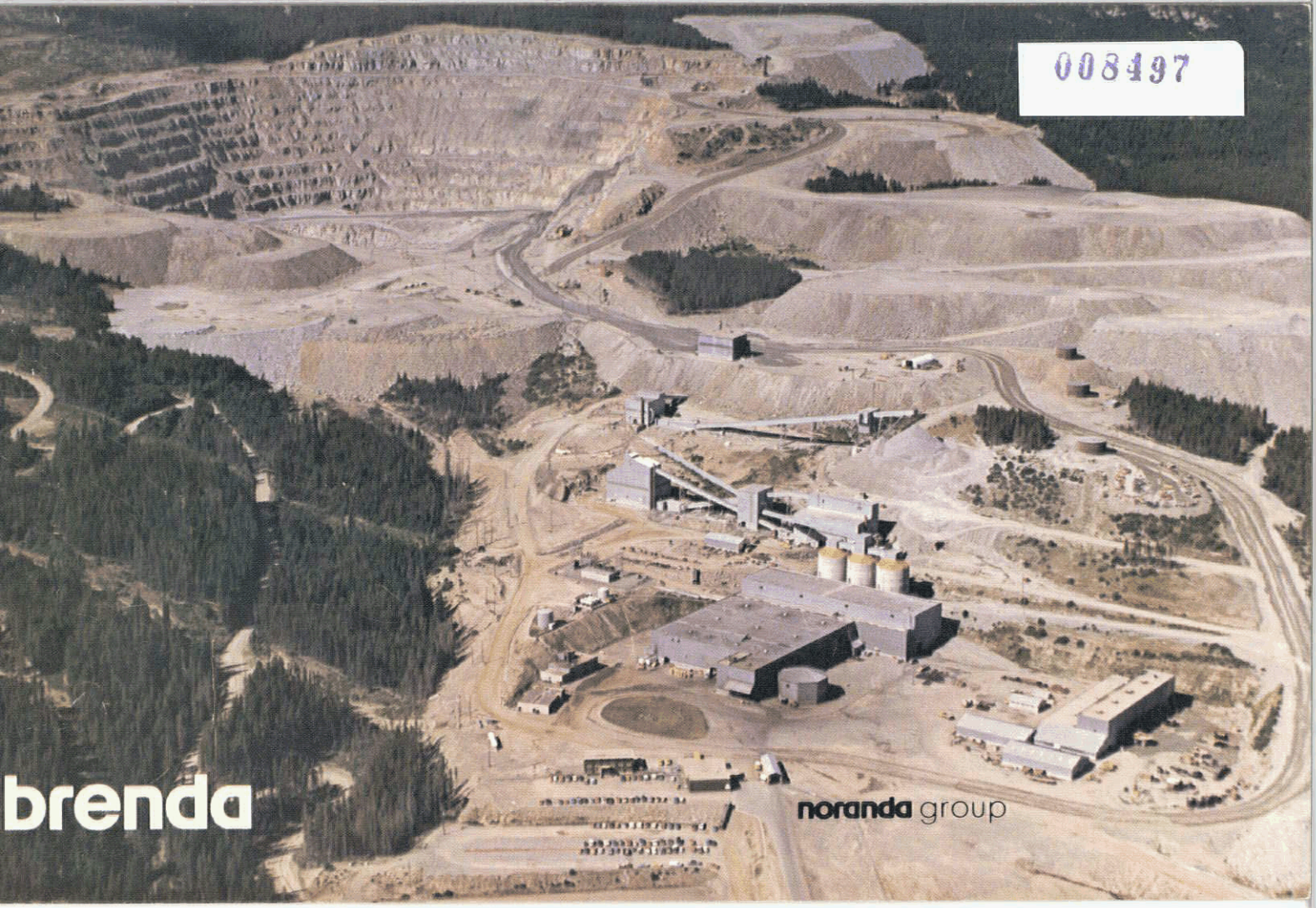


brenda MINES LTD.

P.O. Box 420
Peachland, B.C., Canada
V0H 1X0

noranda group

Location, Access and Climate

(Latitude 49°52'30" N., Longitude 120°00' W., Elevation 1463 metres)
The Brenda deposit is 225 km east-northeast of Vancouver and 23 km northwest of Peachland in the southern interior of British Columbia. The area around the deposit is typified by gentle rolling, tree-covered upland with scattered glacially rounded outcrops.
Twenty-three km of paved and 6 km of gravel road connect the property to Highway 97N at Peachland.
Temperatures at the mine site reach a maximum of 30° C in the summer months and a minimum of −30° C in the winter. Mean daily temperatures approximate 15° C during July and August and −8° C during December and January. Freezing conditions are experienced from mid-September to mid-April. Annual precipitation is in the order of 46 cm, of which 90%+ is in the form of snow.

History and Ownership

During the late 1930's and early 1940's, the Sandbergs of Kelowna worked on the "Copper King" property exploring a 30 cm chalcopyrite-molybdenite bearing quartz vein. They abandoned their claims in the early 1940's and the property lay dormant until it was re-discovered in 1954 by Bob Bechtel, a weekend prospector from Penticton. Between 1954 and 1964, several examinations and test drillings of the property were conducted but the low copper and molybdenum grades and lack of demand for molybdenum discouraged the investigators. During this period, Mr. Bechtel was encouraged and assisted by Messrs. B. O. Brynelsen and M. M. Menzies, then manager and assistant manager, respectively, of the Noranda Exploration Co. Ltd. offices in Vancouver. Brenda Mines Ltd. was formed in 1964 under the guidance of Brynelsen and Menzies. With funds obtained from Nippon Mining Company and private individuals, a detailed exploration and feasibility program was initiated in 1965. Noranda Mines Limited began providing major financing for the feasibility project in June 1966 and, in the spring of 1967, formalized later by agreement dated 4 January 1968, management control was assumed by Noranda. Today, Noranda holds 51% of the issued common shares.
At start-up in early 1970, the Brenda orebody had proven reserves of 160,571,600 tonnes grading .183% Cu and .049% Mo at a cut-off of .300% equivalent Cu. As of 31 December 1979 reserves were 139,681,000 tonnes at .145% Cu and .032% Mo.
A total capital outlay of some $63.5 million was required to bring the Brenda property to production.

brenda

Geology

The Brenda orebody is located within the Brenda Stock, a quartz diorite of Jurassic age which intrudes the stratified tuffs, tuff breccias, argillites, and limestones of the Nicola Group (Upper Triassic).

Mineralization of economic grade occurs in a strongly fractured area 800 metres long and 400 metres wide near the west margin of the Brenda Stock, approximately 250 to 300 metres from the contact with the Nicola Group. (Figure 1) Ore grade mineralization extends to depths exceeding 300 metres. A belt of much lower grade non-economic mineralization up to 600 metres wide extends north-north-easterly almost to Long Lake.

The ore minerals, chalcopyrite and molybdenite, along with minor pyrite and occasional magnetite, occur as fillings within fractures. Disseminations are rare except in areas of intense hydrothermal alteration. The grade of the orebody is a function of fracture density and of mineralogy of the filling material. Filling material, in addition to the sulphides, may be either biotite, quartz + potash feldspar, or quartz.

Property Operations

Under a resident Mine Manager, the operating crew is divided into three departments — Mine Operating, Mill Operating and Plant. Administrative services are provided by the Accounting, Personnel and Purchasing Departments.

As of 1 January 1980, the employees were distributed as follows:

	Hourly Rate	Staff	Total		Hourly Rate	Staff	Total
Mine Operating	93	19	112	Administration	0	25	25
Mill Operating and Maintenance	119	43	162	Purchasing/ Warehousing	6	8	14
Plant Department	130	26	156	TOTALS	348	121	469

During 1979, a total of 9,075,723 metric tonnes of ore grading .144% Cu and .036% Mo were treated in the Brenda concentrator. The concentrates produced contained 10,726 tonnes of copper and 2,536 tonnes of molybdenum.

Distribution of Operating Costs

	% of Cost Per Tonne Milled		% of Cost Per Tonne Milled
Mining	34	Plant	3
Milling	48	Administration	15
			100%

Figure 2 depicts the general arrangement of the Brenda Mine.

brenda

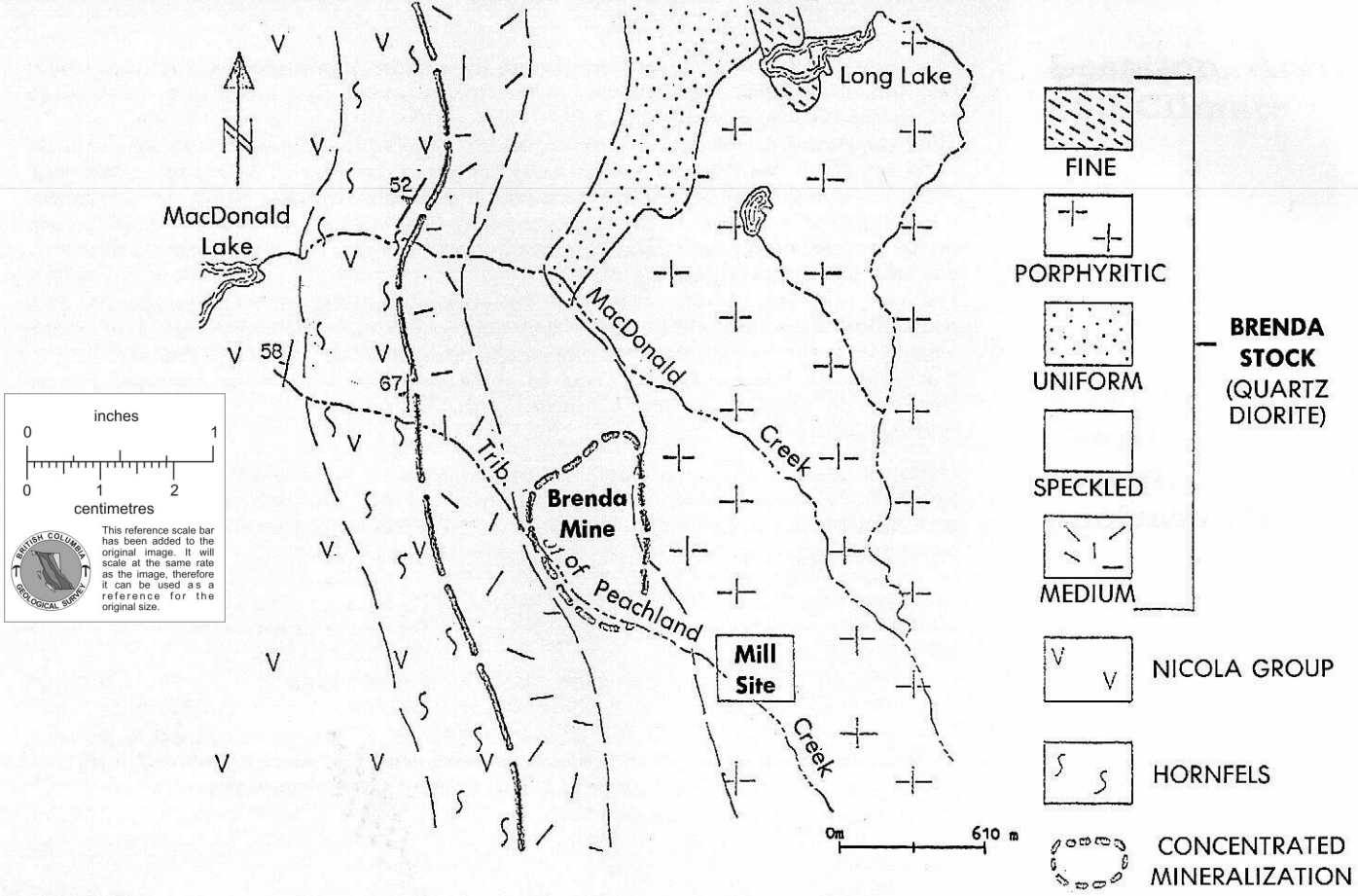


FIGURE 1

BRENDA MINE — GENERAL GEOLOGY

(Modified after Carr, 1967)

Mining Operation

The open pit presently encompasses an area of approximately 60 hectares with another 80 hectares cleared for waste and low grade stockpile dumps. Pit depth varies from 244 metres on the north wall to 107 metres on the south wall.

Daily production during 1979 averaged 27,336 tonnes per operating day of mill feed and 12,675 tonnes of waste/low grade. An average of 830 tonnes per man-shift (hourly pit personnel) was achieved in 1979. The pit operates 7 days per week, 3 shifts per day.

Design Parameters

Bench height	15 metres
Berm width	15 metres
Overall pit slope (excl. roads)	45°
Road width	24 metres
Blast hole patterns	31.12 cm diameter holes
	9 metre spacing
	7 metre burden
	2 metre sub-grade

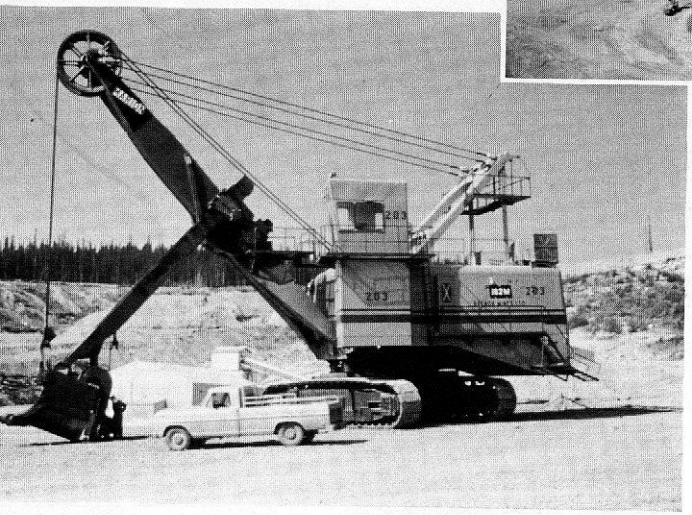
Table 1 contains details on current mining equipment.

Tabulation of Mine Operating Statistics

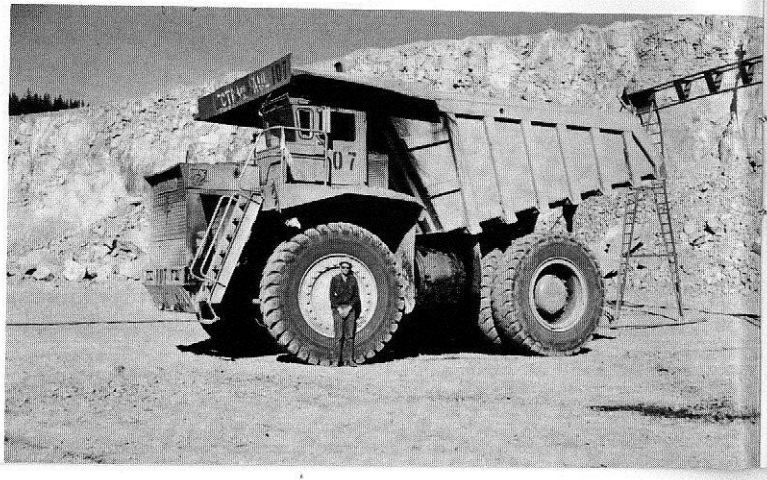
Production

1.	Pre-production (Nov. 1967 through Nov. 1969)	
	overburden	456,200 tonnes
	waste rock	6,716,800 tonnes
	stockpiled low grade	Nil
	stockpiled ore	47,400 tonnes
2.	Production Phase (Dec. 1969 through Dec. 1978)	
	overburden	1,090,400 tonnes
	waste rock	46,664,800 tonnes
	stockpiled	19,263,900 tonnes
	mill feed	78,905,600 tonnes
3.	Production for 1979	
	overburden	8,249,000 tonnes
	waste rock	
	stockpiled low grade	1,071,000 tonnes
	mill feed	8,005,000 tonnes

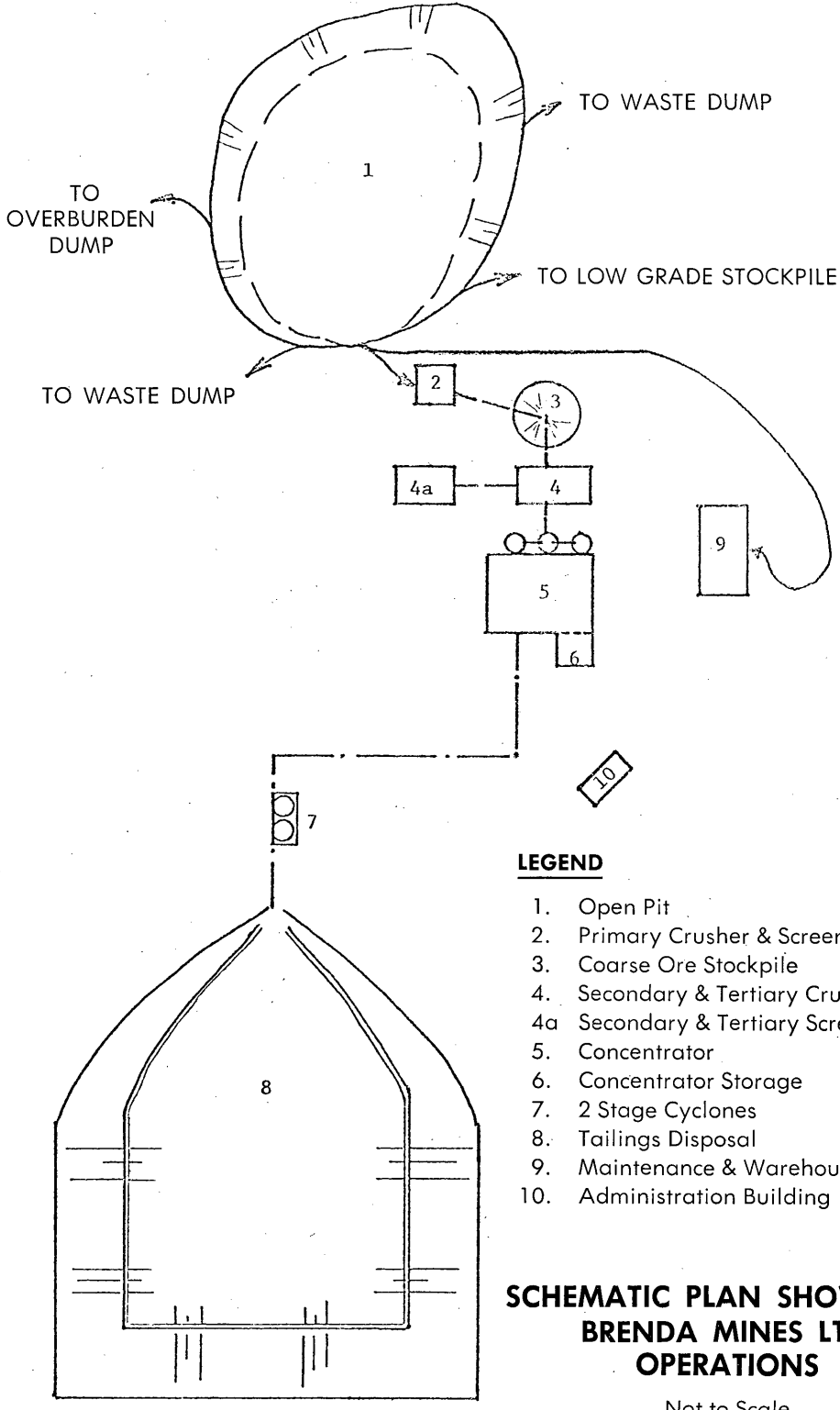
Blast



Marion Shovel



100 Ton Truck



LEGEND

1. Open Pit
2. Primary Crusher & Screening
3. Coarse Ore Stockpile
4. Secondary & Tertiary Crushing

4a Secondary & Tertiary Screening

5. Concentrator
6. Concentrator Storage
7. 2 Stage Cyclones
8. Tailings Disposal
9. Maintenance & Warehouse Bldg.
10. Administration Building

SCHEMATIC PLAN SHOWING BRENDA MINES LTD. OPERATIONS

Not to Scale

FIGURE 2

TABLE 1

MINE PRODUCTION EQUIPMENT

FUNCTIONS	TYPE	NO. OF UNITS	SCHEDULED PER SHIFT	SHIFTS PER DAY	OPERATORS PER UNIT	PERFORMANCE PER OP. HOUR
Drilling, Primary	B.E. 60-R Electric	2	1	3	2	15.2 m/hr.
Drilling, Secondary	Gardner Denver ATD 3100 Airtrac	1	as required		1	4.1 m/hr.
Loading	Marion 191M 11 cu. metre	1	as required	3	2	1,292 tonnes/hr.
	Marion 182M 8 cu. metre	3	2	6	2	1,134 tonnes/hr.
Loading, Secondary	B.E. 150B 6 cu. metre	1	as required		2	571 tonnes/hr.
Haulage	Unit Rig M-100, 48 cu. metre struck box, diesel-electric	12	8	24	1	236 tonnes/hr.
	Unit Rig M-85, 43 cu. metre struck box, diesel-electric	3	3	9	1	186 tonnes/hr.
Shovel Cleanup	Cat 824B rubber-tired Dozers	3	2	6	1	
Dump Maintenance	Cat D-9 tracked, U-blades and rippers	4	2	6	1	
Road Maintenance	Cat 14-G	2	as required	3	1	
	Cat 631 Tractor Tanker, 45,460 litres	1	as required	3	1	
	Cat 769 Sand Truck, 32 tonnes	1	as required	3	1	
Miscellaneous	Cat 988 F.E. Loader	1	as required	3	1	
	Cat 769, 32 tonnes	1	as required	3	1	

Consumed Supplies for 1979

1.	Blasting	
	ANFO	2,379,690 kilograms
	Slurries	232,495 kilograms
2.	Diesel Fuel	4,144,824 litres
3.	Tires 24.00 x 49.00	202
4.	Electric Power (Total Plant)	184.2 million kwh

Mine Department Personnel

Four crews working a 7-1, 7-2, 7-4 shift schedule keep the pit operating 7 days a week, 24 hours per day.

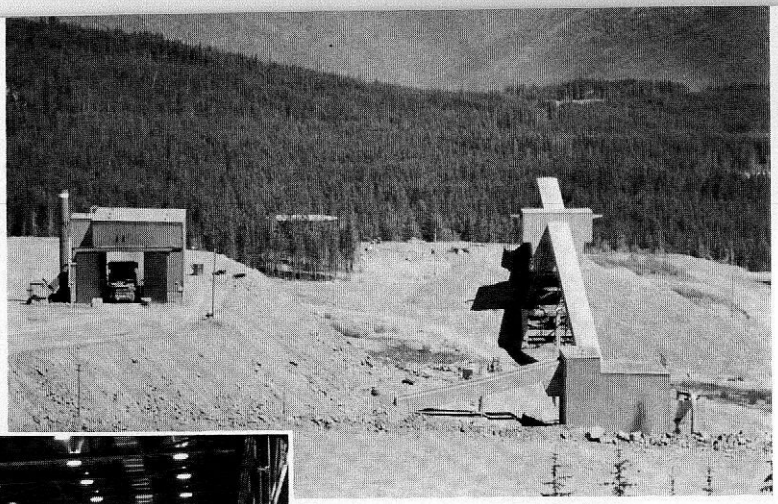
	Hourly	Staff
Drilling	9	
Blasting	3	
Loading	15	
Hauling	45	
Dozers, Graders, etc.	20	
Janitor	1	
Pit Supervision**		10
Surveyors*		3
Engineers*		3
Superintendent*		1
Clerk*		1
Grade Technician*		1
	93	19

* day shift, 5 days per week.
** 8 shift foremen, 1 mine training supervisor, 1 general mine foreman.

Cost of Mining

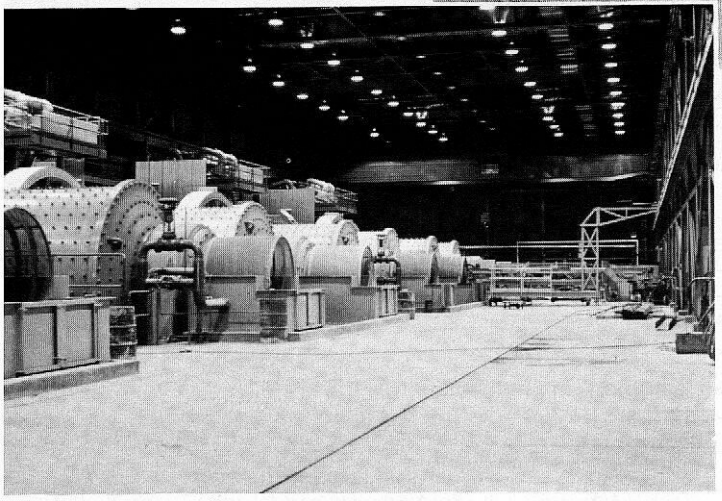
The total cost of mining, including maintenance, for the 17,535,400 tonnes of rock and overburden moved during 1979 is distributed as follows:

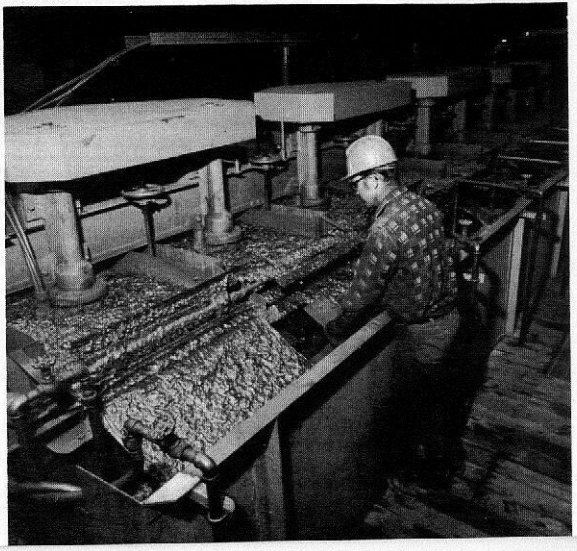
	% per Tonne Mined		% per Tonne Mined
Hauling	28.6	General (power distrib.,	
Drilling	4.5	dewatering, roads, etc.)	33.7
Blasting	9.3	Engineering	5.8
Loading	18.1		100



Primary Crusher (left)
Primary Screening (lower right)

Concentrator
Grinding Bay





Moly Flotation

Mineral Processing

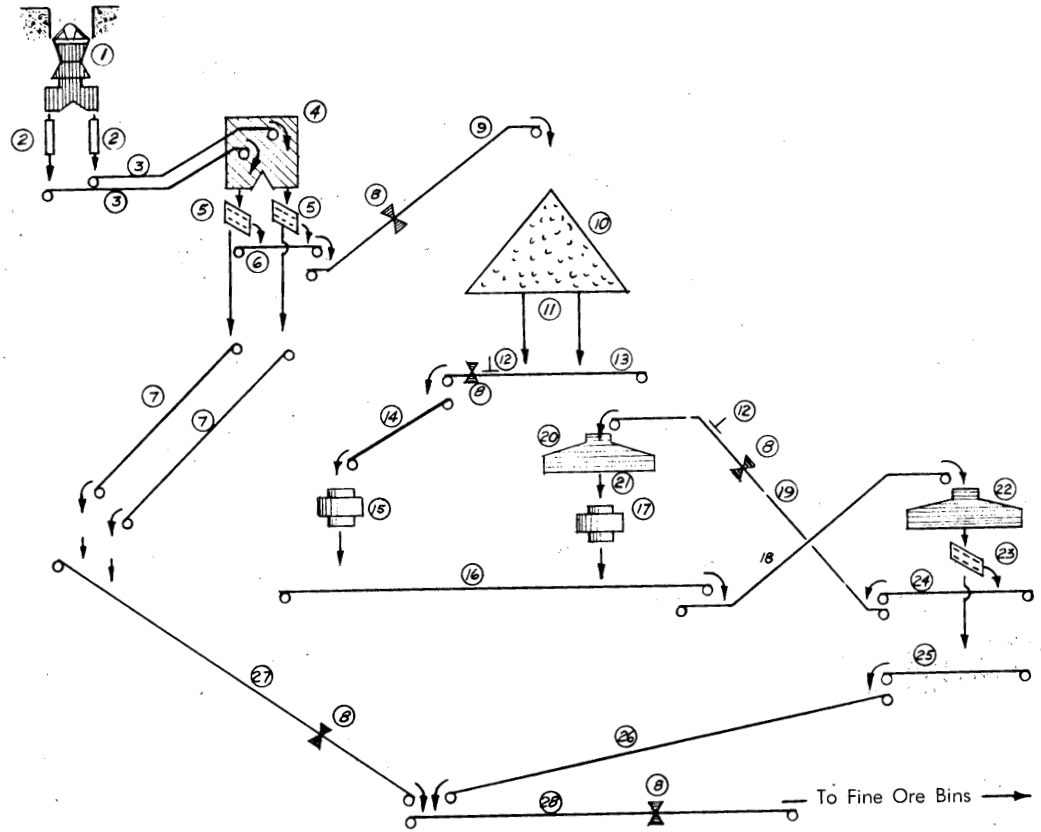
The crushing and concentrating facilities were designed to treat a minimum of 21,800 tones per day from the low grade copper-moly orebody, and the current level of operations is approximately 27,200 tonnes per day. During 1979, the concentrator averaged 110 tonnes of copper concentrate assaying 29.3% copper, and 18.5 tonnes of molybdenum concentrate assaying 56.4% molybdenum per day. The copper concentrate is sold in Japan and Korea and the molybdenum concentrate is marketed primarily in Europe, but lesser amounts are shipped to other parts of the world. (These figures based on 332 day year in 1979.)

The flowsheets of the crushing and concentration operations are included in Figures 3, 4 and 5.

The primary crusher is a 150 cm x 225 cm gyratory crusher driven by a 525 kw motor, and it is capable of reducing mine-run ore to minus 18 cm size at a rate of 2,700 tonnes per hour. The crushed product falls to two 185 cm apron feeders, and is then discharged to two conveyor belts and two 2.5 metre x 6 metre double deck vibrating screens. The undersize from the screens (minus 2 cm) is conveyed to the mill fine ore bins, and the oversize product of both screen decks is conveyed to a 40,000 tonne live load stockpile via a 185 cm conveyor belt equipped with dual drives totalling 560 kw.

Coarse ore from the stockpile is reclaimed by vibrating feeders and two conveyor belts operating in concrete tunnels below it. The conveyors feed the secondary crushing plant which consists of two 2 metre standard cone crushers set at 3 cm in open circuit. The product is conveyed to five 2.5 metre x 6 metre double deck vibrating screens. The minus 2 cm undersize from the lower deck is conveyed to the fine ore bins and the product of both upper screen decks is returned to four 2 metre shorthead crushers which operate in closed circuit with the screens. Secondary tertiary crushing plant output averages 1,270 tonnes per hour.

The concentrator is designed with four parallel circuits each of which handles approximately 6,800 tonnes per day. Each circuit consists of a 4 metre diameter by 5.5 metre long rod mill driven by a 1,500 kw motor. The rod mill discharge is pumped to a cluster of four 75 cm diameter cyclone classifiers. Classifier underflow enters a 4 metre diameter by 7 metres long ball mill driven by a 2,100 kw motor, and the ball mill discharge is returned to the cyclones. The cyclone overflow,

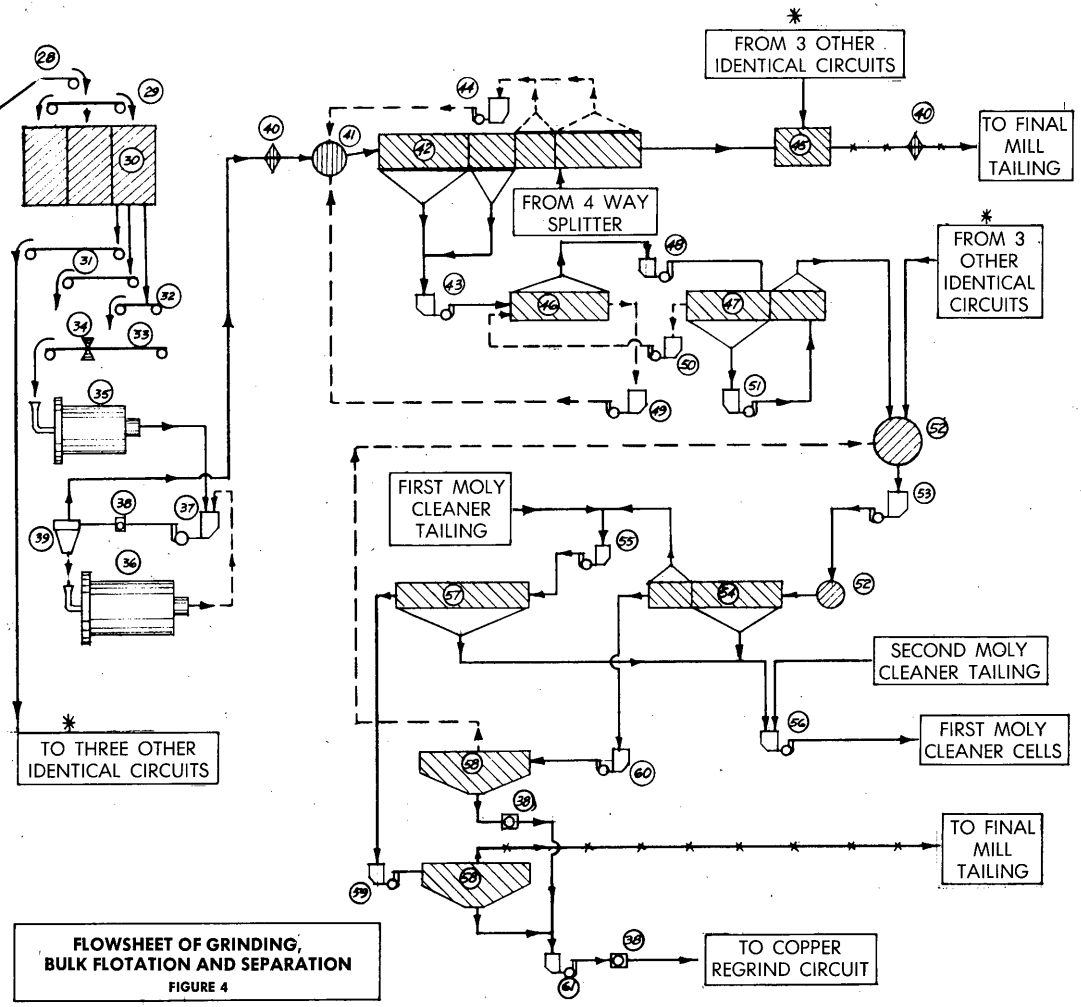


LEGEND

Item	No. Units	Description
1	1	Primary Crusher, 150 cm x 225 cm
2	2	Apron Feeders 185 cm
3	3	Conveyor 135 cm wide
4	1	Surge Bin
5	2	Primary Screens 2.5 m x 6 m
6	1	Conveyor 185 cm wide
7	2	Conveyors 90 cm wide
8	5	Weightometer
9	1	Conveyor 185 cm wide
10	1	Coarse Ore Stockpile
11	8	Vibrating Feeders 120 cm
12	2	Metal Detector
13	2	Conveyor 120 cm wide
14	2	Conveyor 140 cm wide
15	2	Secondary Crusher 2 m std.
16	1	Conveyor 180 cm wide
17	4	Tertiary Crushers 2 m s.h.
18	1	Conveyor 150 cm wide
19	1	Conveyor 120 cm wide
20	1	Surge Bin
21	4	Vibrating Feeders 150 cm
22	1	Surge Bin
23	4	Secondary Screens 2.5 m x 6 m
24	1	Conveyor 150 cm wide
25	1	Conveyor 120 cm wide
26	1	Conveyor 120 cm wide
27	1	Conveyor 90 cm wide
28	1	Conveyor 140 cm wide

CRUSHING AND SCREENING FLOWSHEET

FIGURE 3

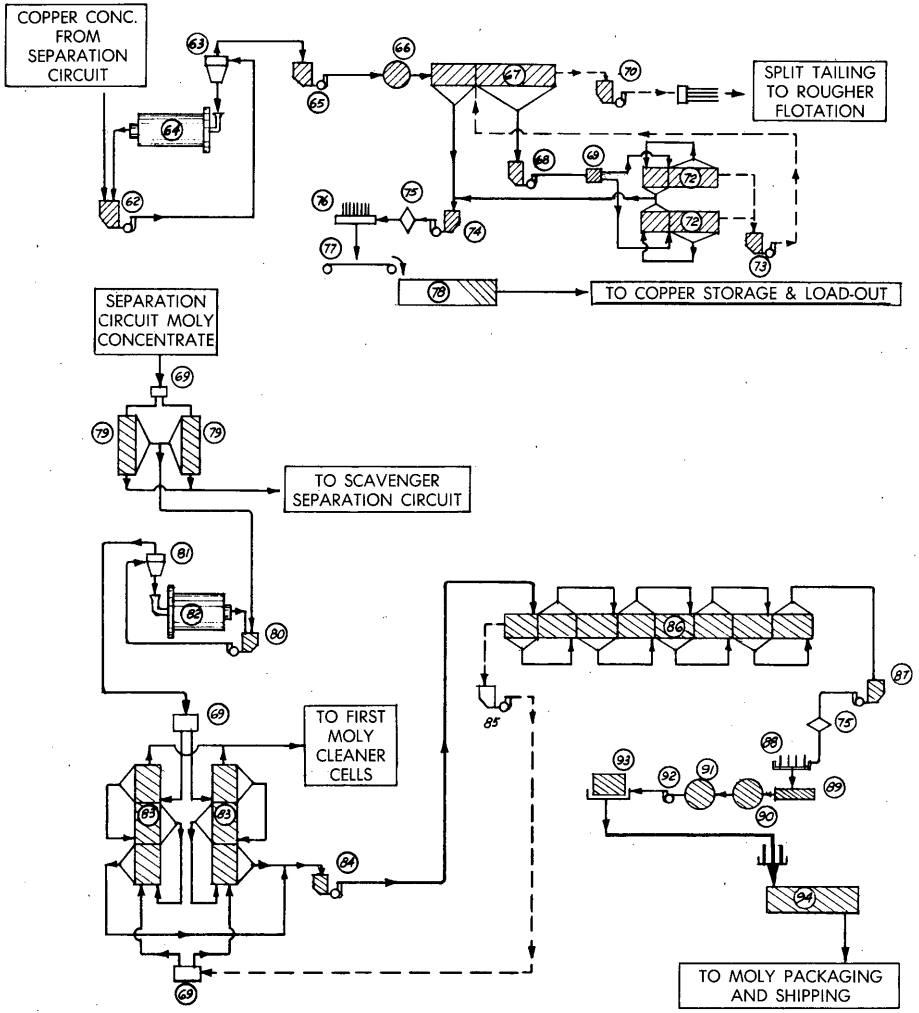


LEGEND

Item	No. Units	Description
28	1	Conveyor 140 cm wide
29	1	Conveyor - reversible 140 cm wide
30	3	Fine Ore Bins 4,500 tonne capacity
31	8	Conveyors, vari-speed 90 cm wide
32	4	Conveyors 90 cm wide
33	4	Conveyors 75 cm wide
34	1	Weightometers
35	4	Rod Mills 4 m x 5.5 m
36	4	Ball Mills 4 m x 7 m
37	8	Pumps, cyclone feed 40 cm x 40 cm
38	3	Density Gauges
39	16	Cyclones, 4 per circuit 75 cm
40	2	Samplers
41	4	Conditioners 3 m x 3 m
42	60	Rougher Cells Agitair 120
43	8	Pumps, Rougher Conc. 15 cm
44	4	Pumps, Scav. Conc. 25 cm x 45 cm
45	1	Tailing Box
46	56	1st Bulk Cleaner Cells #24 DR
47	48	2nd & 3rd Bulk Cleaner Cells, #24 Sub A
48	8	Pumps, 1st Bulk Cl. Conc. 9 cm
49	4	Pumps, 1st Bulk Cl. Tail, 25 cm x 40 cm
50	4	Pumps, 2nd Bulk Cl. Tail 9 cm
51	4	Pumps, 2nd Bulk Cl. Conc. 9 cm
52	2	Conditioners 2.5 m x 2.5 m
53	2	Pumps, combined 3rd Bulk Cl. conc. 9 cm
54	20	Moly Rougher Separation Cells #24 DR
55	1	Pump, Moly Roughers Scav. Conc. 3 cm x 3 cm
56	1	Pump, Rougher Moly Conc. 3 cm x 3 cm
57	20	Moly 1st Cleaner Scav. Cells #24 DR
58	2	Thickeners 21m
59	1	Pump, Moly Scav. Tail. 3 cm x 2 cm
60	1	Pump, Moly Rougher Tail. 3 cm x 2 cm
61	2	Pumps, Copper Conc. 8 cm x 8 cm

FLOWSHEET OF GRINDING, BULK FLOTATION AND SEPARATION

FIGURE 4



LEGEND

Item	No. Units	Description
62	2	Pumps, Copper Regrind Cyclone Feed, 8 cm x 8 cm
63	2	Cyclones 25 cm (one operating)
64	1	Regrind Ball Mill 3 m x 4 m
65	2	Pumps, Cyclone Overflow, 8 cm x 8 cm
66	1	Conditioner 1.5 m x 2 m
67	12	Copper Conc. 1st Cleaner Cells, Agitair
68	2	Pumps, 1st Cleaner Scav. Conc. 13 cm x 10 cm
69	4	2-way Splitter Boxes
70	2	Pumps, Copper Conc. Tail. 13 cm x 10 cm
71	1	4-way Splitter Box
72	12	2nd & 3rd Cu. Conc. Cleaner Cells #24 Sub A
73	2	Pumps, 2nd Cu. Clnr. Tail. 13 cm x 10 cm
74	2	Pumps, Final Cu. Conc. 9 cm vertical
75	2	Samplers
76	1	Disc Filter 2 m x 8 disc
77	1	Conveyor 107 cm wide
78	1	Cu. Conc. Dryer c/w Scrubber
79	20	1st Moly Cleaner Cells, #21 Sub A
80	1	Pump, 1st Moly Clnr. Conc. 15 cm vert.
81	8	Cyclones, 15 cm (2 operating)
82	2	Regrind Ball Mills, 2 m x 4 m (one spare)
83	12	2nd, 3rd & 4th Moly Clnr. Cells #21 Sub A
84	2	Pumps, 4th Moly Clnr. Conc. 6 cm
85	1	Pump, 5th Moly Clnr. Tail 2 cm x 1.5 cm
86	10	5th to 12 Moly Clnr Cells #21 Sub A
87	2	Pumps, 12th Moly Clnr. Conc. 9 cm
88	1	Disc Filter 2 m x 4 disc
89	1	Screw Conveyor, movable
90	3	Glass Lined Reactors
91	1	Glass Lined Cooling Vessel
92	1	Pump, Cooling Vessel Discharge
93	2	Filter Presses 120 cm x 27 Plates
94	1	Dryer, Gas-fired Infra-red

COPPER AND MOLYBDENUM SEPARATION CONCENTRATE TREATMENT

FIGURE 5

approximately 45% solids and 40% minus 200-mesh, flows by gravity to a conditioner and rougher flotation.

Rougher, or bulk flotation, is performed in four parallel circuits each of which consists of three five-cell groups of No. 120 Agitair flotation cells. The bulk rougher concentrate is first cleaned in No. 24 Denver DR cells after which it undergoes two more stages of cleaning in No. 24 Denver Sub A cells. At this point, the concentrate from all four units is combined for conditioning with sodium hydrosulphide in order to depress copper in the first step of the copper-moly separation process. The concentrate is then differentially flotated in one 20-cell row of No. 24 Denver DR cells.

The tailing from these cells is pumped to a 21 metre diameter thickener, and the overflow is recycled to the bulk concentrate conditioner to minimize sodium hydrosulphide consumption. The tailings from the moly first cleaner scavenger circuit are also pumped to a thickener, and the overflow is discarded with the final mill tailings. The thickener underflows are combined to form the copper rougher concentrate. This concentrate is pumped to a 3 metre diameter 4 metre long regrind ball mill (450 kw) in closed circuit with a 25 cm diameter cyclone. Regrinding is followed by copper cleaner flotation to produce the final copper concentrate. This product assays approximately 29.0% copper and is 85% passing 325 mesh. It is then filtered to approximately 12% moisture on a 2 metre diameter vacuum filter, and then dried to 6% moisture in a rotary kiln type of dryer. The concentrate is shipped in 30 tonne truckloads to the railhead in Kelowna, from there it goes by rail to Vancouver to await boat shipment to Japan or rail shipment to eastern Canada.

The moly rougher concentrate and moly scavenger concentrate, from the separation circuits, are combined and pumped to the first cleaning stage which consists of two 10-cell rows of No. 24 Denver Sub A cells. The concentrate product is pumped to a regrind ball mill (190 kw) in closed circuit with a cluster of 15 cm cyclones. The reground concentrate undergoes a further eleven stages of cleaning in No. 21 Denver Sub A cells to produce the final molybdenum concentrate.

While the flotation process produces a molybdenum concentrate of sufficiently high grade, it does not decrease certain impurity levels (copper and lead) within the specification limits required for a primary molybdenum product. For this reason a hot chloride leaching process, patented by Brenda Mines Ltd., is the next step in the mill process.

Leaching reduces the copper content of the concentrate from an average 0.337% to less than 0.07%, and the lead content is reduced to less than 0.05% at those times that lead is present.

The molybdenum concentrate is then filtered, dried, and stored in bins to await packaging in 145 litre steel drums. Four containers are strapped to a pallet and represent approximately one tonne of concentrate. The concentrate is shipped to Vancouver in 18 tonne truckloads to await a vessel to transport it to European roasting facilities.

The concentrator has been extensively computerized during the past five years. A process control system consisting of two Firsher CP212 computers currently controls the grinding circuit and much of the flotation process (the latter in conjunction with an ARL On-stream Analyzer). Computer control of the Secondary-Tertiary Crushing Plant is currently being implemented.

Operating Statistics

The milling statistics for a typical twelve month period are as follows:

Working Days	365
Total Mill Feed	9,950,000 tonnes 0.145% Cu; 0.035% Mo
Overall Copper Recovery and Grades	82.0% — 29.0% Cu; 0.200% Mo
Overall Molybdenum Recovery and Grades	78.0% unleached 0.38% Cu; 54.3% Mo leached 0.07% Cu; 56.5% Mo
Power Consumption (Entire Concentrator)	20 kw hrs per tonne of ore
Grinding Media	0.87 kg/tonne ore
Reagent Usages	
Collectors	
Potassium Anyl Xanthate	.006 kilos/tonne ore
Fuel Oil	.030 kilos/tonne ore
Frother (MIBC)	.030 kilos/tonne ore
Depressants	
Sodium Hydrosulphide	.085 kilos/tonne ore
Sodium Cyanide	.008 kilos/tonne ore

Leach Chemicals	
Sodium Chloride	.040 kilos/tonne ore
Ferros Chloride	.140 kilos/tonne ore
Chlorine	.006 kilos/tonne ore
Filter Aids	
Surfactant	.002 kilos/tonne ore
Flocculant	.001 kilos/tonne ore

Personnel

	Hourly Rated	Staff	Totals
Mill Operation	62	12	74
Mill Maintenance Mechanical	24	2	26
Fabrication — Mechanical	8	1	9
Maintenance Planning	—	3	3
Instrumentation	6	2	8
Assaying	—	11	11
Metallurgical	—	7	7
Clerical	—	1	1
General Foreman	—	1	1
Superintendent	—	1	1
Crusher Maintenance	16	2	18
Janitors	3	—	3
TOTALS	119	43	162

Operating Costs

	% of Total Mill Cost
Operating Salaries	18.6
Maintenance Salaries	9.6
Maintenance Supplies	15.3
Reagents	5.4
Grinding Steel	21.1
Liners and Screens	8.3
Electrical Power	16.0
Fuel	1.9
Other Operating Supplies	3.8
	100.0

Plant Department

The design and operation of the tailings-reclaim system was based on the premise that adequate storage space would be developed by the production of sand.

At present, this production is the most critical problem. Consequently, the operation is continued on a year-round basis. Winter temperatures with a monthly mean minimum ranging around —18° C have caused inconvenient working conditions. However, to date, no delay in the production has occurred that could be ascribed to the cold weather.

The services and maintenance functions are grouped under the Plant Department. Personnel within the department are distributed as follows:

	Hourly	Staff	Total
Pit Shop Mechanical	76	10	86
Electrical Maintenance	24	3	27
Surface	10	1	11
Tailings	14	1	15
Boiler	6	1	7
Planning	—	6	6
Warehouse (includes Purchasing)	6	10	16
Maintenance Staff (includes Superintendent)	—	4	4
TOTAL	136	36	172

Maintenance and warehousing facilities are located in one 4,500 square metre complex and one 200 square metre tire shop located 1.5 kilometres from the open pit. The main shop has eight service bays, two for the welding crew, five for general repairs and one wash bay.

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