansion program, which would include a new concentrator with a daily capacity of 50,000 tons *(45,000)*, is being examined.

		1983
Ore milled	tons	7,906,000
	(tonnes)	*(7,172,000)*
Copper		
Average grade		0.52%
Contained in concentrate	tons	36,700
	(tonnes)	*(33,300)*
Concentrate grade		44.4%
No. of employees at year-end		427

Buckhorn Mine

Located in Eureka County, Nevada, Buckhorn is a low-grade heap-leach gold operation in which Cominco American Incorporated has a 76 per cent interest. Development plans were announced in September with development and construction costs projected at US$12 million. This included the purchase of mining equipment; construction and erection of crushing, agglomerating and stacking equipment; the preparation of heap-leaching pads and ponds; and the construction of roads and processing and office facilities.

Known ore reserves of about 5 million tons *(4.5 million)* of ore will be processed over the scheduled seven-year life of the mine at a rate of 750,000 tons *(680,000)* a year. Plans call for the initial processing of 2.8 million tons *(2.5 million)* of ore grading 0.059 ounces per ton *(2.0 grams per tonne)* of gold. After this higher-than-average-grade tonnage is processed, the remaining lower-grade tonnage will be processed. The mine is expected to reach full production rates in the second quarter of 1984.

Buckhorn will employ 75 persons when in full production.

Magmont Mine

The Magmont lead-zinc-copper mine at Bixby, Missouri, operated by Cominco American Incorporated under a joint-venture arrangement with Dresser Industries Incorporated,continued to be a profitable operation during 1983 notwithstanding the effect of severely depressed lead prices.

Cominco's 50 per cent share of the revenue was $24 million, the same as in 1982. The operating profit in 1983 was $2 million compared with $3 million in 1982, a reduction brought about by lower metal prices. However, increased sales of byproduct zinc concentrate helped to offset the low lead prices. Production of lead concentrate was higher during 1983, primarily due to higher grade ore. A new drift driven 2 miles *(3 km)* from the Magmont shaft to open up the Magmont West area was completed during the year. Production at Magmont West began late in the year, and a significant amount of ore is expected to be mined in this area in 1984.

A new contract for tolling lead concentrate was negotiated with a Missouri custom smelter during the year.

		1983	1982
Ore milled[1]	tons	1,142,000	1,107,000
	(tonnes)	*(1,036,000)*	*(1,004,000)*
Lead			
Average grade		7.2%	6.5%
Concentrate	tons	52,100	44,500
	(tonnes)	*(47,300)*	*(40,400)*
Concentrate grade		77.4%	78.9%
Zinc			
Average grade		1.4%	1.0%
Concentrate	tons	10,700	7,000
	(tonnes)	*(9,800)*	*(6,400)*
Concentrate grade		60.8%	60.0%
Copper			
Average grade		0.2%	0.3%
Concentrate	tons	1,300	2,900
	(tonnes)	*(1,200)*	*(2,600)*
Contained in concentrate	tons	400	900
	(tonnes)	*(300)*	*(800)*
No. of employees at year-end		181	186

[1] This mine is a joint venture of Cominco American Incorporated and Dresser Industries Incorporated. Ore milled is reported at 100 per cent; the concentrate tonnage reported is Cominco's 50 per cent share of production.

Bixby, Missouri: the headframe of the Magmont Mine.

Trail Metallurgical Operations

Production of Refined Metals

		1983	1982
Zinc	tons	239,800	225,800
	(tonnes)	*(217,500)*	*(204,800)*
Lead	tons	132,300	126,600
	(tonnes)	*(120,000)*	*(114,900)*
Silver[1]	oz	10,235,000	9,681,000
	(kg)	*(318,300)*	*(301,100)*
Gold	oz	21,400	24,800
	(kg)	*(666)*	*(771)*

[1] In 1983, 3,717,000 ounces *(115,609 kilograms)* came from Company-owned sources, compared with 3,489,000 ounces *(108,516)* in 1982.

The integrated smelter and refining complex at Trail produces a wide range of metals, principally refined zinc, lead and silver. Annual production capacity is 300,000 tons *(272,000)* of refined zinc and 150,000 tons *(136,000)* of refined lead. In 1983, over 50 per cent of Cominco's Canadian-mined zinc and lead was upgraded to refined metal in Trail. Additional quantities of custom concentrates are purchased and refined at Trail. Other products include phosphate and sulphate fertilizers. Electric power from Cominco's two generating stations is used by Cominco and any surplus is offered to West Kootenay Power and Light Company, Limited and to other utilities.

Revenues from Trail operations, increased to $402 million from $328 million in 1982. The operating loss was reduced by $9 million to $35 million. Silver prices and quantities sold were significantly higher than in 1982. Realized prices for zinc were above 1982 levels but lead prices declined sharply. The simultaneous operation of the new and old electrolytic zinc melting plants during the new plant's commissioning period slightly increased operating costs for zinc production. These costs are expected to improve in 1984 as the new facility reaches its rated capacity and the old plant is shut down.

Refined zinc production at Trail was 239,800 tons *(217,500)* compared with 225,800 tons *(204,800)* in 1982 despite an eight-day strike, a six-month interruption in the supply of zinc concentrates from Pine Point Mines Limited, and the processing of increased quantities of custom concentrate containing a higher level of metal byproducts. Higher production resulted from the enhanced reliability of the new zinc pressure leaching plant and from the output of the new zinc electrolytic and melting plant.

Refined lead production at Trail was 132,300 tons *(120,000)* compared with 126,600 tons *(114,900)* in 1982. This high rate resulted from the plan to maximize silver production, including the purchase of concentrates with high silver content, to offset uneconomic lead prices and to increase revenues. Silver production in the year totalled 10,235,000 ounces *(318,300 kg)* compared with 9,681,000 ounces *(301,100 kg)* in 1982. Purchases of custom concentrates accounted for 6,518,000 ounces *(202,733 kg)* in 1983 compared with 6,192,000 ounces *(192,593 kg)* in 1982.

Gold production at Trail in 1983 was 21,400 ounces *(666 kg)* compared with 24,800 ounces *(771 kg)* in 1982. This decrease was mainly the result of the lower gold content in purchased custom concentrates.

The modernization and expansion program initiated at Trail in 1977 continued during 1983, but at a substantially reduced rate. Expenditures were $25.7 million compared with $68 million in 1982, and several large projects, including the lead smelting modernization project, have been deferred until market conditions and corporate earnings improve.

The new zinc electrolytic and melting plant (see page 3) officially opened in October. Earlier, a project to improve the recovery of sulphur gas from the metallurgical operations went into service (see Environmental Protection, page 19).

As a result of the plan to reduce crew sizes and to curtail construction projects, 3,659 persons were employed at Trail at year-end compared with 4,036 at the beginning of the year.

Ore Reserves

	1983				1982			
	Ore Tons x1000	%Pb	%Zn	Ag oz/ton	Ore Tons x1000	%Pb	%Zn	Ag oz/ton
OPERATING MINES								
(Measured and Indicated)								
SULLIVAN	47,000	4.4	6.2	1.0	49,000	4.4	6.1	1.0
PINE POINT	26,000	2.7	6.3	—	35,000	2.4	6.1	—
POLARIS	18,600	4.1	14.8	—	11,000	4.4	15.2	—
BLACK ANGEL	2,000	3.3	11.0	0.8	2,200	4.0	13.4	1.0
MAGMONT	6,200	8.0	1.0	0.4	5,200	9.4	1.2	0.3
QUE RIVER	2,200	7.4	12.7	6.0	2,100	7.5	13.1	5.5
RUBIALES	12,300	1.1	6.9	0.4	14,300	1.2	6.9	0.4
CON	1,900	0.44 oz Au/ton		—	2,100	0.47 oz Au/ton		—
BUCKHORN	5,100	0.04 oz Au/ton		—	—	—		
VALLEY	509,000	0.475% Cu		—	500,000	0.475% Cu		
ARDLETHAN	400	0.51% Sn			900	0.44% Sn		
CLEVELAND	900	0.80% Sn			1,300	0.73% Sn		
WARM SPRINGS	7,700	30.0% P_2O_5			7,300	30.0% P_2O_5		
VADE	153,000	25.3% K_2O equiv.			155,000	25.3% K_2O equiv.		
OWENS LAKE	33,000	sodium carbonate equiv.			33,000	sodium carbonate equiv.		
HONDEKLIP	400	0.4 carats diamonds/ton			500	0.4 carats diamonds/ton		
FORDING	237,000	clean met. coal equiv.			239,000	clean met. coal equiv.		
OPERATING MINES								
(Inferred Ore)								
POLARIS	5,900	3.0	13.1	—	13,200	3.6	11.9	—
BLACK ANGEL, PLATEAU	360	3.9	8.8	1.0	360	3.9	8.8	1.0
MAGMONT WEST	3,100	3.5	1.9	0.4	3,900	3.4	1.5	—
QUE RIVER	2,200	2.8	5.3	1.4	2,900	2.9	5.7	1.5
VALLEY	272,000	0.475% Cu		—	300,000	0.475% Cu		
POTENTIAL MINES								
(Measured, Indicated and Inferred)								
RED DOG	85,000	5.0	17.1	2.4	85,000	5.0	17.1	2.4
TROYA	5,500	1.2	10.7	0.5	5,500	1.2	10.7	0.5
PINCHI	1,200	6.4 lbs. Hg/ton			1,200	6.4 lbs. Hg/ton		
DOUGLAS	12,000	31.0% P_2O_5 equiv.			12,000	31.0% P_2O_5 equiv.		
FORDING	2,100,000	thermal coal			2,100,000	thermal coal		

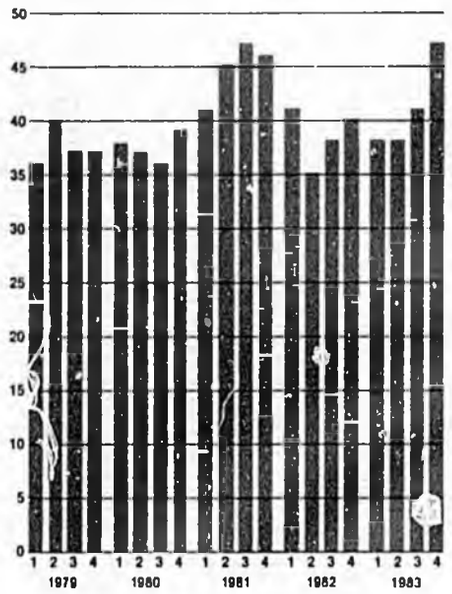
Mineral reserves of Cominco and associated companies are classified as measured, indicated and inferred.

The term *measured* is limited to those reserves at a mine which can be projected from one or more exposed faces on the basis of actual operating results. Reserves are classified as *indicated* where there is sufficient information about the deposit or a portion of it to form the basis of a mine production forecast. Reserves computed on the basis of limited drilling, geological data and through application of geological projections, which are insufficient to support a mine production forecast, are classified as *inferred*.

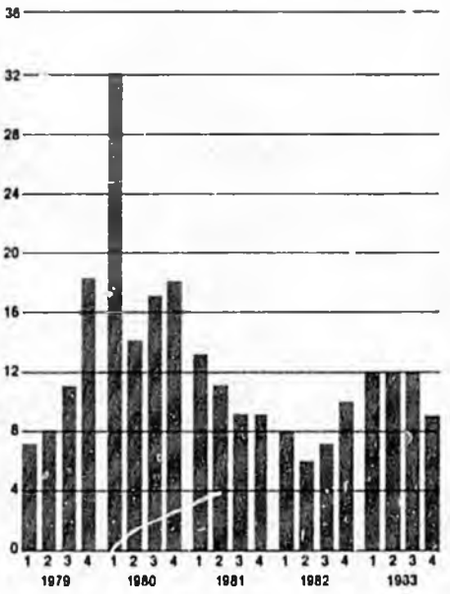
The Year in Review

Quarterly Average Metal Prices

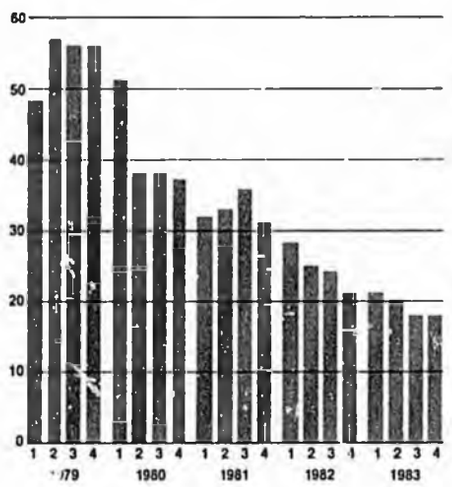
Zinc-U.S. Producer Price (U.S. cents/lb.)
(Source: Metals Week)



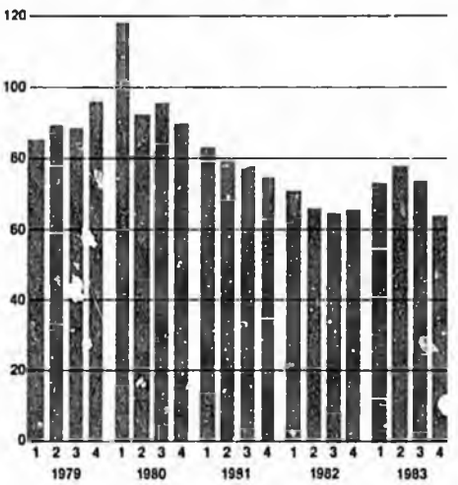
New York Silver Price (U.S. dollars/troy ounce)



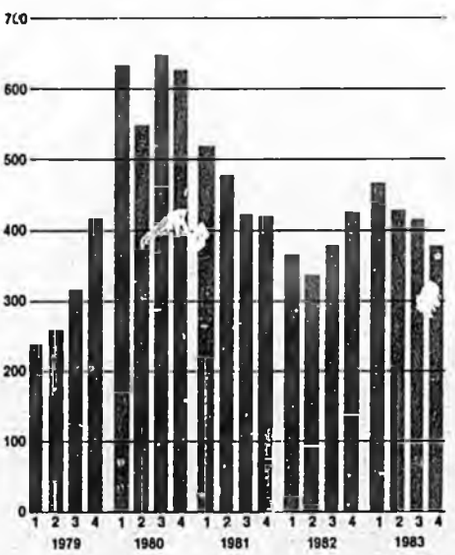
LME Lead Price (U.S. cents/lb.)



LME Copper Price (U.S. cents/lb.)



London Gold Price (U.S. dollars/troy ounce)



Vancouver, B.C.: Cominco zinc from Trail in rail cars awaits export. The Company's head office is located in the Granville Square building in the background. ▷

Chemicals and Fertilizers

Revenues and Operating Profit (Loss)

	Revenues		Operating Profit (Loss)	
	1983	1982	1983	1982
			(millions)	
Kimberley	$ 44	$ 28	$ (3)	$ (4)
Carseland	126	115	25	27
Calgary	25	33	2	4
Borger	56	65*	(5)	(5)
Beatrice	6	18*	(1)	3
Vade	88	74	11	12
Products for resale and others	101	89	5	—
	$446	$422	$ 34	$ 37

*Revenues have been restated to conform with the 1983 presentation.

First Quarter	$ —	$ 7
Second Quarter	22	32
Third Quarter	(3)	(3)
Fourth Quarter	15	1
	$ 34	$ 37

Cominco is a fully integrated plant food producer operating at eight locations in Canada and the United States — at Trail and Kimberley, B.C.; Carseland and Calgary, Alberta; Vade, Saskatchewan; Warm Springs, Montana; Beatrice, Nebraska; and Borger, Texas. The revenues from the Trail fertilizer operations are included in the mining and integrated metals segment because the operations form a part of the sulphur recovery process of the metallurgical operations.

The principal products are ammonia, ammonium nitrate, ammonium phosphate, ammonium sulphate, potash and urea. About one-half of the Company's 1983 total chemical and fertilizer products were sold in the U.S. market by Cominco American Incorporated. The remainder is marketed in Canada and other countries. Substantial quantities of potash are sold to Canpotex Ltd., a marketing corporation owned by Saskatchewan potash producers, which sells potash outside North America. About 60 per cent of Cominco's potash is sold in the United States. In addition to the chemicals produced and used in the manufacture of fertilizers, Cominco produces sulphuric acid and sulphur dioxide for sale to the forest industry, and trona, which is sold for use in the production of borax.

The Industry

Consumption and prices of fertilizers in the United States continued to fall during the spring of 1983 as a result of poor markets for U.S. farm exports and the U.S. Government's Set Aside and Payment-in-Kind (PIK) programs. These programs reduced major crop acreage by more than 50 million acres *(20 million hectares)*.

As the full impact of the U.S. programs took effect, severe drought conditions were experienced in much of the midwest, and U.S. feed grain inventories fell below normal levels. Prices for feed grains and oilseeds increased significantly. Wheat was an exception, and wheat inventories remained high throughout the year in both Canada and the United States.

Canadian fertilizer consumption increased for all major types of fertilizers, largely due to continuing strong Canadian grain exports. Nitrogen fertilizer consumption in western Canada increased by 5.7 per cent in 1983 while U.S. consumption declined by 16.3 per cent. Sales of nitrogen in western Canada by Canadian manufacturers increased by 10 per cent due to decreased imports from the United States.

Phosphate consumption increased by 5.3 per cent in western Canada in 1983, but declined by 13.5 per cent in the United States.

Canadian phosphate manufacturers increased their participation in the western Canadian phosphate market with corresponding decreases in imports from the U.S. Exports to the U.S. were down substantially.

U.S. consumption of potash in 1983 was 13.8 per cent lower than in 1982.

Prices for all fertilizers continued to soften during the first half of 1983, but stabilized during the third quarter and strengthened significantly in the fourth quarter.

To control inventories, much of the fertilizer industry in North America was shut down during part of the year. Inventories of fertilizer products in Canada were normal or below normal for most products by year-end.

Summary of Results

The increase in revenues from the chemicals and fertilizers segment was due to higher sales volumes of most products, although these were partially offset by lower prices. Operating profits were lower mainly because of lower prices received for most products. The Vade operations received lower prices for potash but benefited from higher levels of production.

During the first half of the year, operating profits continued to be depressed by the weak markets that had developed in the latter part of 1982. The strong fourth-quarter performance resulted from increased sales volumes.

Kimberley Operation

The production of ammonium phosphate fertilizer at Kimberley, B.C. rose by 18 per cent over 1982, and sulphuric acid production increased by 9 per cent, although operations were shut down for eight weeks at mid-year for annual maintenance and inventory control.

Revenues were $44 million compared with $28 million in 1982. The $3 million operating loss in 1983 compared with a $4 million loss in 1982. Sales volumes were well ahead of the previous year but at lower prices. However, losses decreased due to lower production costs.

The production of ammonium phosphate fertilizer was 151,000 tons *(137,000)* compared with 123,600 tons *(112,100)* in 1982.

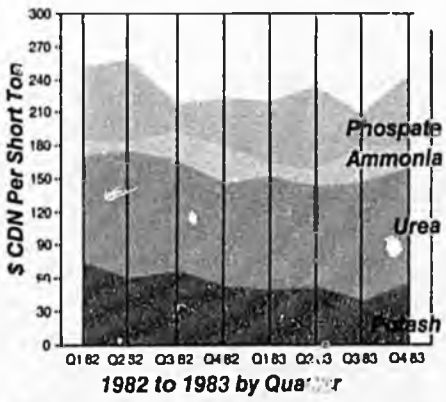
There were 152 persons employed at the Kimberley fertilizer operations at the beginning of the year, and 143 at year-end.

Warm Springs Operation

Phosphate rock is produced at Cominco American Incorporated's Warm Springs, Montana operation from an underground mine and is shipped to Kimberley for use in the manufacture of phosphate fertilizer. Production for 1983 was 188,000 tons *(171,000)* compared with 186,000 tons *(169,000)* in 1982.

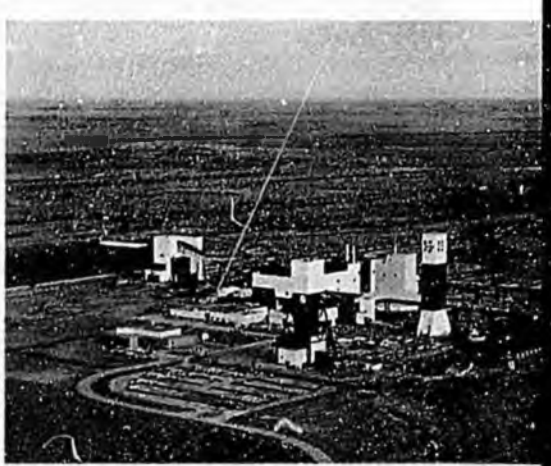
Warm Springs was shut down for a total of four weeks during the year for inventory control. The operation employed 114 persons at the beginning and the end of the year.

Fertilizer Prices



1982 to 1983 by Quarter

Calgary, Alberta: the Carseland fertilizer △ operation is one of Cominco's eight plant food facilities in North America.



Vanscoy, Saskatchewan: record production △ at the Vade potash mine in 1983 reflected the completion of major expansion which included the new headframe, right.

◁ Vanscoy, Saskatchewan: wheat farmer Stan Mogenson (right) chats with Cominco employee George McVittie. They are standing 3,530 feet (1,075 metres) above the Vade potash mine. Mr. Mogenson farms 1,500 acres (600 hectares) owned by the Company.

Carseland Operation

The Carseland fertilizer operation produces ammonia and urea. Ammonia production was slightly below the previous year's level because of increased maintenance downtime. Urea production was reduced because of the diversion of ammonia feedstock from urea to meet market demands for ammonia. In 1983, 436,700 tons *(396,200)* of ammonia and 465,900 tons *(422,700)* of urea were produced, compared with 439,800 tons *(399,000)* of ammonia and 494,200 tons *(448,300)* of urea in 1982.

Revenues increased by $11 million to $126 million in 1983 due to higher sales volumes but at lower prices. The operating profit was lower by $2 million. Distribution costs were higher and lower operating costs only partially offset the lower selling prices.

There were 140 employees at the beginning of the year, and 137 at year-end.

Calgary Operation

Lower demand and prices necessitated a 24 per cent reduction of total fertilizer production in 1983 to 158,800 tons *(144,100)* compared with 208,600 tons *(189,200)* in 1982. The urea plant was shut down for 29 weeks because of poor market conditions.

Revenues were $25 million in 1983 compared with $33 million in 1982. The operating profit was $2 million compared with $4 million in the previous year. Sales volumes of ammonia increased but prices were lower. Prices and sales volumes for urea, ammonium nitrate and urea sulphur were also below 1982 levels.

There were 141 employees at the Calgary fertilizer operation at the beginning of the year, and 121 at year-end.

Borger Operation

The production of anhydrous ammonia and urea at Borger, Texas by Cominco American Incorporated declined as the result of production curtailments to control high inventories. The 1983 ammonia production was 240,800 tons *(218,500)* compared with 285,500 tons *(259,000)* in 1982.The 1983 urea production was 51,700 tons *(46,900)* compared with 55,400 tons *(50,300)* in 1982.

The Borger operation was shut down for the month of January, and for three months in the fall for inventory control and maintenance purposes. Revenue was $56 million in 1983, $9 million lower than in 1982. The operating loss remained unchanged at $5 million.

The number of employees was 84 at the beginning of the year and 81 at year-end.

Beatrice Operation

Cominco American Incorporated's Homestead ammonium nitrate plant at Beatrice, Nebraska produced 123,600 tons *(112,100)* in 1983 compared with 113,300 tons *(102,800)* in 1982. The Homestead plant operated through the year, although because of weak demand the production rate was curtailed to control inventories. Sales tonnages were about 60 per cent of the 1982 level and prices were 4 per cent lower. Revenue was $6 million in 1983, down significantly from $18 million in 1982 and a $1 million operating loss was incurred.

The number of employees was 56 at the beginning of the year and 60 at year-end.

Vade Operation

Potash is produced at the Vade operation near Saskatoon, Saskatchewan. Demand for potash was low in all markets through the first eight months of the year, resulting in lower prices and high inventories. A marked increase in demand in the last four months reduced inventories to normal levels by year-end with some strengthening in prices. The plant was shut down for nine weeks during the year: six weeks for inventory control, and three for maintenance.

Production for the year was 1,123,000 tons *(1,018,000)* compared with 794,000 tons *(720,000)* in 1982. This established a production record, reflecting the completion of a major expansion project in 1982. Production per man-shift rose significantly.

Revenues were $88 million in 1983 compared with $74 million in 1982. The operating profit decreased from $12 million to $11 million. Sales tonnages increased by 34 per cent but selling prices were 8 per cent lower. Unit operating costs were substantially lower due to the increased production, but distribution costs were higher.

There were 442 persons employed at the beginning of the year and one less at year-end.

Owens Lake, California: a unique diking system in the lake bed recovers trona at the Lake Minerals operation.

Lake Minerals

Lake Minerals Corporation generated revenues of US $1.6 million from its Owens Lake, California trona mining operation in 1983. This compares with US $0.7 million in 1982.

The operating profit was US $0.7 million compared with US $0.2 million in 1982. Improved demand resulted in the production of 45,000 tons *(41,000)* of trona, compared with 34,000 tons *(31,000)* mined in the previous year.

Other Operations

Revenues and Operating Profit

	Revenues		Operating Profit (Loss)	
	1983	1982	1983	1982
			(millions)	
Electronic Materials	$ 47	$ 37	$ 2	$ 3
Western Canada Steel	58	76	(4)	2
West Kootenay Power	53	51	18	13
Miscellaneous	11	11	1	3
	$169	$175	$ 17	$ 21
First Quarter			$ 4	$ 7
Second Quarter			4	5
Third Quarter			4	5
Fourth Quarter			5	4
			$ 17	$ 21

This segment of Cominco's business comprises principally the operations of the Electronic Materials Division, Western Canada Steel Limited and West Kootenay Power and Light Company, Limited. Miscellaneous operations include the activities of Cominco Engineering Services Ltd. and European holding and trading companies.

Summary of Results

The fall in revenues and operating profits in this segment was mainly due to lower sales by Western Canada Steel Limited because of the reduced construction activity in its market areas, and the closure of its Vancouver plant for six and one-half months during a labour dispute.

Electronic Materials Division

The Electronic Materials Division produces high-purity materials and compound semiconductors in facilities at Trail. In addition, the production of fabrications, bonding wire and ribbon and sputtering products is conducted through the facilities of a wholly owned subsidiary of Cominco American Incorporated, Cominco Electronic Materials Incorporated, in Spokane, Washington. Seventeen elements, including aluminum, arsenic, gallium, gold, silver, indium and tellurium are refined to high purity to meet the special needs of the electronics industry. Seven compound semiconductors, including cadmium mercury telluride, gallium arsenide and indium antimonide, are in commercial production for use in infrared radiation detection devices, communication equipment and high-speed microcircuits.

Revenues from Electronic Materials were $47 million compared with $37 million in 1982 as a result of higher gold prices and higher sales volumes. The operating profit was $2 million, $1 million less than in 1982 because of increased development and administration costs.

Sales of compound semiconductor wafers increased steadily throughout the year. High-performance cadmium mercury telluride wafers produced in the Trail plant completed in 1982 are being further developed for new applications. The first stage of the gallium arsenide expansion program was completed in 1983. Cominco's gallium arsenide wafers are now recognized as the leading product in the market and, with the resulting rapid growth in demand, a further expansion of production facilities at Trail is in progress.

The marketing group was further strengthened during 1983 with the addition of staff in Canada and the conclusion of a sales agency agreement with two Japanese firms for the Asian Pacific market areas.

The total number of employees in Electronic Materials in Spokane and Trail was 221 at the beginning of the year and 248 at year-end.

Western Canada Steel

Western Canada Steel Limited (100 per cent owned) operates plants producing steel products from scrap metal in Vancouver and Calgary and at Hawaiian Western Steel Limited (51 per cent owned) on the island of Oahu, Hawaii.

Revenues of Western Canada Steel declined from $76 million in 1982 to $58 million in 1983 principally because of lower sales volumes resulting from a lock-out at the Vancouver operations which lasted six and one-half months.

The Vancouver plant production for the year was 37,500 tons *(34,000)* compared with 94,200 tons *(85,400)* in 1982. The labour dispute delayed the start-up of the tandem rolling mill by seven months to March 1984. The new $24 million continuous mill will increase the volume and size range of steel products.

The Calgary plant produced 87,000 tons *(78,900)* of steel during the year compared with the near-capacity total of 96,600 tons *(87,600)* in 1982.

The Hawaiian plant continued to operate at one-half of its capacity, with production and sales of 26,000 tons *(23,600)* of steel, the same as in 1982. This reflected the continuing low level of construction activity in Hawaii.

West Kootenay Power and Light

West Kootenay Power and Light Company, Limited, in Trail, B.C., provides electrical energy for residential and industrial customers in south central British Columbia.

Despite the slow recovery from the recession in its service area, energy sales were only slightly below 1982 levels. In anticipation of higher costs in 1984, the British Columbia Utilities Commission granted West Kootenay a 7.3 per cent interim rate increase effective January 1, 1984.

Construction began in 1983 on the extension of West Kootenay's 230 kV transmission system from Kelowna to Penticton, B.C. Work continued on the conversion of the subtransmission system in the Kelowna area from 60 kV to 138 kV. The period for making the conversion has been extended to match the slow load growth in the area. West Kootenay continued its policy of undertaking new construction of facilities only when needed for load growth or to ensure continuing reliable service.

In the first quarter of 1983, West Kootenay converted $35 million of short-term floating-rate bank debt to fixed-rate longer-term debt.

In 1982 West Kootenay purchased three power plants and concluded a long-term power purchase agreement with Cominco. A detailed analysis is in progress on the various power supply alternatives available to meet anticipated increases in power demand in the West Kootenay service area.

Cominco Engineering Services

Cominco Engineering Services Ltd., formed to sell expertise gained in the development of Cominco operations, completed its second full year of operation in 1983. The subsidiary, with offices in Vancouver and Trail, worked for Cominco, for associated companies and for other customers in Canada, Norway, Spain and the United States.

Associated Companies

Associated companies are those in which Cominco's interest is 50 per cent or less and over which it has significant influence.

Associated Companies	Percentage Ownership	Revenues		Share of Net Earnings (Loss)	
		1983	1982	1983	1982
			(millions)		
Fording Coal Limited	40	$217	$269	$ 1.6	$ 4.7
Aberfoyle Limited	47	56	62	0.4	(1.3)
Exploración Minera Internacional España S.A. (Exminesa)	48	37	54	(0.1)	1.4
Transcom Joint Venture	50	4	7	0.2	0.8
The Canada Metal Company Limited	50	56	63	(0.1)	(0.4)
Other		39	51	0.3	—
		$409	$506	$ 2.3	$ 5.2

Fording Coal

Fording Coal Limited is engaged in the mining and development of metallurgical and thermal coal reserves in southeastern B.C. and Alberta. Revenues were $217 million in 1983, compared with $269 million in 1982, and Cominco's share of net earnings for the year was $1.6 million compared with $4.7 million in 1982.

Despite depressed worldwide coal markets, an 82-day strike, and a 15 per cent price reduction to principal buyers, a modest profit was made due to continued improvements in productivity. The quantity of coal and waste moved per man-shift has almost doubled since 1981.

Fording's production and sales of metallurgical clean coal from its surface operations near Elkford, B.C. were 3,041,000 tons *(2,759,000)* and 3,250,000 tons *(2,949,000)* respectively, compared with production of 4,299,000 tons *(3,900,000)* and sales of 3,786,000 tons *(3,435,000)* in 1982.

Fording's joint venture with Edmonton Power, the city-owned utility, to establish a thermal coal mine at Genesee, Alberta has been delayed by 18 months due to surplus generating capacity in the province. The estimated total cost of the coal mine, which will fuel an electric generating station, is $100 million, with operation now planned for 1987.

Aberfoyle

Aberfoyle Limited of Australia operates a zinc-lead-silver mine in Tasmania and two tin mines, one in Tasmania and the other in New South Wales. Aberfoyle had revenues of $56 million in 1983, compared with $62 million in 1982. Net earnings of Aberfoyle for 1983 were A$2.9 million. After translation into Canadian dollars and amortization of other investment costs, Cominco's share of the earnings was $0.4 million compared with a loss of $1.3 million in 1982.

Aberfoyle's revenues were adversely affected by lower production, by low zinc and lead prices which prevailed during the year and by continuing export restrictions imposed by the International Tin Council, of which the Australian Government is a member. This restriction required the company to reduce production from its Ardlethan and Cleveland mines.

The Que River zinc-lead-silver mine in Tasmania produced 255,000 tons *(231,000)* of ore and delivered 240,200 tons *(217,900)* to a custom concentrator.

Exploration results in 1983 were encouraging. Several diamond drill intersections were made at Hellyer, a new zinc-lead-silver sulphide discovery close to Que River. Grades and thicknesses approach those at Que River and drilling is continuing to define the deposit.

The search for diamonds in the Northern Territory was encouraging during the year, and direct testing of a number of targets is expected to take place in 1984.

Exminesa

Exminesa's (Exploración Minera Internacional España SA) Rubiales Mine in the Spanish province of Lugo had revenues of $37 million in 1983

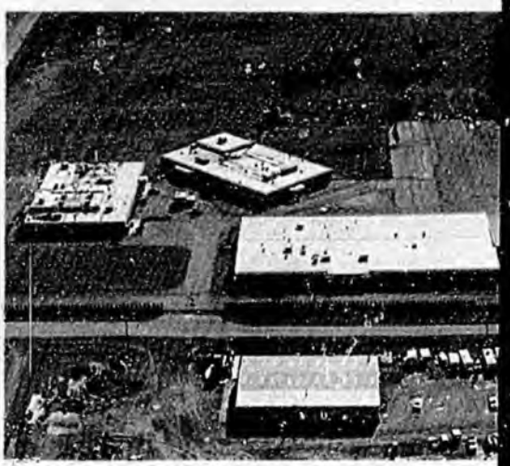
Summary of Financial Position of Associated Companies

	1983	1982
		(millions)
Working Capital	$ 39.2	$ 52.6
Fixed Assets	350.7	347.8
Other Assets	7.6	6.4
	397.5	406.8
Less: Long-term debt	101.4	121.4
Other non-current liabilities	17.0	15.0
Income taxes not currently payable	74.6	67.5
Net assets	$204.5	$202.9
Cominco's share of net assets	$ 91.0	$ 90.2

Summary of Results of Operations of Associated Companies

	1983	1982
		(millions)
Revenues	$408.9	$506.2
Costs and expenses	398.7	471.8
Earnings before the following	10.2	34.4
Income taxes	7.9	8.1
Exchange gain (losses) on translation of foreign companies	2.4	(1.4)
Total net earnings of associated companies	$ 4.7	$ 16.9
Cominco's share of net earnings	$ 2.3	$ 5.2
Dividends received by Cominco	$ 3.4	$ 4.8

A commitment to quality: these vacuum deposition products from the Electronic Materials Division meet the increasingly sophisticated requirements of the electronics industry. △



Spokane, Washington: Cominco Electronic Materials Incorporated's plants make fabrications, bonding wire, ribbon and sputtering targets. △

Vancouver, B.C.: the new continuous rolling mill at Western Canada Steel increases the volume and size range of steel production. △

◁ *Rubiales, Spain: The scenic countryside of Galicia surrounds the headframe of Exminesa's mine in the province of Lugo.*

compared with $54 million in 1982. After recording an exchange translation gain of $1.0 million, Cominco's share of the loss was $0.1 million. This compares with earnings of $1.4 million in 1982, after an exchange translation loss of $1.3 million. The 1983 loss resulted from low metal prices and reduced production caused by continuing ground control problems in the mine.

In 1983, the Rubiales concentrator treated 921,000 tons *(836,000)* of ore compared with 1,144,000 tons *(1,038,000)* in 1982. Zinc concentrate production was 103,900 tons *(94,300)* compared with the production of 146,800 tons *(133,200)* in 1982. Lead concentrate production was 16,400 tons *(14,800)*, compared with 19,300 tons *(17,500)* in 1982. Adjustments were made to ore reserves mainly to allow for unrecoverable pillars.

During the year, a basic engineering study was completed for the development of Exminesa's zinc-lead deposit at Troya in the province of Guipúzcoa, Spain. This property has inferred reserves of 5.5 million tons *(5.0 million)* of zinc and lead ore containing small amounts of copper and silver.

Transcom Joint Venture

Production from the small alluvial diamond mine at Hondeklip, South Africa, in which Cominco has a 50 per cent interest, was 53,100 carats in 1983 compared with 97,200 carats in 1982. Revenues were $4 million in 1983 compared with $7 million in 1982, as a result of lower production and higher costs. Cominco's share of the net earnings was $0.2 million compared with $0.8 million in 1982. The terms of employment of the 61 persons on the staff and work force of the Transcom Joint Venture conform with the Canadian Government's guidelines for Canadian companies operating in South Africa.

Canada Metal

The Canada Metal Company Limited is a major Canadian manufacturer of secondary lead and a fabricator of lead and other metal products. Carter Chem Ltée, Montreal, a subsidiary, is the principal manufacturer in Canada of lead chemicals.

Canada Metal had sales of $58 million in 1983 compared with $63 million in 1982. The decline is attributed mainly to the lower value of lead metal. Cominco's share of the net loss was $81,000 compared with a loss of $400,000 in 1982.

Cominco Binani Zinc

During the year, Cominco agreed to sell its 40 per cent interest in Cominco Binani Zinc Limited to the remaining shareholders subject to the approval of the Reserve Bank of India.

Other Investments

Investments in other companies are carried at cost in the accompanying financial statements, less amounts written off due to the uncertainty of the future value of the investments. Income is recorded only to the extent of dividends received. No dividends were received during the year.

Cominco sold its entire 17.2 per cent interest in Tara Exploration and Development Company Limited on January 20, 1984. Proceeds from the sale of 1,125,724 Tara shares, at $20 each, was approximately $22.5 million.

Panarctic Oils Ltd. (6.9 per cent owned) continues to capitalize its exploration costs as none of its properties is in production. Natural gas reserves in the Arctic Islands are 18 trillion cubic feet, insufficient to justify a pipeline under present conditions. Oil discoveries in the region indicate the possibility of substantial oil reserves.

Exploration

The objectives of Cominco's exploration program are to extend known reserves at existing mines, and to discover new deposits that could be developed into profitable mines.

Exploration expenditures in 1983 totalled $35.0 million compared with $42.0 million spent in 1982. Investigation and appraisal of identified mineral properties accounted for $14.3 million. This amount was capitalized as investments in mineral properties and is being amortized against earnings. The remaining $20.7 million was spent on general exploration and charged against 1983 earnings. In addition to these amounts, an expenditure of $7.7 million was made on the continuing evaluation of the Red Dog property in Alaska.

Exploration for new deposits was carried out in North America, Europe and Australia, and on a selected basis in South America and Africa. Projects in Canada accounted for 43 per cent of the total expenditures; 25 per cent was spent on projects in the United States; and the remaining 32 per cent on projects in 12 other countries.

While the major part of Cominco's 1983 exploration program was directed towards the search for zinc, lead and gold deposits, specific programs sought other metals, including silver, copper, phosphate, niobium, diamonds and tin.

Diamond drilling programs were carried out on over 30 properties with results in more than half of them being sufficiently encouraging to justify further exploration.

The search for zinc deposits included programs in Canada, the United States, Europe and Australia. In the central Yukon Territory of Canada, significant zinc-lead-silver values were obtained by drilling. In Australia, drilling is currently in progress on a promising new discovery only 2 miles *(3 km)* north of Que River in Tasmania. Grades in excess of 20 per cent zinc, plus lead and 6 ounces of silver a ton *(206 grams per tonne)* have been found.

In Alaska, work continued by Cominco American Incorporated in the Noatak area, where the large Red Dog high-grade zinc-lead-silver deposit is located. Engineering studies and economic assessments continued in order to select the most suitable development plan for Red Dog. Other showings of interest are held in the immediate area, and drilling on two sites in 1983 gave additional encouraging results.

The search for gold and silver deposits was intensified, with programs carried out in all geographical areas being explored by Cominco. The low-grade Buckhorn leach gold open-pit operation moved from the exploration and feasibility stages of development to plant construction. Exploration continues in Nevada for similar deposits.

In French Polynesia the Mataiva phosphate deposit is being studied for production by a four-party joint venture.

Exploration in 1983 at operating mines was successful in replacing reserves mined during the year at the Polaris, Magmont, Que River and Warm Springs mines.

Environmental Protection

Capital expenditures addressed directly to environmental improvements were $10.7 million in 1983, including $1 million spent on environmental impact and baseline data studies for the Red Dog Project in Alaska.

The mercury removal plant at the Trail operations, a part of the overall sulphur gas handling project, was commissioned in 1983 and approached full operational status at year-end. This plant will allow greater flexibility in the processing of zinc concentrates containing mercury in the integrated zinc-lead processes at Trail. A new smoke eliminator, further reducing the residual emissions from zinc operations, was also installed.

Biological monitoring of employees working in the lead smelter at Trail yielded overall blood lead levels in 1983 that were the lowest on record.

Wide-ranging environmental studies were conducted at the Red Dog project. The project is being planned so that the impact on the quality of air, land, water, wildlife and the local community will be minimal.

Research and Development

The Technical Research Centre at Trail supports Cominco's operations worldwide through its technical expertise, laboratory facilities and pilot programs.

In 1983, a pilot plant began testing new methods of zinc electrolyte purification. A new smelting technique using a top blown rotary furnace has been developed for the recovery of tin, indium and other values from lead smelter dust. A process for the recovery of germanium from the Trail operations was developed and pilot plant work was underway at year-end. Studies are continuing on the recovery of marketable commodities from difficult-to-store waste byproducts, and on the recovery of low but valuable concentrations of metals found in some process streams.

Research for the Lake Minerals operation continued towards the development of a new low-cost process based on the use of solar energy to recover soda ash from a complex salt deposit at Owens Lake, California.

The Technical Research Centre provided assistance in the commissioning and start-up phases of new plants at Trail, and work continued on developing new and improved processes and products from existing operations. The Centre had 48 employees at the beginning of the year and 44 at year-end. Its operating budget was $3.1 million.

The Product Research Centre at Sheridan Park continued to support Cominco's metal customers with technical assistance in applying the latest technologies to their processes and products. Support was concentrated on the galvanizing, die casting and battery manufacturing industries, which represent the largest users of zinc and lead. Work continued on Cominco's battery manufacturing equipment, zinc foundry alloys and electrochemical battery research. The Product Research Centre had 37 employees at the beginning of the year and 35 at year-end. The operating budget was $2.3 million.

Human Resources

Approximately 70 per cent of Cominco's employees are represented by industrial unions. During the year 16 collective agreements were concluded. Before settlements were reached, work stoppages occurred at Trail and Kimberley for eight days, at the Con Mine in Yellowknife for nine weeks and at Western Canada Steel Limited for six and one-half months. During 1984 four collective agreements will expire.

Increased productivity is a vital part of Cominco's business plan. Through improvements in planning and technology, the workforce was reduced in 1983 by 331 or three per cent, bringing the total number of employees at year-end to 10,466. This total includes employees hired for the new Valley and Buckhorn mines. Reductions were achieved through the rationalization of crew sizes and the completion of major portions of the modernization project at Trail. The number of employees on roll at year-end at Trail operations was about the same as in 1977 when the modernization program started. Reductions in staff and increases in production, the reasons for replacement of the old Trail plants, are expected to continue in 1984.

The Government of Canada had determined earlier that commencing in 1984 employer-provided assistance towards travel and housing costs received by employees in northern Canada would be regarded as taxable benefits. After concerted representations to the Government by groups which included Cominco's management and unions, the Government altered its position and continued the remission order exempting northern employees from declaring such assistance to be taxable benefits. The Government's decision averted a significant cost to Cominco employees living in established communities, such as Pine Point and Yellowknife, and helped to maintain the viability of northern mine operations.

Forty years of service was completed by 35 employees in 1983, bringing the total number of those who have reached this milestone to 1,187. There were 65 scholarships of $500 or $750 granted in Cominco's higher education award program for children of employees and pensioners.

To achieve more effective use of benefit dollars received by non-union salaried employees, Cominco has developed one of the first flexible benefit programs in Canada. The new plan, which was implemented on March 1, 1984, covers about 1,600 non-union salaried employees. It combines a base level of benefits with a variety of options available to employees to fit their different personal needs.

Safety

Safety programs throughout Cominco's operations continue to be emphasized and effective. Some of the notable achievements are:

In the United States, Cominco American Incorporated had an outstanding year. The Magmont Mine at Bixby, Missouri won an award from the American Mining Congress and the Mine Safety and Health Administration for the best safety record in the United States in the Underground Metal Mine Division.

Magmont won this award also in 1975 and 1978, and is the first mine to win three times. The Magmont mill achieved another record on its own. At year-end the mill employees had worked over 13 years without a lost-time accident.

The Homestead operation at Beatrice, Nebraska received a National Safety Council award for working since 1979 without a lost-time accident. The award is the fourth major safety award in the Homestead plant's 17-year history.

At year-end, the natural gas ammonia plant at Trail had operated for 28 years, a total of 1.2 million man-hours, with no lost-time accidents.

Production and Sales Statistics

		1983		1982	
		Sales	Production	Sales	Production
Refined Metal					
Zinc					
Trail	tons	242,000	239,800	228,100	225,800
Tolled — Black Angel	tons	13,000	13,400	24,300	21,000
— Polaris	tons	24,100	17,900	3,500	3,500
		279,100	271,100	255,900	250,300
Lead					
Trail	tons	142,800	132,300	113,600	126,600
Tolled — Magmont	tons	36,200	32,300	33,600	33,100
		179,000	164,600	147,200	159,700
Silver[1]	ounces	11,316,100	11,451,300	10,003,800	10,337,800
Gold					
Con	ounces	68,300	70,500	79,300	79,500
Trail	ounces	21,400	21,400	24,800	24,800
		89,700	91,900	104,100	104,300
Concentrates[2]					
Zinc					
Sullivan	tons	—	136,000	—	131,000
Polaris	tons	118,700	239,300	71,400	142,400
Magmont	tons	10,700	10,700	7,200	7,000
Pine Point	tons	—	129,700	9,900	287,400
Black Angel	tons	132,200	150,300	127,200	154,900
		261,600	666,000	215,700	722,700
Lead					
Sullivan	tons	32,200	139,300	3,400	170,600
Polaris	tons	38,700	56,300	27,900	45,900
Magmont	tons	1,000	52,100	1,500	44,500
Pine Point	tons	55,300	32,100	76,100	84,500
Black Angel	tons	42,400	33,800	33,300	41,300
		169,600	313,600	142,200	386,800
Copper[3]					
Valley	tons	33,000	36,700	16,800	11,000
Magmont	tons	600	400	1,100	900
		33,600	37,100	17,900	11,900
Chemicals and Fertilizers					
Nitrogen products		1,151,900	1,102,800	1,192,000	1,171,000
Phosphates		356,900	300,600	241,900	250,700
Potash		1,113,800	1,122,400	827,300	793,700
Other		272,200	278,200	274,500	281,900
		2,894,800	2,804,000	2,535,700	2,497,300

[1] Includes silver sold in concentrates and intermediate products. [2] Sales exclude concentrates processed at Trail, British Columbia and concentrates processed through other smelters, which are reported as refined metal sales. Operations at Pine Point Mines Limited were suspended for the period January 2, 1983 to June 14, 1983. [3] Tonnages are for copper contained in concentrate.

Statement on Inflation Accounting

Canada and other Western World nations have come through a period of high inflation that has eroded the purchasing power not only of individuals but also of corporations. The cumulative effect of prolonged periods of inflation diminishes the usefulness of the conventional historical cost balance sheet and statement of earnings, which do not measure the ability of a corporation to maintain its productive capacity. To overcome this deficiency, the Canadian Institute of Chartered Accountants (CICA) has recommended that major corporations disclose selected information regarding the effects of changing prices. The CICA views its recommendations as experimental and part of an ongoing process to explain the impact of changing prices.

Cominco's consolidated financial statements are prepared on an historical cost basis. Under this concept, assets are reported at the amounts originally paid and are not adjusted for subsequent changes in the purchasing power of money or for the current cost of replacing the assets.

The CICA recommended disclosure is to report the effects of changes in the replacement cost of productive capacity by adjusting certain historical cost amounts (principally fixed assets and inventory) for changes in current costs and to measure this change against the rate of general inflation.

Cominco has been monitoring this experiment closely and has for several years used some of these principles for management purposes when evaluating the replacement of production facilities and new projects. The process is complex and difficult to understand and involves the use of arbitrary assumptions concerning the replacement of production facilities which will not likely reflect economic conditions when replacement decisions are made.

Therefore, at this stage of the experiment, Cominco does not believe that the recommended disclosures contribute to a better understanding by shareholders of its economic performance. As a mining company, our most valuable assets are our mineral resources and the infrastructure and facilities to process the ore. Resource properties are unique in terms of location, ground condition and mineral potential and, when depleted, they cannot be specifically replaced. The replacement cost of a mineral asset will be influenced to a far greater extent by its location and ground condition than by the direct effect of inflation.

Cominco's management is conscious of the CICA's desire to stimulate improved reporting to account for the effects of inflation and will continue to monitor the development of this experiment.

Consolidated Financial Statements

Auditors' Report

Summary of Significant Accounting Policies

Consolidated Statement of Earnings

Year Ended December 31, 1983

	1983	1982
	(thousands)	
Revenue		
Sales of products and services	$1,374,723	$1,234,727
Income from investments	4,600	5,933
	1,379,323	1,240,660
Costs and Expenses		
Costs of products and services	1,015,195	932,301
Distribution	161,817	139,585
Selling	28,491	27,205
General and administrative	44,023	47,910
General mineral exploration	15,642	14,452
Interest (Note 8)	81,376	90,383
Depreciation, depletion and amortization	100,153	86,388
	1,446,696	1,338,224
Loss before the Following	67,373	97,564
Taxes on income including resource taxes (Note 9)		
Current	5,853	6,829
Not currently payable (reduction)	(32,591)	(49,871)
	(26,738)	(43,042)
	40,635	54,522
Minority interests in net losses of subsidiary companies	1,327	686
	39,308	53,836
Equity in net earnings of associated companies	(2,275)	(5,207)
Loss on translation of accounts of foreign subsidiaries	2,292	674
Loss before Extraordinary Item	39,325	49,303
Extraordinary gain (Note 10)	—	18,106
Net Loss	$ 39,325	$ 31,197
Per Common Share		
Loss before extraordinary item	$ 2.60	$ 3.16
Net Loss	$ 2.60	$ 2.20

Consolidated Statement of Earnings Reinvested in the Business

Year Ended December 31, 1983

	1983	1982
	(thousands)	
Amount at Beginning of Year	$554,414	$622,310
Deduct:		
Loss for the year	39,325	31,197
Costs incurred on issue of shares	2,326	1,796
Dividends paid		
Preferred — Series A $2.00 per share	3,498	3,542
— Series C $1.98 per share (1982 - $2.64)	3,968	5,275
— Series D $3.25 per share (1982 - $0.82)	6,500	1,643
Common — $0.40 per share (1982 - $1.30)	8,182	24,443
	63,799	67,896
Amount at end of Year	$490,615	$554,414

Consolidated Balance Sheet

at December 31, 1983

	1983	1982
	(thousands)	
Current Assets		
Cash and short-term investments	$ 13,858	$ 31,279
Accounts receivable	224,273	182,573
Inventories (Note 2)	324,352	352,156
Prepaid expenses	9,481	9,732
	571,964	575,740
Investments (Note 3)		
Associated companies	94,796	95,929
Other companies	30,482	31,941
	125,278	127,870
Fixed Assets		
Land, buildings and equipment	1,633,691	1,562,144
Less accumulated depreciation	581,595	518,682
	1,052,096	1,043,462
Mineral properties and development (Note 4)	416,977	417,975
Less accumulated depletion	108,846	101,645
	308,131	316,330
	1,360,227	1,359,792
Other Assets (Note 5)	25,862	28,142
	$2,083,331	$2,091,544
Current Liabilities		
Bank loans and notes payable	$ 157,672	$ 161,633
Accounts payable and accrued liabilities	166,380	146,411
Income and resource taxes	17,830	16,206
Long-term debt due within one year	43,058	30,457
	384,940	354,707
Long-Term Debt (Note 6)	649,428	687,975
Income Taxes Provided but not Currently Payable	144,498	175,520
Minority Interests	34,561	38,397
Shareholders' Equity		
Capital (Note 7)	379,289	280,531
Earnings reinvested in the business	490,615	554,414
	869,904	834,945
Commitments and Contingent Liabilities (Note 12)		
	$2,083,331	$2,091,544

Approved by the Board:

Director

Director

Consolidated Statement of Changes in Financial Position

Year Ended December 31, 1983

	1983	1982
	(thousands)	
Source of Funds		
Funds (deficit) from operations	$ 31,551	$(8,090)
Disposal of land, buildings, equipment and investments	8,949	13,983
Sale of oil and gas properties (Note 10)	—	25,728
Additional long-term debt	8,811	151,304
Issue of share capital		
— Preferred	—	50,000
— Common	100,406	95
	149,717	233,020
Application of Funds		
Land, buildings and equipment	83,529	176,900
Mineral properties and development	22,807	53,505
Reduction of long-term debt	46,670	29,612
Preferred shares purchased for cancellation	1,552	1,277
Dividends — to preferred shareholders	13,966	10,460
— to common shareholders	8,182	24,443
— to minority shareholders of subsidiary companies	2,487	6,366
Other	4,533	1,429
	183,726	303,992
Decrease in working capital	34,009	70,972
Working capital at beginning of year	221,033	292,005
Working capital at end of year	$187,024	$221,033

Notes to Consolidated Financial Statements

Year Ended December 31, 1983

1. Accounting Policies

The significant accounting policies followed by the Corporation and its subsidiary companies are summarized under the caption "Summary of Significant Accounting Policies".

2. Inventories

	1983	1982
	(thousands)	
Finished goods	$141,936	$165,992
Raw materials and partially processed materials	96,866	100,173
Stores and operating supplies	85,550	85,991
	$324,352	$352,156

3. Investments

	1983	1982
	(thousands)	
Associated companies:		
Shares at cost	$ 65,608	$ 66,788
Equity in undistributed earnings	29,188	29,141
	$ 94,796	$ 95,929
Other companies:		
Shares at cost		
Panarctic Oils Ltd. (6.9% owned)	$ 18,962	$ 19,228
Tara Exploration and Development Company Limited (17.2% owned 1983 at realized value)	22,515	26,903
Other companies	5,092	5,781
Other	519	334
	47,088	52,246
Less accumulated amortization of mineral investments	16,606	20,305
	$ 30,482	$ 31,941

On January 20, 1984 the Corporation sold its shares in Tara Exploration and Development Company Limited for $22,515,000 in cash.

4. Mineral Properties and Development

	1983	1982
	(thousands)	
Operating mineral properties	$291,367	$301,023
Less accumulated depletion	47,350	44,873
	244,017	256,150
Exploration properties, less amounts amortized	64,114	60,180
	$308,131	$316,330

5. Other Assets

	1983	1982
	(thousands)	
Debt financing costs, less amounts amortized	$ 1,886	$ 1,742
Loan to Bankeno Mines Limited	3,000	3,000
Deferred start-up costs, less amounts amortized	13,830	15,440
Other	7,146	7,960
	$ 25,862	$ 28,142

6. Long-Term Debt (excluding amounts due within one year)

	1983	1982
	(thousands)	
Cominco Ltd.		
10% Serial Notes due 1985 to 1996, U.S. $40,000,000	$ 39,380	$ 42,662
8½% Sinking Fund debentures due 1991	50,571	52,106
10⅞% Sinking Fund debentures due 1995	45,074	48,856
Export-Import Bank of the United States 8% loan due 1985 U.S. $763,000	759	2,278
Bank loans due 1985 to 1994 with interest related to prime bank rates	422,800	456,400
West Kootenay Power and Light Company, Limited		
5¾% First Mortgage bonds due 1985	5,218	5,437
Bank loan due 1985 with interest related to prime bank rates	9,300	41,100
13% secured debentures due 1988	10,000	—
14¼% secured Sinking Fund debentures due 1998	10,000	—
14¾% retractable Sinking Fund debentures due 1998	15,000	—
Cominco American Incorporated		
8½% Note payable due 1985 to 2000 U.S. $2,122,000	2,548	2,627
Other debt U.S. $478,000	568	2,029
Pine Point Mines Limited		
Bank loans due 1987 to 1991 with interest related to prime bank rates	15,000	13,700
Western Canada Steel Limited		
Bank loan due 1985 to 1993 with interest related to prime bank rates	22,500	19,900
Other debt	710	880
	$649,428	$687,975

Payments required on long-term debt, assuming the conversion of revolving bank loans into five-year term loans, are: 1984 — $43,058,000; 1985 — $55,756,000; 1986 — $45,177,000; 1987 — $68,167,000; 1988 — $77,916,000.

If translated into Canadian dollars at year-end rates of exchange, long-term debt would increase by $10,704,000 in 1983 and $11,439,000 in 1982. This is not necessarily indicative of the amounts of the exchange premium, if any, which will be payable when the obligations are retired.

7. Capital

The Corporation is incorporated under the Canada Business Corporations Act and is authorized to issue an unlimited number of Preferred and Common Shares.

	1983	1982
	(thousands)	
a) Issued and fully paid:		
Preferred —		
1,722,484 shares (1982 — 1,788,384) — $2.00 Tax Deferred Exchangeable Preferred Shares Series A — issued 1976 (Note 7(d))	$ 43,061	$ 44,709
2,000,000 shares — Floating Rate Preferred Shares Series C — issued 1978	50,000	50,000
2,000,000 shares — $3.25 Cumulative Redeemable Preferred Shares Series D — issued 1982	50,000	50,000
	143,061	144,709
Common —		
21,008,523 shares (1982 — 18,805,743) (Note 7(c))	236,228	135,822
	$379,289	$280,531

b) Preferred Shares:
The Corporation has constituted the following Preferred Shares:

- 2,000,000 shares as "$2.00 Tax Deferred Exchangeable Preferred Shares Series A"
- 2,000,000 shares as "$2.4375 Preferred Shares Series B"
- 2,000,000 shares as "Floating Rate Preferred Shares Series C"
- 2,000,000 shares as "$3.25 Cumulative Redeemable Preferred Shares Series D"

Each Series A Preferred Share is entitled to a fixed cumulative cash dividend of $2.00 per annum payable semi-annually. The Series A Preferred Shares are exchangeable into Series B Preferred Shares after June 1, 1988. Each Series C Preferred Share is entitled to a cumulative cash dividend which is related to the prime rate of interest charged by certain Canadian banks, adjusted quarterly and payable semi-annually. The holders of the Series C Preferred Shares may call for retraction on March 31, 1988. Each Series D Preferred Share is entitled to a fixed cumulative cash dividend of $3.25 per annum payable quarterly. The holders of the Series D Preferred Shares may call for retraction on March 31, 1988. The Corporation may elect on or after February 1, 1988 to designate a further series of Preferred Shares into which the Series D Preferred Shares may be converted.

c) Shares issued during the year for cash:

	1983	1982
	(thousands)	
Preferred —		
2,000,000 $3.25 Cumulative Redeemable Preferred shares	$ —	$50,000
Common —		
2,191,780 shares	$100,000	$ —
111,000 shares (1982 — 3,025 shares) (Note 7(e))	406	95
	$100,406	$ 95

d) Shares purchased for cancellation:
During 1983, the Corporation purchased for cancellation 65,900 Series A Preferred Shares with an issued value of $1,647,500 for $1,551,500 cash.

e) The Corporation has 55,800 Common Shares remaining available for issuance under stock option plans in favour of certain executives in the full-time employment of the Corporation or a subsidiary. Options are exercisable within five years of issue at 90% of the market price on the day prior to the day when granted.

Outstanding options at December 31, 1983 are as follows:

Granted	Price	Out-standing	Exercised in 1983
1978	24.41	nil	1,000
1979	32.40	7,000	3,000
1980	52.31	19,500	1,000
1981	60.98	24,250	500
1982	36.68	23,500	5,500
1983	46.01	28,050	nil
		102,300	11,000

8. Interest

Interest charges were as follows:

	1983	1982
	(thousands)	
Long-term debt interest	$ 72,091	$ 88,980
Short-term debt interest	14,028	24,365
	86,119	113,345
Less interest capitalized	4,744	22,962
Charged to earnings	$ 81,375	$ 90,383

9. Taxes on income

Taxes on income have been reduced by investment and research and development tax credits of $1,663,000 (1982: $386,000).

Accumulated investment tax credits amounting to $46,400,000 are available to reduce income taxes otherwise payable during the years 1984 to 1990.

10. Extraordinary Gain

In 1982 a subsidiary company, Cominco American Incorporated, realized a gain of $18,106,000 from the sale of its oil and gas properties. The Corporation received proceeds of $25,728,000 after income taxes of $11,915,000.

11. Pensions

The Corporation and its subsidiaries have pension plans covering substantially all employees. Pension costs for current service are charged to earnings in the year incurred. The liability for past service is being funded and charged to earnings over varying periods up to 15 years. The date of the most recent actuarial evaluation for most pension plans is December 31, 1982. At December 31, 1983, actuarial estimates of the liability for past service to be funded in future years amount to $50,000,000 (1982 — $56,000,000). The vested portion of the liability for past service to be funded in future years is $23,000,000 (1982 — $34,000,000).

Total pension expense including past service costs was $18,600,000 for 1983 and $13,300,000 for 1982.

12. Commitments and Contingent Liabilities

a) At December 31, 1983 guarantees amounted to $15,300,000, of which $6,000,000 was for bank loans of an associated company.

b) At December 31, 1983 unexpended amounts remaining on approved major capital projects were $80,000,000, of which $38,000,000 is expected to be spent in 1984.

c) At December 31, 1983 the aggregate minimum payments under operating leases were estimated at $40,295,000 with annual payments in each of the five years following 1983 of: 1984 — $11,821,000; 1985 — $9,183,000; 1986 — $7,283,000; 1987 — $5,906,000; 1988 — $4,263,000.

13. Related Party Transactions

Related parties consist of the Corporation's associated companies and Canadian Pacific Limited and its subsidiary and associated companies. Sales (all at fair market prices) to related parties amounted to $27,900,000 (1982: $29,400,000).

The Corporation has a revolving line of credit with Canadian Pacific Securities Limited in the amount of $75,000,000 which provides for loans of up to one year at interest rates related to commercial paper rates. The amount outstanding at December 31, 1983 was $75,000,000 (1982: $50,000,000).

The Corporation makes extensive use of both major Canadian railroads, one of which is a division of Canadian Pacific Limited (CP Rail), for the transportation of its raw materials and finished products. Freight charges from CP Rail are at published tariff rates. In addition, in the regular conduct of its business, the Corporation makes use of other services, facilities and products of the Canadian Pacific organization. These transactions are at rates and terms similar to those for unrelated customers.

14. Segmented Information

a) The Corporation operates in three industry segments:

Mining and Integrated Metals — Principally the mining, processing, smelting, and refining of zinc, lead, copper, silver and gold into concentrates and refined metal.

Chemicals and Fertilizers — Principally the production of sulphuric acid, potash, ammonia, urea, phosphates and nitrates.

Other Operations — Principally fabricated metal products, electronic materials and electric power distribution.

b) Sales to other segments are accounted for at prices which approximate market.

c) Investment income and certain corporate expenditures and assets relating to the overall direction and management of the Corporation's activities are not allocated to industry segments.

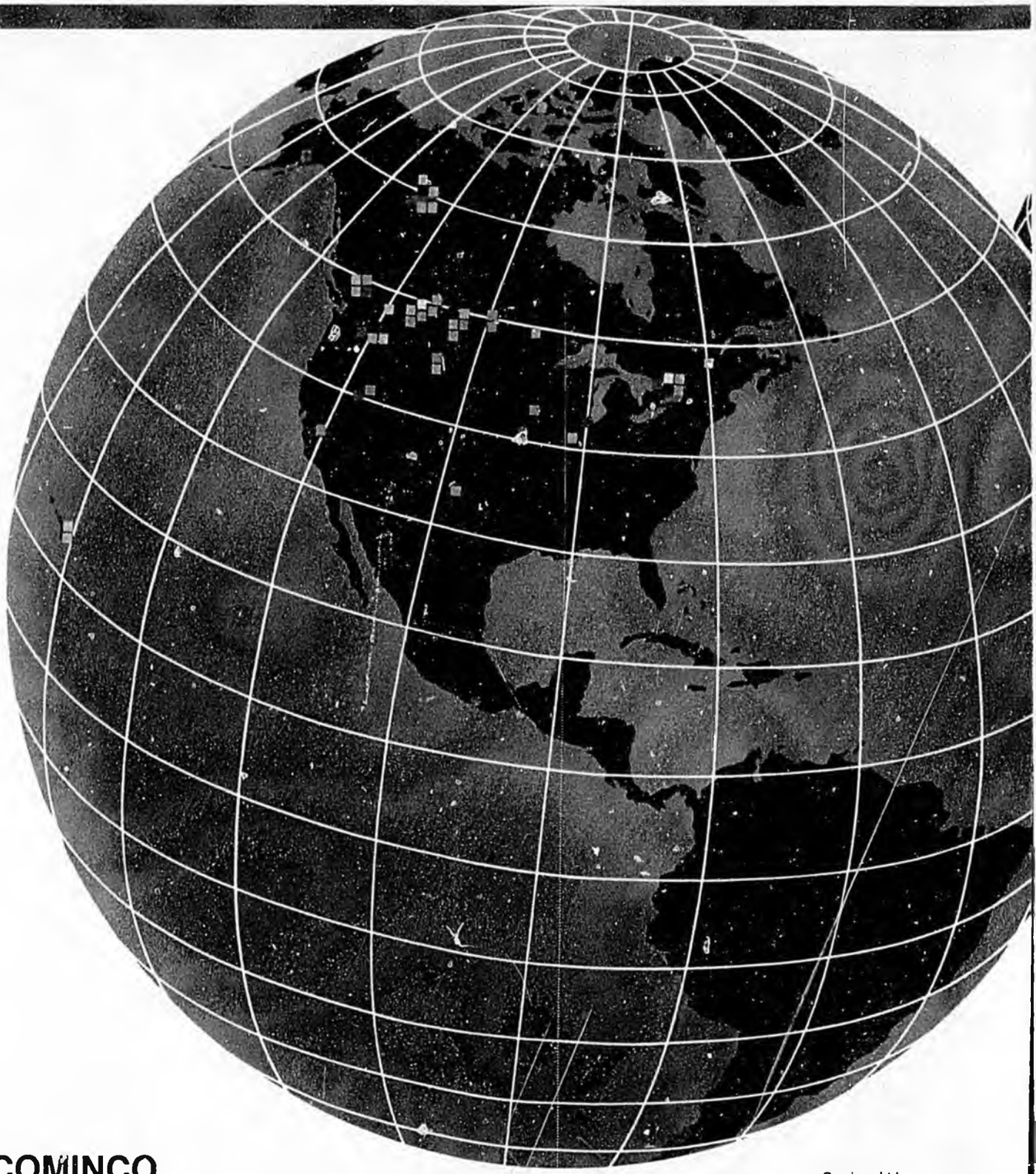
d) Canadian export sales amounted to $605,000,000 (1982: $529,000,000).

Segmented Information

Year Ended December 31, 1983
(Millions)

By Industry Segment	Mining and Integrated Metals		Chemicals and Fertilizers		Other Operations		Consolidated	
	1983	1982	1983	1982	1983	1982	1983	1982
Revenue								
Sales to external customers	$ 767	$ 641	$ 443	$ 421	$ 165	$ 173	$1,375	$1,235
Sales to other segments	31	34	3	1	4	2		
	$ 798	$ 675	$ 446	$ 422	$ 169	$ 175		
Earnings								
Operating profit (loss) before unallocated items, below	$ (6)	$ (38)	$ 34	$ 37	$ 17	$ 21	$ 45	$ 20
General mineral exploration							(16)	(15)
Interest expense							(81)	(90)
Corporate (net)							(16)	(13)
Income and resource taxes							27	43
Earnings (loss) before minority interest, gain or loss on translation, equity in earnings of associates and extraordinary item							$ (41)	$ (55)
Identifiable Assets								
Segment assets								
— Operating	$1,183	$ 793	$ 384	$ 399	$ 165	$ 159	$1,732	$1,351
— Undeveloped properties and construction in progress	137	518	1	4	33	27	171	549
	$1,320	$1,311	$ 385	$ 403	$ 198	$ 186	$1,903	$ 1,900
Corporate assets							55	63
Investment in associated and other companies							125	128
Total Assets							$2,083	$2,091
Depreciation, Depletion and Amortization	$ 71	$ 57	$ 22	$ 22	$ 7	$ 7	$ 100	$ 86
Capital Expenditures	$ 81	$ 178	$ 9	$ 21	$ 16	$ 31	$ 106	$ 230

By Geographic Region	Canada		United States		Other Countries		Consolidated	
	1983	1982	1983	1982	1983	1982	1983	1982
Revenue								
Sales to external customers	$ 980	$ 840	$ 325	$ 330	$ 70	$ 65	$1,375	$1,235
Sales to other regions	96	99	9	8	—	—		
	$1,076	$ 939	$ 334	$ 338	$ 70	$ 65		
Earnings								
Operating profit (loss) before unallocated items	$ 26	$ 6	$ 4	$ (1)	$ 15	$ 15	$ 45	$ 20
Identifiable Assets								
Regional assets								
— Operating	$1,509	$1,143	$ 150	$ 128	$ 73	$ 80	$1,732	$1,351
— Undeveloped properties and construction in progress	115	503	46	40	10	6	171	549
	$1,624	$1,646	$ 196	$ 168	$ 83	$ 86	$1,903	$1,900
Depreciation, Depletion and Amortization	$ 79	$ 63	$ 12	$ 16	$ 9	$ 7	$ 100	$ 86
Capital Expenditures	$ 75	$ 204	$ 27	$ 21	$ 4	$ 5	$ 106	$ 230



COMINCO

PRINCIPAL OFFICES, OPERATIONS, SUBSIDIARIES AND ASSOCIATED COMPANIES

■ **PRINCIPAL OFFICES**

Head Office:
2300 — 200 Granville Street
Vancouver, British Columbia
V6C 2R2

Group Offices:

B.C. Group
J. E. Fletcher,
Vice-President
Trail, British Columbia
V1R 4L8

Prairie Group
W. J. Robertson,
Vice-President
426 —10333 Southport
Road SW
Calgary, Alberta
T2W 3X6

Northern Group
J. M. Wilson, Vice-President
P.O. Box 1979
Yellowknife, N.W.T.
X1A 2P5

Australia
Cominco Australian Pty. Ltd.
N. A. Gilberthorpe,
Chairman & Chief
Executive Officer
367 Collins Street
Melbourne, Victoria 3000
Australia

Europe and Africa
Cominco Europe Limited
P. Hansen, Chairman &
Managing Director
50 Finsbury Square
London EC2A 1DD
United Kingdom

U.S.A.
Cominco American
Incorporated
J. L. Anderson, President &
Chief Executive Officer
818 West Riverside Avenue
Spokane, WA 99220 U.S.A.

Cominco Engineering
Services Ltd.
J. E. Fletcher, Chairman
& Chief Executive Officer
Trail, British Columbia
V1R 4L8

Copper Division
R. P. Taylor, President
2200 — 200 Granville Street
Vancouver, British Columbia
V6C 2R2

Electronic Materials Division
A. V. Marcolin, President
Trail, British Columbia
V1R 4L8

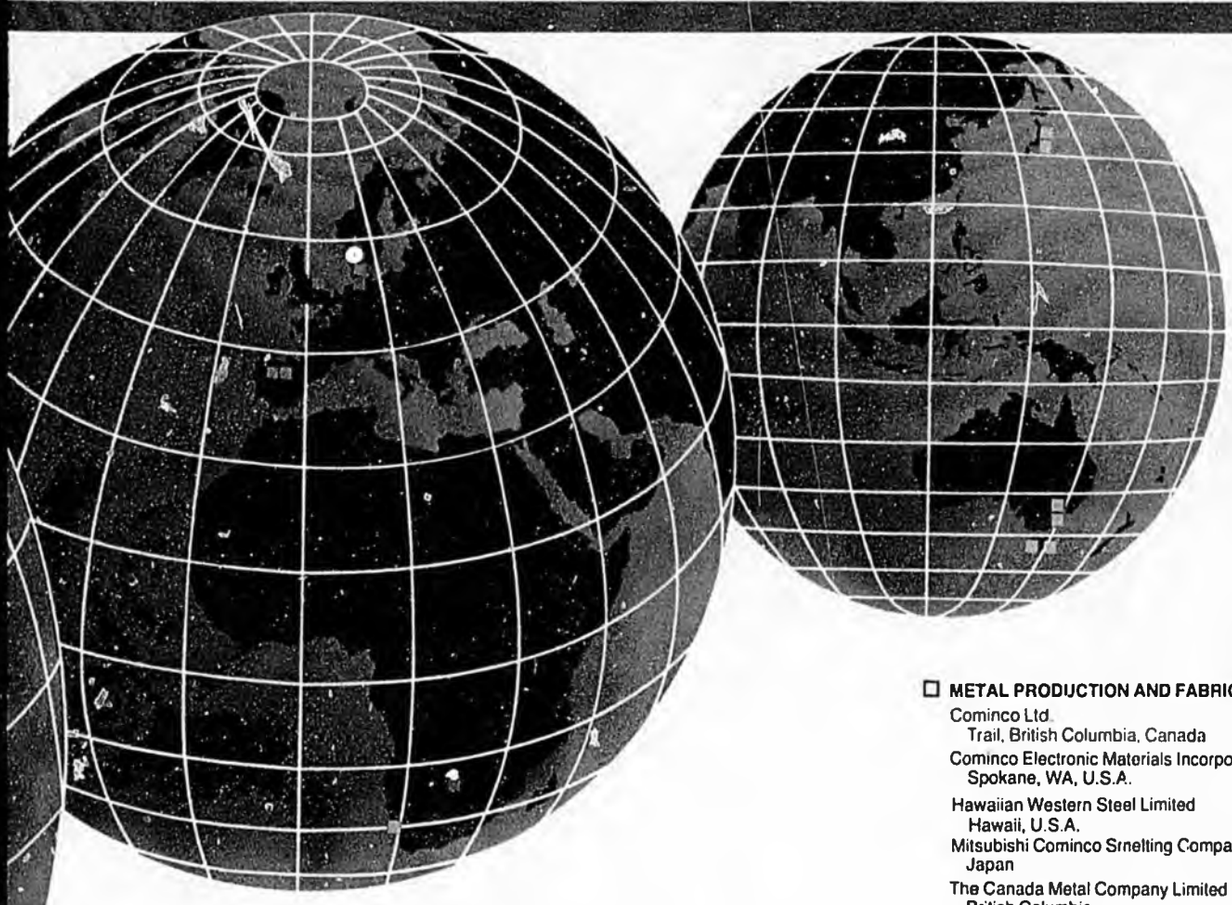
■ *Sales Offices:*
Cominco Ltd.
2300 — 200 Granville Street
Vancouver, British Columbia
V6C 2R2

Cominco Ltd.
426 —10333 Southport
Road SW
Calgary, Alberta
T2W 3X6

Cominco Ltd.
120 Adelaide Street West
Suite 1500
Toronto, Ontario
M5H 1T1

Cominco American
Incorporated
818 West Riverside Avenue
Spokane, WA 99220 U.S.A.
(also Amarillo, Texas;
Chicago, Illinois; Fargo,
North Dakota; Lincoln,
Nebraska; Minneapolis,
Minnesota)

Cominco Electronic
Materials Incorporated
East 15128 Euclid Avenue
Spokane, WA 99216 U.S.A.



Cominco (U.K.) Limited
50 Finsbury Square
London EC2A 1DD
United Kingdom

Cominco (U.K.) Limited
Crown House
550 Maudeth Rd. W.
Chorlton-cum-Hardy
Manchester M21 2SJ
England

☐ PRINCIPAL SUBSIDIARIES AND ASSOCIATED COMPANIES

(Cominco ownership in parentheses)

Aberfoyle Limited
Melbourne, Australia (47%)

The Canada Metal Company Limited
Toronto, Ontario (50%)

Cominco American Incorporated
Spokane, Washington, U.S.A. (100%)

Cominco Electronic Materials Incorporated
Spokane, Washington, U.S.A. (100%)

Cominco Europe Limited
London, England (100%)

Cominco Holdings (N.V.)
Amsterdam, The Netherlands (100%)

Cominco (U.K.) Limited
London, England (100%)

Exploración Minera Internacional España S.A.
Villafranca del Bierzo, León, Spain (48%)

Fording Coal Limited
Calgary, Alberta (40%)

Mitsubishi Cominco Smelting Company, Limited
Tokyo, Japan (45%)

Pine Point Mines Limited
Pine Point, N.W.T. (69%)

Vestgron Mines Limited
Yellowknife, N.W.T. (63%)

Greenex A/S
Copenhagen, Denmark (63%)

Western Canada Steel Limited
Vancouver, British Columbia (100%)

Hawaiian Western Steel Limited
Ewa, Hawaii, U.S.A. (51%)

West Kootenay Power and Light Company, Limited
Trail, British Columbia (common shares 100%) (preferred shares 30%)

☐ OPERATING MINES

Ardlethan
New South Wales, Australia

Black Angel
Greenland

Buckhorn
Nevada, U.S.A.

Cleveland
Tasmania, Australia

Con
Northwest Territories
Canada

Fording Coal
British Columbia
Canada

Hondeklip
Cape Province
South Africa

Magmont
Missouri, U.S.A.

Pine Point
Northwest Territories
Canada

Polaris
Northwest Territories
Canada

Que River
Tasmania, Australia

Rubiales
León, Spain

Sullivan
British Columbia
Canada

Vade
Saskatchewan,
Canada

Valley
British Columbia
Canada

Warm Springs
Montana, U.S.A.

☐ METAL PRODUCTION AND FABRICATION

Cominco Ltd.
Trail, British Columbia, Canada

Cominco Electronic Materials Incorporated
Spokane, WA, U.S.A.

Hawaiian Western Steel Limited
Hawaii, U.S.A.

Mitsubishi Cominco Smelting Company, Limited
Japan

The Canada Metal Company Limited
British Columbia
Alberta
Manitoba
Ontario
Quebec

Western Canada Steel Limited
Calgary, Alberta
Vancouver, British Columbia

☐ CHEMICAL AND FERTILIZER PRODUCTION

Cominco Ltd.
Trail and Kimberley, British Columbia, Canada
Calgary and Carseland, Alberta, Canada
Vade, Saskatchewan
Canada

Cominco American Incorporated
Beatrice, Nebraska, U.S.A.
Borger, Texas, U.S.A.
Owens Lake, California
U.S.A.
Warm Springs, Montana
U.S.A.

☐ RESEARCH CENTRES

Trail, British Columbia
Sheridan Park, Ontario

☐ EXPLORATION OFFICES

Cominco Ltd.
Vancouver, British Columbia; Toronto, Ontario

Cominco American Incorporated
Spokane, Washington; Anchorage, Alaska; Reno, Nevada

Cominco Europe Limited
Guildford, England

Cominco France S.A.
Paris, France

Cominco S.A.
Brussels, Belgium

Aberfoyle Limited
Melbourne, Australia

Compañia Minera Constelación S.A. de C.V.
Guadalajara, Mexico

Eland Exploration (Pty.) Ltd.
Johannesburg, South Africa

Cominco (Perú) S.R. Ltda.
Lima, Peru

Five Year Financial Summary

(All dollar amounts in millions except per share figures)

	1983	1982	1981	1980	1979
Operations					
Sales of products and services	$1,374.7	$1,234.7	$1,416.9	$1,442.7	$1,273.9
Net earnings (loss)	(39.3)	(31.2)	70.3	171.1	204.6
—per common share	(2.60)	(2.20)	3.35	9.54	11.57
Funds (deficit) from operations	31.6	(8.1)	201.3	307.7	325.7
—per common share	0.88	(0.97)	10.52	17.54	18.69
Dividends on common shares	8.2	24.4	75.2	75.2	80.9
—per common share	0.40	1.30	4.10	4.40	4.75
Capital expenditures	106.3	230.4	333.7	280.3	150.1
Financial Position					
Assets:					
Working Capital	$ 187.0	$ 221.0	$ 292.0	$ 323.7	$ 275.2
Fixed assets (net)	1,360.2	1,359.8	1,242.4	909.9	645.5
Investments and other assets	151.2	156.0	151.4	129.6	166.0
	$1,698.4	$1,736.8	$1,685.8	$1,363.2	$1,086.7
Financed by:					
Long-term debt	$ 649.4	$ 688.0	$ 566.7	$ 329.0	$ 226.0
Income taxes not currently payable	144.5	175.5	219.2	172.9	122.4
Minority interests	34.6	38.4	45.4	90.4	54.8
Shareholders' equity	869.9	834.9	854.5	770.9	683.5
	$1,698.4	$1,736.8	$1,685.8	$1,363.2	$1,086.7
Return on assets	Nil	Nil	7.7%	16.4%	23.7%
Return on common shareholders' equity	Nil	Nil	9.3%	26.2%	37.7%
Number of employees at year-end	10,466	10,797	12,643	12,296	11,254
Total employment costs	$ 400.4	$ 421.3	$ 416.1	$ 341.8	$ 278.5
Market price per common share					
(Toronto Stock Exchange) — High	$64¾	$55¼	$72	$81	$55½
— Low	$44¾	$33¾	$43¾	$47½	$31⅝

Shareholder Information

Transfer Agents and Registrars

The Royal Trust Company
555 Burrard Street
Vancouver, B.C.
V6B 3R7

333 — 7th Avenue S.W.,
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*330 St. Mary Avenue
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**2 Wall Street
New York, N.Y.
10005

Stock Exchanges
Vancouver, Montreal,
Toronto (Canada)
**American (U.S.A.)

*Series A and D Preferred Shares Only
**Common Shares Only
***Series D Preferred Shares Only

Share Valuation

For Canadian capital gains tax purposes the Valuation Day value of Cominco Ltd. common shares on December 22, 1971, as established by the Department of National Revenue, was $22.88 per share.

Stock Holdings

The number of registered holdings of voting stock on March 5, 1984 was 20,930. The distribution of the voting rights on that date was as follows:

96.28% Canada
3.32% United States
0.40% Other Countries

Dividends

Cominco's practice is to declare dividends on its common shares quarterly payable towards the end of each calendar quarter.

Dividends are paid in Canadian dollars to all common shareholders who reside in Canada and in U.S. dollars to all other common shareholders. Common shareholders resident in Canada may elect to receive dividends in U.S. dollars and common shareholders not resident in Canada may elect to receive dividends in Canadian dollars upon forwarding a written request to any office of the Company's principal Registrar and Transfer Agent, the Royal Trust Company, listed in this Report.

Sources of Shareholder Information

The Annual Report is one of several sources of information available to Cominco shareholders. A description of other regularly published sources is given below.

Quarterly interim reports are mailed in May, August and November. These reports contain financial results and other news about the Company.

The Information Circular, Proxy and Annual Report are mailed to each registered common shareholder in March. The Information Circular describes the matters to be considered at the Annual General Meeting.

The Company has been qualified under the Prompt Offering Qualification System for securities of senior Canadian issuers. Upon written request to the Corporate Secretary, shareholders may receive a copy of the Company's current Annual Information Form that has been filed under this system.

To permit shareholders who do not hold Cominco stock in their own names to receive published information on a timely basis, the Company has established a special mailing list. Shareholders on the list will have reports mailed directly to them. To be placed on direct mailing lists, shareholders and others should write to the Corporate Secretary, Cominco Ltd., Suite 2300 — 200 Granville Street, Vancouver, B.C., Canada, V6C 2R2.

Directors and Officers

Directors

* M.N. ANDERSON
Chairman and Chief Executive Officer
Cominco Ltd., Vancouver

†H.C. BENTALL
Chairman, the Bentall Group
Vancouver

* F.S. BURBIDGE
Chairman and Chief Executive Officer
Canadian Pacific Limited, Montreal

* F.E. BURNET
Corporate Director
Spokane

* R.W. CAMPBELL
Vice-Chairman and Chief Executive Officer
Canadian Pacific Enterprises Limited
Calgary

R.G. DUTHIE
Corporate Director
Vancouver

S.E. EAGLES
President
Canadian Pacific Enterprises Limited
Calgary

* H.T. FARGEY
Executive Vice-President at Toronto
Cominco Ltd., Toronto

R. HOUGEN
Chairman of the Board,
Canadian Satellite Communications Inc., Whitehorse

D.J. KELSEY
Consultant and
Corporate Director
Vancouver

†R.A. MacKIMMIE, Q.C.
Barrister and Solicitor
MacKimmie Matthews
Calgary

†P.A. NEPVEU
Chairman of the Board
CIP Inc.
Montreal

THE HON. I.D. SINCLAIR, O.C., Q.C.
Senator
Chairman
Canadian Pacific Enterprises Limited
Toronto

* W.G. WILSON
President
Cominco Ltd., Vancouver

Officers

M.N. ANDERSON
Chairman and Chief Executive Officer

W.G. WILSON
President

H.T. FARGEY
Executive Vice-President at Toronto

R.P. DOUGLAS
Executive Vice-President, Operations

R.R. STONE
Vice-President, Finance

O.E. OWENS
Vice-President, Exploration

K.H. SPURR
Vice-President, Metal Sales

J. GIOVANETTO
Vice-President, Human Resources

W.J. ROBERTSON
Vice-President, Prairie Group

J.E. FLETCHER
Vice-President, B.C. Group

J.M. WILLSON
Vice-President, Northern Group

E.A. KOWALENKO
Vice-President, Chemical and Fertilizer Marketing

A.V. MARCOLIN
President, Electronic Materials Division

R.P. TAYLOR
President, Copper Division

K.S. BENSON
Corporate Secretary

L.D. MARGERM
Treasurer

A.D. MILLER
Comptroller

B.J. PARTRIDGE
General Counsel

* Members of Executive Committee
† Members of Audit Committee

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Resources Comm.

Red Dog Project Analysis

A report to Governor
Bill Sheffield

February, 1984

Red Dog Project Analysis

February 1984

Lead Agency

Office of Mineral Development
Department of Commerce and Economic Development

Contributing Agencies

Department of Commerce and Economic Development
Department of Community and Regional Affairs
Department of Transportation and Public Facilities
Department of Natural Resources
Office of the Governor

Table of Contents

Table of Contents (Cont.)

I. Introduction

The Red Dog zinc, lead and silver deposit was discovered in the mid 1970's. Located in the Noatak River drainage 55 miles from the Chukchi Sea, the deposit was included in a 1976 NANA land selection. In February 1982, the NANA Regional Corporation signed an agreement with Cominco American Ltd. to develop the deposit.

In late 1984, the Board of Directors of Cominco will decide whether or not to proceed with the project according to the present proposed schedule. If the decision is positive, construction would begin in mid 1985, with initial production starting at a rate of one million tons per year. The capacity of the mine would be expanded to 2 million tons of ore per year in 1993.

The development of the mine will require the construction of a port facility on the Chukchi Sea and a 55 mile road inland to the mine. Cominco estimates the cost of port construction to be $57 million and the cost of the road to be $75 million. Total development costs for the mine, including the port and the road are estimated to be $390 million. NANA and Cominco have jointly indicated that they will seek State funding assistance for construction of the road and the port.

This report was commissioned by the Governor to provide his office with the information necessary to formulate the State's role in the development of Red Dog. The lead agency in the preparation of the report is the Office of Mineral Development, Department of Commerce and Economic Development. Other State agencies contributing to the report are the Division of Finance and Economics, Office of Management and Budget, Department of Community and Regional Affairs, Department of Transportation and Public Facilities, the Division of Land and Water Management, and the Department of Revenue. Guidance in the handling of confidential information was provided by the Department of Law.

The following section is an executive summary which includes a summary of findings and recommendations. Following the Executive Summary, the contributions of each agency are included in their entirety. Minor inconsistencies inevitably occur in a report of this type which incorporates contributions from originating agencies.

The information used in the writing of this report represents independent research by the agencies involved as well as confidential and non-confidential information provided by NANA and Cominco.

II. Executive Summary

- This section of the report was prepared by the Office of Mineral Development. The contributing agencies have reviewed the Executive Summary for consistency.

A. Summary of Findings

Project Feasibility

- The enormous tonnage and high combined grade of zinc, lead and silver make Red Dog the worlds largest, undeveloped zinc/lead deposit.

- Development costs will be high. However, the deposit can be mined as an open pit with a very low ratio of waste material to ore. Therefore, actual mining costs will be low compared with the majority of world zinc/lead mines. This will give the Red Dog mine competitive advantage and result in reducing the possibility of temporary mine shutdowns in times of world economic recession.

- For the foreseeable future, 70%-80% of mine revenues will be from the sale of zinc concentrates. Zinc is the fourth most widely used industrial metal, and compared with the other base metals (copper and lead), zinc has the greatest potential for growth in terms of world demand and the least potential for being over-produced.

- Without State investment, an average long term zinc price of 63¢ per pound is estimated to provide Cominco a 15% return on investment. A return on investment of 15% is cited for comparison purposes only and should not be interpreted as a decision threshold for Cominco. A 2.5% change in the return on investment is estimated for each 5¢ change in the long-term average zinc price.

- In the long term, much of Red Dog's concentrate production can be refined at Cominco's smelter and refiner in Trail, British Columbia, and will replace concentrates from other depleting Cominco zinc mines. In the near and long term, concentrates from Red Dog will be attractive to Japanese and European processors because of the reliability of the supplier, the longevity of the mine, and the political stability of the United States. The development of Red Dog and other base metal deposits may eventually make the construction of an in-State smelter and refiner feasible.

Permitting and Access

- Conditions at Red Dog will allow the operators to meet the most stringent environmental regulations and environmental permitting should not pose any problems.

- Obtaining an access right-of-way from a Chukchi Sea port, across the Krusenstern National Monument to the mine site, poses the single greatest hurdle to mine development.

NANA

- The NANA Regional Corporation is solvent and is strongly oriented towards projects which offer long-term employment benefits to its shareholders, principally in the form of joint ventures within the region.

Cominco

- Cominco is a sound corporation, has good overall prospects, is backed by a large, reputable parent corporation, and appears able to provide a solid corporate base for support and development of the Red Dog mine project.

- Cominco is presently the free worlds largest producer of zinc and lead and has been successfully mining, processing and marketing zinc and lead for over 70 years.

- Cominco has developed and successfully operates four major mines in the North American arctic. Three of these are zinc/lead mines and have been developed within the last 20 years. The senior management for the Red Dog project will include many of the same personnel responsible for building and operating these arctic mines.

State Impacts

- The project will create between 350 and 400 direct, permanent jobs within the State with an annual gross payroll of between $11.2 and $12.9 million. Additionally, approximately 225 secondary and indirect jobs will be created. Construction employment will total 143 full time equivalent jobs between 1986 and 1988 with an annual gross payroll of $8.8 million during those years.

- Revenues to the State from the mine will be derived from the mining license tax and the corporate income tax. As both taxes are based on net profits, annual State revenues range from $9 to $20 million in current dollars subject to how repayment of infrastructure costs are treated. The net present value of revenues to the State over 30 years, including estimated reductions in

transfer payments, is from $200 million to $300 million based on a zinc price range between 55¢ and 65¢ per pound. Additionally, earnings derived by NANA from the mine will provide revenue to the State. At present, there is no personal income tax so no revenues from employee income can be projected.

- No estimates have been made for the potential demands on State programs from the migration of out-of-state job seekers attracted by the project. Because of the NANA/Cominco agreement requiring preferential local hire, the remoteness of the project, and the lessening of national unemployment, the problem of out-of-state job seekers may not be significant.

- Recent dramatic decreases in the total of state transfer payments to the NANA region have been tentatively linked with permanent fund distributions. This indicates that income derived from mine wages may also have a positive effect on reducing regional transfer payments by the State.

- If State ownership and future control of the transportation corridor and infrastructure facilities are not considered and assuming a 60¢ lb. zinc price an examination of project finances estimates that a direct State subsidy of $40.1 million towards project development costs would assure a 15% rate on investment. This would provide a six-fold net present return on the State's subsidy in the form of tax revenues and transfer payment reductions totaling $270 million. If the State were to completely finance construction of the road and port for an estimated cost of $135 million, the cost/benefit ratio would be reduced to 2:1.

- Industrial development bond financing of the project infrastructure would not adversely affect the State's bonding capacity.

Regional Impacts

- Red Dog will provide approximately 260 full-time jobs for regional residents at mine start-up in 1988, increasing to 400 in 1993. The total regional payroll will total approximately $7.0 million initially and will increase constantly as local employees move into professional and technical positions. Additionally, some 75 secondary jobs will be created after start-up and would mostly be filled by regional residents. At present, 88% of the regional economy is supported by Federal and State revenues, and the existing 1200 full-time equivalent jobs in the region are heavily dependent upon Federal, State and local government employment.

- If the local hire objectives are met, the net effect of the mine on increasing the regional population will not be significant. Some increase in the population of Kotzebue is expected as regional residents relocate to be closer to their jobs. Kotzebue's population increase attributable to the mine represents about 6% of the total increase in Kotzebue's population over the next 20 years. With the possible exception of the water system, existing municipal facilities should not be significantly stressed by population growth attributable to development of the mine.

- Because Red Dog is an enclaved development, no substantial additional demands will be placed upon the region's service delivery. However, an increase in regional affluence is likely to require some increased social service delivery, at least temporarily. Service delivery in Kotzebue will be impacted to some degree if mine workers commute regularly through the city. That impact will depend on the frequency and duration of transient visits.

- The NANA/Cominco agreement requires Cominco, contingent upon the availability of skilled labor, to preferentially hire regional

residents, state residents and out-of-state residents in that order. While there is no guarantee of the percentage of local hire, NANA has stated it will assume the responsibility to train regional residents for these jobs.

- The region could benefit from the use of the project's port facilities and backhaul capabilities. Savings on freight costs are estimated by Cominco to be between $1 million and $3 million annually assuming port user fees are not assessed to incoming regional freight.

- NANA is presently seeking to detach Red Dog and other mineral deposits in the area from the North Slope Borough. Successful detachment is seen as a factor in the decision to proceed with the Red Dog project (due to uncertain future taxation policies of the North Slope Borough), and in the creation of a Northwest Alaska Borough.

Infrastructure Costs

- Cominco's route selection and road design are based on sound engineering criteria and the cost estimate of $80 to $90 million for the preferred road through the Krusenstern National Monument is realistic for this stage of the evaluation.

- Cominco's estimates for port costs of $50 to $60 million, based on the proposed, ballasted-tanker design, appear reasonable.

B. Recommendations

Red Dog will become one of the premier zinc/lead mines in the world. While the mine would eventually be developed without assistance, there are several reasons why the State may want to consider participating in the funding of all or part of the costs of building a road and regional port.

- There is little risk that the project will not generate sufficient revenues to amortize infrastructure costs at a modest interest rate.

- In addition to being able to repay any State funding, the project will generate over 400 year-round, permanent jobs; provide direct tax revenues to the State and local governments; and may significantly reduce the amount of regional transfer payments.

- The port facility, tidelands, uplands and right-of-way will service the region as well as the mine, and both the road and the port may stimulate future development of additional mineral deposits in the Noatak area. The road could eventually become part of an integrated transportation system that could link other more distant mineral developments such as the Northern Alaska Coal Field.

- The development of Red Dog will signal Alaska's firm intention to become a world supplier of mineral resources. This will have the effect of establishing Alaska's credibility with international consumers and attracting investment capital for other resource development projects.

If the State is to participate in the funding of the road and port facilities, the following recommendations are suggested.

- Any major State investment in the road and port facilities which will initially service the Red Dog mine should be conditional upon

firm agreements with NANA and Cominco which will provide for State interests in the facilities and right-of-way, as well as further guarantee the use of the road and the port to other potential users. This requires that State tidelands, privately owned uplands and the right-of-way be available for expanded development and use, in a reciprocal use agreement among affected landowners and users.

- The maintenance and operating costs of the road and the port should be borne by the users.

- If State funding were to take the form of a loan or appropriation, repayment of the funds should be required and should be spread over a period of 20 years or longer to begin with mine production. Whether repayment is to be made in the form of annual installments, tied to a tonnage user fee or some combination of both, the interest rate attached to the repayment should reflect the State's willingness to share in the project risk and should recognize the total benefits the project will provide, including State interests in the road and port.

- Any agreement between the State and NANA/Cominco should include an equitable mechanism to accommodate other future users into a fee schedule which would incorporate a pro rated share of debt amortization as well as operating and maintenance costs.

III. Report of the Office of Minneral Development Department of Commerce and Economic Development

A. Technical Description of the Project and Permitting Requirements

B. Cominco Profile: History; Metal Mining and Processing Operations; and Arctic Mining Experience

C. Commodity Profile of Mine Products, Marketing Considerations and Price Forecasts

D. Zinc Resources of Alaska and Northwest Canada

E. Potential Alaskan Mineral Projects Requiring Public Sector Infrastructure

F. Bibliography

A. Technical Description of the Project and Permitting Requirements

1. Project Description

The Red Dog deposit has indicated reserves of 85 million tons of ore with an average grade of 17.1% zinc, 5.0% lead (22.1% combined) and 2.4 ounces per ton silver. Red Dog's reserves and grades compare extremely favorably on a worldwide basis with other primary zinc/lead mines. These would include the Brunswick Mining Company's (64% Noranda) No. 12 mine in Eastern Canada with reserves of 100 million tons of 13% combined zinc and lead; the Mount Isa Mine in Australia with 93 million tons of 14% combined zinc and lead; and the Tara Mine in Ireland with 59 million tons of 12.7% combined zinc and lead.

On a regional comparison, the open pit Cyprus Anvil zinc/lead mine in the neighboring Yukon Territory has reserves of about 37 million tons with a combined zinc/lead grade of only 7.8%. On a world basis, according the U. S. Bureau of Mines, the average zinc grade of primary zinc mines is between 6% and 9%, spotlighting Red Dog's 17% zinc grade.

While the Red Dog grades and reserve tonnage compare favorably with major world producers, Red Dog will also enjoy the advantage of being an open pit mine, while most major zinc mines operate underground. U. S. Bureau of Mines statistics indicate less than 20% of the world's present primary zinc producers are surface mines. The cost of mining a ton of ore from an open pit is significantly less than the cost from an underground operation. This will enhance Red Dog's ability to operate during periods of market weakness and low prices. Cominco officials believe that Red Dog's actual cost to produce a ton of zinc, excluding development costs, will be lower than production costs of the majority of world zinc mines.

The mine site is located about 55 miles inland from the Chukchi seacoast and about 100 miles north of Kotzebue. A port site is proposed south of the village of Kivalina on the Chukchi Sea. The port will include either offshore or shore-connected docking facilities to accommodate 25,000-35,000 ton ore carriers which will ship mine concentrates to smelters and backhaul mine supplies during the ice-free shipping season from early July to mid October.

A 55 mile road will be constructed between the port and the mine site for the supply of the mine and for the transport of mine concentrates to port. At the proposed initial start-up production rate, 9 to 12 truckloads of concentrate will be hauled over the road daily. The road grade will be engineered for possible modification to a railbed when the production rate doubles and the economics of rail haulage become beneficial.

The mine site facilities will include an accommodation building for housing workers on a rotational basis, a mill complex for concentrating the mine ore, and other buildings for housing a vehicle maintenance shop, a primary ore crusher, an ore storage shed and other facilities. To the greatest extent possible, these buildings will be prefabricated in modules at Pacific port sites, shipped on barges to the port, and transported overland to Red Dog for siting on bedrock foundations.

The mine and mill will require 18 MW of power and the port facilities an additional 1.5 MW. The power will probably be supplied by diesel generators. While the cost of buying and transporting coal to the mine is significantly cheaper on a per Btu basis, Cominco has indicated the capital costs of a coal-fired power plant may not be competitive. A 50 MW power requirement is reported as being the minimum that would allow for the economies of scale necessary for coal fired generation to be considered cost effective.

The mine itself will be an open pit that may eventually reach a depth of 700 feet and cover 65 acres. Associated with the pit is the waste tailing pile area and the mill tailings pond. The tailings pond is located to allow treatment of all discharge water draining from the mine area including the pit, the waste tailings and the mill complex. Water naturally draining into the tailings pond basin will be diverted to an adjacent drainage to minimize the volume of water that must be treated. Once the tailings pond and drainage ditches are in place, the water quality in Red Dog Creek will be improved and the periodic fish kills in Ikalukrok Creek (caused by natural ground water leaching metals out of the orebody) will be eliminated.

The pit will require removal of only 1.3 million tons (less than 1 million yards) of material to prepare the mine site for production. Much of the waste material will be used in the construction of the tailings pond dam and access road. A portion of this preproduction material is mineralized and will be stockpiled in the tailings pond drainage area for possible future processing. The overall ratio of waste stripping to ore production is 0.8:1, which represents an extremely favorable situation compared with most open pit mines and will contribute significantly to the long term viability of the mine. Additionally, the first five years of ore to come from the pit will grade 21% zinc and 6% lead, 5% above the average mine ore grade, enhancing revenues from the initial production.

Initial ore production will be 1.1 million tons per year on a basis of 3000 tons per day. The ore will be crushed and concentrated using selective flotation. The final products shipped to smelters will be a lead sulfide concentrate with an approximate lead content of 62%, and a zinc sulfide concentrate with an approximate zinc content of 59%.

Forecast production at the initial mining rate is 350,000 tons of zinc concentrate and 79,000 tons of lead concentrate. The silver will be equally contained by weight in the lead and zinc concentrates,

resulting in a silver grade in the lead concentrate of 4-5 times than that of the silver grade in the zinc concentrate due to the smaller tonnage of the lead concentrate.

The chemicals and technology required to treat and concentrate the raw ore is well developed and the equipment and chemicals needed are readily available. The only departure from an "average" treatment scheme is the need for finer grinding of the ore to effectively liberate the ore minerals from the waste minerals.

Under the expanded scenario beginning in the sixth year of operation, production will nearly double increasing the daily mill throughput from 3000 tons to 5,600 tons. Annual ore tonnage will be 2.0 million tons with annual zinc concentrate shipments of 585,000 tons and lead concentrate shipments of 119,000 tons.

Two Appendices are attached to this report which provide further details on the design, construction and operation of the Red Dog project. Appendix A is from the Preliminary Draft Environmental Impact Statement. Appendix B is a "Red Dog Fact Sheet" generated and distributed by Cominco.

2. Permitting Requirements

Permitting activity to date for the Red Dog project has included the initiation of applications for those permits requiring long lead times. Cominco employs a full time environmental coordinator to manage this aspect of the project. This position is staffed by Mr. Harry Noah who formerly filled a similar position with the Noranda Mining Company during which the Federal EIS for the Greens Creek project was being prepared.

Environmental baseline data collection for the Red Dog project began in the winter of 1981 and continued through the summer of 1983.

The Environmental Impact Statement (EIS) process was begun in January of 1983 and the formal Draft EIS will be distributed to the public in March 1984. The final EIS could be issued by July of 1984. Other major permits applications which have been filed to date include a National Pollution Discharge Elimination System permit, a Section 10(404) Army Corps of Engineers wetlands permit, a State of Alaska right-of-way permit, and a Title 11 right-of-way permit with the U.S. Department of Interior.

The following is an itemization of major permits needed before the construction and operation of Red Dog can begin.

Federal Permits

U. S. Environmental Protection Agency
- National Pollutant Discharge Elimination System Permit
- Review of U. S. Army Corps of Engineers Section 404 Permit for conformance with Section 404(b)(1) guidelines

U. S. Army Corps of Engineers
- Section 404 Permit (wetlands)
- Section 10 Permit (navigable waters dredge and fill)

U. S. National Park Service
- Right-of-way for transportation system

U. S. Fish and Wildlife
- Possible Section 7 Consultation (for endangered species)

National Marine Fisheries Service
- Possible Section 7 Consultation (for endangered marine mammals)

State Permits

Department of Environmental Conservation

- Air Quality Permit to Operate
- Certificate of Reasonable Assurance (Water Quality)
- Wastewater Disposal Permit
- Solid Waste Disposal Permit

Department of Fish and Game

- Title 16 Anadramous Fish Stream Permit

Department of Natural Resources

- Right-of-way Permit
- Water Rights Permit
- Tidelands Use Permit
- Tidelands Lease
- Materials Sale Contract

State Historic Preservation Office

- Archaeological Clearance

Office of Management and Budget

- Coastal Zone Management Consistency Determination

Local Permits

North Slope Borough

- Land Use Permit

Little problem is foreseen by Cominco in obtaining permits for the environmental aspects of the project. However, special interest litigation challenging procedural matters or other aspects of the issuance of federal permits may be possible as the project is large and represents the development of a remote area of Alaska.

In general the project should be able to meet the most stringent environmental standards. A water treatment plant will be installed to process the limited mine and mill discharge water. The naturally contaminated drainage from the mineral zone will also be treated. Ultimately the project will have permanently improved the quality of Red Dog Creek, even after the mine and water treatment facilities have been removed.

It is of interest to note that the present EPA regulations mandating zero-discharge of mill process water (which were developed on the basis of mill tailings ponds in the arid and evaporative climate of Southwest America) will be met at Red Dog by constructing a dam large enough to impound the cumulative volume of mill discharge water over the life of the mine. This regulation is attainable at Red Dog because the topography and the availability of stripped overburden material allow the construction of a mine tailings pond large enough to satisfy this requirement. The Quartz Hill mine, in the rainforest of Southeastern Alaska, will not have to comply with the regulation because a sole variance was granted to the project in the language of the regulations. However, this regulation has the potential to preclude the development of other Alaskan and U. S. mines which have neither a variance nor the favorable conditions found at Red Dog.

A possible major environmental permit that is not listed, but that may be in effect and needed for the permitting of Red Dog is a State Hazardous Waste permit which will be necessary if the proposed hazardous waste regulations are adopted. It is the contention of Cominco's staff that all the applicable provisions of these proposed regulations will have been addressed by the federal permitting process and that the State's permit requirements for Red Dog will be redundant. The State's proposed Hazardous Waste permitting process, however, would present an additional opportunity for project delay through litigation of permitting procedures.

At present, the most critical aspect of permitting for the project is the road access from the Chukchi coast to the mine site. Of two possible routes, a northern route across State lands and southern route through the Cape Krusenstern National Monument, the southern route has been identified in the Draft EIS as the preferred access option as it will have the least environmental impact and is the most cost-effective alternative for the project.

Use of the southern route requires either securing land from the Krusenstern National Monument or gaining a right-of-way across it. Both of these avenues are being pursued. The NANA Corporation is presently seeking a land exchange with the National Park Service for the four, corner townships in the monument through which the road would pass. Cominco has also begun a right-of-way application to the Park Service under the process outlined in Title 11 of ANILCA. The land swap is seen as the preferred method for gaining access as the alternative Title 11 right-of-way process is lengthy, complex, untried and would ultimately require approval of both the U. S. Congress and the President.

At present, government approval for access to the project is seen to be the only major permitting hurdle to the development of the mine. Appendix C contains a permit schedule time-line, and Appendix D is the basic flow chart for the Red Dog permitting process.

B. Cominco Profile: History; Metal Mining and Processing Operations; and Arctic Mining Experience

1. History

The development and operation of Red Dog will be carried out by Cominco Alaska Incorporated, a wholly owned subsidiary of Cominco Ltd. of Canada. Cominco Ltd. was originally formed in 1906 as the Consolidated Mining and Smelting Company of Canada by the Canadian Pacific Railway (CPR), which remains the majority stockholder (53%) of Cominco Ltd.

The CPR entered the smelting business indirectly in 1898 when they purchased a government-granted railroad franchise from Augustus Heinze. Heinze's railroad franchise threatened the viability of the CPR's own rail expansion plans, but as a condition of the sale, Heinze required the CPR to purchase his smelter located at Trail, British Columbia. In 1906, to secure ore concentrates for the smelter, CPR merged its smelting interests with three mining companies and a local power company to form the Consolidated Mining and Smelting Company of Canada.

In 1913, the company purchased the Sullivan Mine in Kimberly, British Columbia (150 miles from Trail) at a sheriff's auction. The ore at the mine was extremely complex for the existing technology, but shortly after acquiring the mine, the company's research division discovered a new recovery technique called selective flotation which allowed the processing of the complex sulphide ore. The actual size of the Sullivan Mine turned out to be larger than anyone had imagined. Still operating in 1983 with an additional mine life of 20 years, the Sullivan Mine is the flagship of the company.

At present, Cominco is one of the largest mining, smelting and refining enterprises in the world. It is the leading producer of zinc

and lead, accounting for 10% and 11% of the world's supply, respectively. Additionally, the company operates fertilizer plants in the U.S. and Canada and operates a potash mine in Saskatchewan and a phosphate mine in Montana. Cominco supplies 22% of Canada's fertilizer demand and 12% of the U.S. demand.

2. Metal Mining and Processing Operations

Smelters and Refineries

Trail, British Columbia - The smelting and refining complex at Trail, British Columbia has an annual production capacity of 300,000 tons of refined zinc, 150,000 tons of refined lead and 12 million ounces of silver. Other products include gold, bismuth, cadmium, antimonial lead, sulphuric acid, ammonia, and fertilizers. The operation includes two hydro-electric plants which supply Cominco's power needs and sell the surplus locally. The Trail metallurgical operations represent Cominco's largest single source of revenue. Trail processes concentrates from the Sullivan Mine (100% Cominco) in British Columbia and from the Pine Point Mine (69% Cominco) in the Northwest Territories. Additional Trail capacity is met by purchasing concentrates from other sources including South America.

In 1977 Cominco began a modernization program at Trail which included $210 million for a new zinc refinery. Of the 300,000 ton annual production capacity at the recently completed zinc facility, 70,000 tons is produced in a "state of the art" hydrometallurgical plant which uses a pressure leaching process to produce zinc. Elemental sulfur is a by-product of this process instead of sulfuric acid. An additional $200 million investment is planned to rebuild the lead smelting segment of the complex.

Mitsubishi Cominco Smelting Company - Cominco holds a 45% interest in a lead smelter located on Naoshima Island, Japan. The

smelter has a 40,000 ton annual refined lead production annual capacity and purchases lead concentrates from the Pine Point mine.

Cominco Binani Zinc Ltd. - Cominco Ltd. and Metal Distributors Ltd. in joint venture operate an electrolytic zinc plant in India with a capacity of 32,000 tons refined zinc, and by-product cadmium and sulphuric acid.

Metal Mines

Sullivan Mine, Kimberly, B.C. - In its 74th year of production, the Sullivan Mine is wholly owned by Cominco and is the principal supplier of lead and zinc concentrates to the Trail smelter. In 1982 the Sullivan Mine milled 2.4 million tons of ore grading 3.2% zinc, 5.0% lead, and 1.9 ounces per ton silver and shipped 131,000 tons of zinc concentrate and 171,000 tons of lead concentrate to Trail. The Sullivan Mine has published ore reserves of 49 million tons grading 6.1% zinc 4.4% lead, and 1.0 ounces per ton silver, giving it an indicated mine life of an additional 20 years at the present production rate.

Pine Point Mine, Pine Point, Northwest Territory - Cominco is a 69% owner of the Pine Point Mine. In 1982 Pine Point milled 2.4 million tons of ore grading of 7.3% zinc and 3.0% lead. Almost all of the 287,000 tons of zinc concentrates were shipped to the Trail, British Columbia smelter while most of the 85,000 tons of lead concentrate were shipped to the Mitsubishi Cominco lead smelter in Japan. Published reserves are 25 million tons at 6.1% zinc and 2.4% lead. Full mine production capacity is four million tons of ore per year indicating an assured mine life of 7 years.

The Pine Point Mine began production in 1964 after a joint development effort with the Canadian government which provided infrastructure to the remote location consisting of a 400 mile railroad, and a hydroelectric power plant.

Polaris Mine, Little Cornwallis Island, Northwest Territory - The recently developed Polaris Mine commenced operation in 1982 at an annual production rate of 800,000 to 900,000 tons per year. Proven reserves are 11 million tons of 15.2% zinc and 4.4% lead while an additional 13 million tons of ore are inferred, indicating a mine life of 25-30 years. The concentrate production from Polaris is shipped to European smelters.

The Polaris Mine is located on Little Cornwallis Island only 75 miles from the magnetic North Pole. The shipping season from Polaris is restricted to a few months in the summer, as will be the shipping season at Red Dog, and a year's production of concentrate is shipped during the brief ice-free season. The mine's mill complex was constructed as a module at a Quebec port site and barged to Little Cornwallis Island for installation. This is the same method that will be used for construction of facilities at Red Dog.

Black Angel Mine, Maarmorilik, Greenland - Cominco is a 63% owner of the Black Angel Mine which milled 744,000 tons of ore in 1982, grading 12.6% zinc, 4.5% lead and 1.0 ounce per ton silver. Zinc and lead concentrates are shipped from Black Angel to European smelters during the summer shipping season. Black Angel reserves are 2.2 million tons grading 13.4% zinc, 4.0% lead and 1.0 ounces per ton silver. A mine life of 3 years is indicated unless additional reserves are discovered.

Magmont Mine, Bixby, Missouri - Cominco owns 50% of the Magmont Mine which milled 1.1 million tons of ore in 1982 at grades of 1.0% zinc and 6.5% lead. Concentrates from the mine are sold to U.S. smelters. The mine has 9.1 million tons of proven and inferred reserves indicating a mine life of 8-9 years.

Con Mine, Yellowknife, Northwest Territory - The Con Mine is located on the shores of Great Slave Lake and has been in production

since 1938. In 1982, 234,000 tons of ore were milled with an average grade of 0.36 ounces per ton gold. The ore is milled and the gold refined locally in Yellowknife. The mine has reserves of 2.1 million tons grading 0.47 ounces of gold per ton for an indicated mine life of 8-10 years.

Jersey Mine and Valley Mine, Logan, B.C. - These two open pit mines have reserves of over 500 million tons of copper ore. The Valley Mine is the largest known copper deposit of its type in Canada. The Valley Mine began production in January 1983 at a rate of 23,000 tons per day.

Warm Springs Mine, Garrison, Montana - Cominco owns and operates the Warm Springs Mine, a major underground producer of phosphate which employs 114 people.

Other Metal Mining and Exploration Interests - Cominco has interests in several other metal mines worldwide including a 47% interest in Aberfoyle Ltd. which operates two tin mines, a zinc/lead mine and other properties in Australia; a 17% interest in Tara Exploration which operates an underground zinc/lead mine in Ireland; and a 47% interest in Exploracion Minera Internacional Espana S.A. which operates a zinc/lead mine in Spain. Cominco also operates wholly owned subsidiaries for exploration in America, Australia, Belgium, France, Italy and the United Kingdom.

Research - Cominco operates a Product Research Center in Ontario which works towards developing uses for lead and zinc, including developing, marketing and licensing new products and processes.

3. Arctic Mining Experience

Cominco has major and minor interests in eight zinc/lead mines in the world of which five are in North America. Of these five, three are

located in the arctic and were developed and are being operated by Cominco. The Pine Point Mine in Northern Canada is located at latitude 62°, the Black Angel in Greenland at latitude 71° and the Polaris on Little Cornwallis at latitude 77°N. The Red Dog deposit is located at latitude 68°.

The development and operation of each of these mines has presented special challenges which have been successfully met.

The Pine Point Mine located in Northern Canada required the construction of the Great Slave Lake Railway between the closest existing rail link in Alberta, to the mine site on the south shore of Great Slave Lake, 423 miles to the north. Much of the railroad was built over permafrost. Construction was financed by the Canadian Government under the northern "Roads to Resources" program and construction and operating costs were recovered from the mine through a schedule of user fees based on a guaranteed volume of 215,000 tons of concentrate shipped annually and special fees based upon the value of the concentrate as determined by smelter returns. When the agreement was negotiated, infrastructure costs were to be recovered in 10 years as there were only 10 years of proven ore reserves known at that time. Due to higher than forecast shipping tonnages, the mine ultimately repaid the railroad capital costs in about seven years.

Cominco underwrote the costs of developing a hydro-electric generating plant for use by the Pine Point mine and the developing region. Also a complete townsite was constructed which is today a chartered village with a population of 2200 and presently enjoys the second highest per capita income in the Northwest Territories. 640 residents are employed by the mine. Pine Point is an open pit, as will be Red Dog, with production coming from several pits. The ore is concentrated at the mine site and shipped to smelters at Trail, B.C. and Naoshima, Japan.

The Black Angel Mine was developed in 1972 with production beginning in 1973. The mine's entrance is located in a cliff wall of Maarmorilik Fjord on the west coast of Greenland. The mill and concentrator are located on the opposite side of the fjord and ore is transported from the mine portal, by aerial tramway, across the fjord to the mill site. The mine ships its concentrates by ocean transport to various European smelters, and as will be true at Red Dog, is limited to a shipping season determined by the winter ice pack.

The decision to develop the Polaris Mine was made by Cominco in November of 1979 and the first ore was processed in the mill on November 4, 1981, just two years later and 10 weeks ahead of schedule. Located on Little Cornwallis Island only 1,009 miles from the North Pole, the severe climactic conditions and short ice-free season required innovative development. As at Black Angel, the mine was located virtually at tide water. The mill and administrative offices were constructed as a single barge-mounted module at a port in Quebec and towed to the mine site. This is the same scenario Cominco will use to develop the Red Dog facilities. For Red Dog the modules will be constructed and shipped from Pacific ports and will then be transported overland approximately 55 miles.

Polaris is an underground mine, and mining techniques take into account the underground permafrost conditions which extend to a depth of about 1200 feet. While Red Dog will be and open pit mine and will therefore not have the mining problems as at Polaris, similar arctic conditions will be experienced at Red Dog. During the ice free season at Polaris, eight shiploads of concentrate, representing 12 months of mine and mill production, are shipped to European smelters.

The Polaris Mine maintains a personnel program targeted at maximizing regional employment of the area's Inuit natives. A training program for Northern Canadians is utilized and work schedules have

been tailored to accommodate the subsistence lifestyle of the northern residents.

The Con Mine in Yellowknife, Northwest Territories is a gold mine and as such does not handle the same large quantities of ore that a basemetal producer must mine, mill, concentrate and transport. The mine has been in operation since 1938, was one of the first of Canada's northern mines, and has given Cominco 45 years of practical experience operating in the arctic.

Cominco's success has been attributed to its strong management. Locally, the President and General Manager of Cominco Alaska is Hank Giegerich, who is responsible for Cominco's statewide activities and for the development of Red Dog.

Mr. Giegerich is a 30 year Cominco employee and was formerly Vice President of Cominco's northern operations, headquartered in Yellowknife. In that position Mr. Giegerich was responsible for the operation of the Con and Pine Point mines was responsible for the development of the Polaris Mine. Prior to that assignment he was Project Engineer for the development of the Black Angel Mine in Greenland. Mr. Giegerich recently received awards from the Canadian Institute of Mining and Metallurgy and the Alberta Chamber of Commerce for the success of the development of the Polaris Mine and is undoubtedly one of the most qualified individuals in North America (and quite probably in the world) to manage the development of the Red Dog Mine.

The project manager for the Red Dog development is James "Bud" Rae. Mr. Rae is a long time Cominco employee and participated in the construction of the Pine Point Mine and later served as the mine's production superintendent. Mr. Rae managed the rehabilitation and development of Cominco's Pinchi Lake mercury mine in Northern B.C. which operated until the mid 1970's, and has been involved in the

development of Cominco's Valley Copper Mine, the operation of the Trail smelter and the construction of hydroelectric dams in British Columbia.

More generally, as the world's largest miner, smelter, refiner and marketer of zinc and lead, Cominco's profitable history is the result of its success in assessing market demand and timing the development of carefully planned and efficiently operated mines. This record is more impressive when it is taken into consideration that four of Cominco's major mines operate in remote regions of the arctic. These mines are successful despite the high development costs of infrastructure creation, and high operating and labor costs.

C. Commodity Profile of Mine Products and Marketing Considerations

1. Introduction

The average grade of the Red Dog Mine is 17.1% zinc, 5.0% lead and 2.4 ounces per ton silver. The importance of zinc to the economics of the mine is understated as the actual zinc grades will be closer to 21% in the first five years and average 19% for the following 15 years. It is in this initial period of the mine life when capital costs are amortized and therefore the higher ore grade is important to the ultimate return on investment.

Using an average grade of 19.0% zinc, 5.0% lead and 2.4 ounces per ton silver (conservatively representing the first 20 years of operation), an appreciation can be gained for the relative contribution each commodity will make to the total mine revenues by figuring the gross value of a ton of ore and the relative percentage each metal contributes.

Commodity prices published for November 4, 1983 were 49¢ per pound for zinc, 25¢ per pound for lead and $9.00 per ounce for silver. Though the price a smelter pays for contained metals is discounted to reflect smelting charges and other considerations, applying these basic prices will give a relative comparison of the importance of each commodity.

At a grade of 19.0% zinc, one ton of ore will contain 380 pounds of zinc with a gross value of $186.20 at 49¢ per pound. At a 5% grade, one ton of ore will contain 100 pounds of lead with a gross value of $25.00 at 25¢ per pound. And at 2.4 ounces per ton silver, one ton of ore contains 2.4 ounces of silver with a gross value of $21.60 at $9.00 per ounce. The total gross value of a ton of ore at these prices is therefore $232.80. Gross value, as used here, simply states the value

of the contained metals and does not account for the costs and losses that occur during mining, milling and refining. Zinc value represents 80% of this total while lead and silver contribute 11% and 9% respectively. It is obvious that zinc is the critical commodity in the economics of the Red Dog mine.

To further highlight the importance of zinc, the same calculations can be done holding the price of zinc at its present level of 49¢ while doubling both the price of lead (to 50¢ per pound) and silver (to $18.00 per ounce.) The recalculated percentage contributions to revenues are 67% zinc, 18% lead and 15% silver. Thus Red Dog is primarily a zinc mine and unless there are extraordinary increases in lead and silver prices, the critical commodity is, and in the foreseeable future will remain, zinc.

2. Zinc

Uses and Substitutes

Zinc is the fourth most widely used industrial metal, surpassed only by iron, aluminum and copper. Its importance, however, often goes unnoticed as the metal loses its identity in most end product forms. There are four primary areas of zinc use.

1) Protective coatings. The greatest use of zinc is for coating (galvanizing) steel and iron products. This use accounted for about 44% of all zinc consumed in 1982. Zinc coating protects steel in two ways; by providing a long-lived barrier between the steel base and the corrosive environment; and by protecting the steel through galvanic action due to zinc's high electrochemical activity. Common applications for zinc coating are steel sheet, fencing, storage tanks, fasteners, wire rope, towers, industrial plants, culverts, bridges, ships and structural shapes. As a second method of protecting steel, sacrificial zinc anodes are used

to inhibit electrolytic corrosion of ship hulls, offshore drilling rigs, submerged or buried steel including tanks, pipes or other works.

2) Brass. Brass is an alloy of copper and zinc containing up to 40% zinc. Brass tubes, valves, radiators, and fittings are extensively used in vehicles, motors, refrigeration equipment, heat exchangers, communication and electronic devices. Brass accounts for about 20% of the world's zinc consumption.

3) Die casting. Zinc's low melting point allows problem-free gravity casting. Zinc used in die casting is often combined with small percentages of aluminum to impart strength and wear resistance, and copper to improve tensile strength, hardness and other properties. Zinc die cast parts, such as handles, grills, brackets, carburetors, gauges, pumps, and housings are extensively used in automobiles, machinery, business machines, appliances, scientific and electronic equipment. Die casting accounts for about 16% of the world's zinc consumption.

4) Rolled Zinc. Products manufactured from rolled zinc include engraving plate, coinage and zinc foil. These uses account for about 8% of consumption.

5) Zinc compounds. Zinc dust, zinc oxide, and other zinc compounds are used in a variety of industrial applications as corrosion inhibitors, activators in vulcanizing rubber, chemical catalysts, fluxing agents, fungicides, pharmaceuticals, TV screen phosphors, and additives in lubricants. Zinc ferrite is used in electrical motors, transformers, coils, amplifiers, timers, and in radios, television and computers.

It also should be noted that zinc is an essential element in the growth of human beings and animals. An animal with a zinc deficient

diet will require 50% more food to achieve the same weight-gain as an animal supplied with sufficient zinc. While inhalation of freshly formed zinc oxide can result in the temporary disorder known as "zinc chills" or "oxide shakes," zinc is not considered to be a toxic substance.

The primary substitutes for zinc, (and therefore its economic competition) are aluminum, plastic and magnesium.

In protective coatings there is no substitute for zinc galvanizing in large-tonnage applications and therefore, zinc's largest use has an assured base level demand. In steel sheet coating a recently marketed product, Galvalume, has made significant inroads on traditional zinc-coated steel sheet. Galvalume is comprised of 55% aluminum and 43% zinc. Because the coating is less dense and offers greater corrosive resistance, much less zinc is used than when steel sheet is hot-dipped in zinc to form conventional galvanized sheet. However, Galvalume is not easily molded, nor can it be welded, so there are presently limitations on its ability to substitute for zinc coated sheet. A competitive sheeting product, Galfan (95% zinc, 5% aluminum), has also been developed and may be competitive with Galvalume in some applications. Aluminum sheet also competes with galvanized steel sheet for such applications as roofing and siding.

Aluminum alloys, stainless steels and plastics have replaced many traditional uses of brass and will continue to compete for those applications.

In die casting, aluminum and magnesium are competitive materials where weight limitations, temperature tolerances, and surface finishes are important. Plastics have also made inroads in this field. However the recent development of thinwall zinc die casting and improved zinc alloys and finishing techniques has allowed zinc die casting to retain many of its challenged applications. It is also possible that the recent

MAJOR WORLD ZINC MINES

Mine Name*	Location	Average Grade(1) Zn	Pb	Ag	Annual(2) Capacity	Re-(2) serves	Life(3)	Ownership
#Red Dog (S)	Alaska	17.1	5.0	2.4	2.0	85	40+	NANA (100%)
Sullivan (U)	Canada	6.1	4.4	1.0	2.4	49	20	Cominco (100%)
Pine Point (S)	Canada	6.1	2.4	-	4.0	25	7	Cominco (69%)
Polaris (U)	Canada	15.2	4.4	-	0.8	24	30	Cominco (100%)
Black Angel (U)	Greenland	13.4	4.0	1.0	0.9	2	3	Cominco (63%)
Magmont (U)	Missouri	1.3	6.8	0.1	1.1	9	8	Cominco (50%)
Que River (U)	Australia	8.8	4.8	3.2	0.3	5	17	Cominco (47%)
Rubiales (U)	Spain	6.9	1.2	0.4	1.2	14	12	Cominco (48%)
Tara (U)	Ireland	9.6	2.8	-	3.0	74	25	Noranda (36%)
Nanisivik (U)	Canada	10.4	0.8	-	0.7	4	5	Mineral Res. Int'l. (53%)
Brunswick (U)	Cnanda	9.1	3.7	3.0	3.5	100	29	Noranda (64%)
Cyprus Anvil (S)	Canada	4.5	3.0	1.5	3.5	60	17	Dome Petroleum (100%)
Kidd Creek (U)	Canada	5.0	0.2	2.0	5.0	100	20	Canada Devel. Corp. (100%)
Mount Isa (U)	Australia	6.3	6.5	4.8	3.5	54	15	Mount Isa Mines (100%)
#Hilton (U)	Australia	6.6	9.6	4.8	3.5	46	13	Mount Isa Mines (100%)
Zinc Corp. (U)	Australia	9.5	8.9	2.8	1.0	13	13	Rio Tinto Zinc (61%)
New Broken Hill (U)	Australia	12.2	6.6	1.9	1.5	13	13	Rio Tinto Zinc (61%)
North Broken Hill (U)	Australia	10.0	13.0	6.5	1.1	6	5	North Broken Hill (100%)
Elura (U)	Australia	8.6	5.6	4.4	1.5	30	20	Electrolytic Zinc (100%)
#Scuddles (U)	Australia	9.0	-	2.3	1.5	29	20	Electrolytic Zinc (100%)
Cerro de Pasco (U,S)	Peru	7.9	3.3	2.7	2.5	57	23	Centromin (100%)
Prieska (U)	South Africa	3.0	-	-	3.0	9	3	U. S. Steel (46%)
#Crandon (U)	Wisconsin	5.4	5.0	0.4	3.5	84	24	Exxon (100%)

* - (S) Surface or open pit mine, (U) Underground mine
(1) - Zinc and lead grades in percentages, silver in troy ounces per ton
(2) - Million short tons
(3) - Years
\# - Indicates property is in development stage

developments in thinwall zinc die casting may find new applications, further limiting any erosion of zinc demand.

In chemical uses, aluminum and magnesium replace zinc to some extent in chemical reactions, and titanium oxide can replace zinc oxide in paints.

In general, economic and other considerations favor the continued wide use of zinc and limit inroads of substitutes. Magnesium substitution is limited by the low capacity of magnesium production facilities, and while aluminum and plastics are widely available, the price of zinc is favorable. As aluminum production is energy intensive and as plastics are petrochemical products, both are sensitive to energy price increases.

The energy requirement for producing 1 ton of aluminum from ore is 244 million Btu's while the equivalent process for zinc requires only 65 million Btu's. Additionally, where durability is a factor, plastic will never be an acceptable substitute for metals. Cominco's Product Research Center has developed a super plastic zinc (SPZ) consisting of 78% zinc and 22% aluminum with a low forming temperature which would allow use of the same low cost thermoforming technology utilized by plastics and would possibly result in zinc becoming a substitute for plastic in certain applications.

World Supply and Demand

The U.S. consumes one sixth of the world's zinc supply, but presently produces only a third of its own demand. U.S. zinc smelter capacity has decreased from self-sufficiency in 1968, to 60% dependency on foreign sources at present. In the absence of a repeal of the Jones Act, which penalizes the shipment of commodities between U. S. ports, Red Dog Mine concentrates will be processed by foreign smelters as a matter of economic reality. U.S. consumers will enjoy no inherent

domestic supply advantage despite the nationality of the mine. Therefore discussions of supply and demand for zinc and other commodities will be examined from primarily a global perspective.

World mine production in 1982 from non-socialist countries was 4.8 million tons of contained zinc. Production of refined metal was 4.3 million tons while metal consumption was 4.1 million tons. Consumption was 6% below the 1981 level and primarily reflected a 17% decline in U.S. consumption due to the general economic recession, and a lesser decline in Europe for the same reasons. Japan showed no consumption change in 1982.

The decline in world demand reflected general worldwide economic recession. As zinc consumption is tied to automobile production, residential and commercial construction and general industrial output, zinc consumption will parallel general economic trends.

A demand increase in U.S. consumption is forecast as a nationwide program to restore or replace highway structures such as bridges, guardrails and culverts will increase the need for galvanized steel. Additionally the change from a 95% copper penny to a 98% zinc penny will increase the annual U.S. base demand by about 40,000 tons per year, which represents about 1% of the 1982 world demand. Similar changes in coinage elsewhere in the world could add significantly to zinc demand.

In world automotive production, zinc may increasingly be used to coat exterior sheet metal surfaces as well as interior surfaces due to improvements in the ability of zinc coatings to accept high quality paint finishes. A survey of the four major U.S. auto makers found that zinc consumption in sheet metal materials had increased 2% per vehicle for 1983 models. This new demand may begin to offset reductions in zinc die castings used in automobiles which declined in total weight from about 45 pounds per car to 23 pounds per car between 1975 and 1982.

In general, demand for zinc has grown faster in developing industrialized countries such as Brazil, Mexico and South East Asian countries than in the older industrial nations. In 1982 increased export of zinc concentrates and record export levels of refined metal to socialist countries were recorded. Much of this tonnage was shipped to China which may represent a growing zinc consumer.

The U.S. Bureau of Mines estimates a probable annual world growth rate in zinc consumption through the year 2000 of 2.5%. This compares with an annual growth rate of 4.8% between 1960-73. Using the 1981 free world zinc consumption of 4.3 million tons as a base level for demand (this assumes the recessionary 1982 consumption level is not representative of the present base level) a growth rate of 2.5% would indicate an increase in world consumption to 5.1 million tons in 1988. Using the three year mine production high of 4.8 million tons in 1982 as representing present annual capacity, a need for an additional 0.3 million tons of production will be required in 1988. The new production from Red Dog will produce 0.2 million tons of zinc metal in 1988. In 1993 when Red Dog's zinc metal production has increased to 0.3 million tons, the free world demand forecast would be 5.8 million tons or 1.0 million tons greater than 1982 mine production levels. Several sources also suggest the socialist bloc will become a significant importer of zinc, supporting the demand growth forecast.

An important factor in forecasting the need for new mine's is the possibility of new supply coming from recycling or secondary sources. Unlike lead, in which a significant component of supply comes from recycled batteries and other products, the largest uses of zinc are sacrificial. Zinc used for coatings is dissipated and therefore recycle will never become a major supply source.

Marketing Considerations

At the initial production levels, the Red Dog Mine will produce 350,000 tons of zinc concentrate. Assuming a concentrate grade of about 59%, this represents 207,000 tons of contained metal. Cominco has indicated its intention to sell concentrates to Japanese and European smelters and to its own smelter at Trail, B.C. In 1982 Trail produced 226,000 tons of zinc, representing the zinc concentrate output of both the Sullivan and Pine Point Mines. The total zinc capacity at Trail is 300,000 tons so that the smelter has an additional unused capacity of 75,000 tons, representing about a third of Red Dog's initial production.

The reserves at the Sullivan Mine indicate it will continue to produce for about 20 years if no additional reserves are discovered, while reserves at Pine Point indicate the mine may be exhausted in about 10 years. In 1993 Red Dog is scheduled to increase its zinc production to 585,000 tons of concentrate or about 345,000 tons of contained zinc which will exceed the total present capacity of Trail, B.C. However, the new zinc smelter at Trail was designed with space available for installing an additional zinc refining capacity of 150,000 tons. Cominco could exercise the option to expand the zinc smelter prior to Red Dog expansion (or earlier) and thereby have the capability to smelt all Sullivan and Pine Point concentrates (at their present production rate), as well as over 60% of Red Dog's expanded production. When the Pine Point Mine is exhausted the expanded Trail zinc refinery could handle 100% of Red Dog's maximum production, plus all production from the Sullivan Mine.

Japanese zinc refineries at present have a a combined capacity of in excess of 800 thousand tons refined metal. In recent years Japanese refineries have had problems securing adequate supplies of zinc concentrates and may view Red Dog as a desirable long-term, stable source. European smelters, not counting communist countries, have a combined capacity of about 2.0 million tons. At present there is an over capacity

of zinc smelters in Europe. Red Dog will be attractive to both Japanese and European refineries as a long term zinc concentrate source (more than 40 years) and, with a competitive climate among smelters to secure adequate concentrate supplies, Red Dog should receive favorable rates and terms from smelters.

A final marketing consideration is the ownership of the zinc mining and processing industry. At present the zinc industry, compared with the coppe. industry, is being operated more in line with free enterprise concepts. Better balance of zinc metal stocks with demand will result in stronger and more predictable long term prices. This contrasts with metal industries in which gross overproduction for the sake of generating foreign exchange results in depressed or even below cost metal prices - very much a factor in the copper industry for example.

3. Lead

Uses and Substitutes

Lead ranks as the fifth most widely used metal behind iron, aluminum, copper and zinc. At present the two major uses of lead are for lead-acid batteries and as an anti-knock gasoline additive. Other uses include construction materials, ammunition, solders, protective coatings and paints, radiation shielding and electrical cable sheathing.

Over 50% of present lead consumption is used in lead-acid batteries, primarily vehicle starting-lighting-ignition (SLI) batteries. In transportation applications, weight is a primary consideration, and as average car size and "cranking" requirements have diminished, so has the average lead content from about 30 pounds per car in 1977 to 20 pounds per car in 1983. Severe winters shorten battery life and increase demand for replacement batteries.

Research to find alternate combinations of metals and non-metals for batteries has been extensive, and while most substitutes can match or exceed the performance of the lead-acid battery, problems include cost of components, economics of material recycling, toxicity, and operating limitations and difficulties. The U.S. Bureau of Mines indicates no large scale substitution for lead-acid batteries is forthcoming.

Domestically the use of lead additives in gasoline is gradually declining due to environmental restrictions on lead emissions. Consumption of lead in the U.S. for gasoline additives has dropped by 50% since the early 1970's. However, while the use of lead additives has declined in the U.S. and future use may be strictly limited to certain types of engines, consumption in developing countries may continue to increase.

Lead coatings are used on materials exposed to corrosive agents and lead lined containers and tanks are used for the storage of corrosive chemicals and hazardous wastes. Lead coatings are also used as shields against radiation. While demand for these applications may increase, the use of lead in paints and other chemical applications where lead is likely to enter the environmen has declined in recent years.

The large scale use of massive, stationery, lead-acid storage batteries for leveling power loads in electrical generating plants may represent a significant future use.

Supply and Demand

With only a few exceptions, primary lead is produced as a by- or co-product of zinc, copper and silver mining. Recovery of lead from batteries and other sources results in a large component of recycled metal. In 1982 free-world mine production totaled 2.6 million tons.

Refined lead production, including recycled lead, totaled 3.9 million tons while lead consumption totaled 3.8 million tons.

The forecast demand for lead varies. The U.S. Bureau of Mines forecasts a probable average annual world growth rate of 2.8%, which is larger than the agency's forecast of 2.5% growth for zinc. Other sources indicate the lead growth rate will be significantly less, possibly approaching 1.0%.

At present, 75% of lead use is in transportation. If the use of lead in gasoline declines on a world wide basis, the importance of lead-acid batteries as a percentage of total lead consumption will increase. Battery demand for vehicles is a function of the total number of vehicles in use as replacement batteries constitute some 80% of sales. Any increased long term demand for lead-acid batteries will ultimately depend upon increasing automobile use in developing countries.

Marketing Considerations

Markets for lead concentrates from Red Dog would be found either at Cominco's Trail, B.C. smelter, at the Cominco Mitsubishi Lead Smelter in Japan or at other Japanese lead smelters. Lead concentrate production from Red Dog could replace Pine Point concentrates at the Cominco Mitsubishi smelter when the mine is exhausted. Present Trail lead capacity is 150,000 tons refined metal. Actual utilized capacity in 1982 was 126,000 tons. Plans to modernize and expand the lead smelter, as was done with the zinc refinery, could assure an in-house market for lead concentrates.

At present with Pine Point lead concentrates being shipped to Japan, concentrates from Cominco's Sullivan Mine represent about 100,000 tons of the Trail's refined capacity, leaving 50,000 tons available. At Red Dog's initial production rate, mine out put in terms of refined lead would just match this capacity.

4. Silver

Uses and Substitutes

The largest use of silver is in the production of photographic materials. Despite intensive research, no substitutes have been found to replace light sensitive silver-halides used in photographic films. Other industrial uses of silver include electrical switches, silver solders and batteries. Medicinal uses include antiseptics for certain types of infections, and as an amalgam in dental fillings. Silver coinage, jewelry, tableware, and investment bars are also major uses.

No viable substitute has been found for silver in photographic uses. Gold or platinum-group metals may be substituted for silver in electrical applications but only where the more oxidation resistant qualities of these precious metals overcomes the cost disparity. Copper, nickel, zinc and aluminum in various combinations have replaced silver coinage in many countries.

Supply and Demand

About two-thirds of the world's future supply of silver is contained in copper, lead and zinc deposits. Therefore the supply of silver will be determined more by the production of these base metals than by actual silver demand. The long term growth of silver demand, as with zinc and lead, is seen to be tied to the prosperity of developing nations. Increasing industrial and photographic demands, attendant upon an increased standard of living in these countries, will contribute to a strong demand growth.

The U.S. Bureau of Mines forecasts a probable annual world growth rate of 2.5% through 2000. Complicating the supply, demand, and price structure are the large quantities of silver held by investors. Silver holdings of private investors are large compared with annual

industrial consumption and these investors can respond to price fluctuations as either a source of supply or a source of demand. Also, despite the large industrial base, the silver price, to a certain extent, is influenced by gold prices. Rarely do the prices of the two metals move in opposite directions, a factor which underlines price linkage.

5. Barite

Uses

Over 90% of the world barite demand, and over 98% of the U.S. barite demand, is for use in oil and gas well drilling fluids. Barite is finely ground and slurried with water and other agents to produce a heavy fluid which is circulated in the drill hole as it is being drilled. In 1982 an average of 47 tons were used per well.

Supply and Demand

Barite has a low per unit cost and high bulk. The reported average value of primary barite in the United States was about $40 per ton in 1982. The delivered price of drilling grade barite to Alaska's North Slope drill rigs is said to be close to $600 per ton, however this cost incorporates a wide range of services carried out at the drill site. If barite must be shipped a significant distance, the transportation costs can easily exceed the cost of the barite itself. Therefore a relatively local market for barite must be available before the commodity is saleable.

Potential markets for Red Dog barite are the North Slope oil fields, and possibly the Norton Sound and Chukchi Sea fields if oil is discovered at either of these locations. Currently restrictive trade practices would inhibit the sale of Red Dog barite to Canadian Arctic oil and gas operations in the Beaufort Sea. At present, Cominco is examining possible processes to recover barite concentrates from the zinc/lead

ore. Also, high grade zones of barite are found apart from the metal rich zones of the ore deposit and barite could be selectively mined from these zones. One possible problem with barite from either of these sources is the presence of heavy metal or silica contamination which could result in the barite being unacceptable as a drill mud. The financial analyses of the project have not included any revenues from the possible sale of barite.

6. Zinc, Lead and Silver Price Forecast

The following price projections which were estimated by the Office of Mineral Development are for a 20 year period and represent the average commodity price in 1983 U.S. dollars.

RED DOG METAL PRICES

	Zinc (¢/lb.)	Lead (¢/lb.)	Silver ($ /tr.oz.)
Base Level	55	30	10
Probable	60	35	18
High	65	40	25

The demand for all three of these metals is dependent upon the growth of the world economy. The North American and European economies may be described as maturing and major increases in the consumption of base metals is in these economies unlikely. However, expansion and growth of economies in the developing countries will increase world demand for these metals. The present prices for zinc and lead (49¢/lb. and 25¢/lb. respectively) are below what could be considered base level prices due to the low recessionary demand and present high levels of metal stocks. As the world economy recovers, base level prices will be reached.

Discussion:

Zinc

Zinc is the most important commodity to the Red Dog Mine and will contribute up to 4 times the revenue generated by lead and silver combined.

World demand for zinc will grow commensurate with the growth of the world economy and the increasing industrialization of developing nations. The U. S. Bureau of Mines forecasts a probable growth of world demand at 2.5% annually. The increase in world demand coupled with the following factors indicates a stable market characterized by real price increases is likely for primary zinc producers (mines) over the long term.

1) Zinc is the fourth most widely used industrial metal surpassed only by iron, aluminum and copper.

2) The largest use of zinc (galvanizing) results in its dissipation. Therefore recycling and secondary production will always remain a less important supply factor than is the case for other metals.

3) There are no environmental problems associated with the use of zinc.

4) While known world zinc reserves, including Red Dog, appear adequate to satisfy medium and long term demand, the market is not over-shadowed by enormous undeveloped deposits as is the case with copper.