THE CLEVELAND-CLIFFS IRON COMPANY

Ore Mining Department

ANNUAL REPORT OF GENERAL MANAGER

For Year Ending December 31, 1959

#2030

THE CLEVELAND-CLIFFS IRON COMPANY
ORE MINING DEPARTMENT

Manager's Annual Report Year 1959

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CLIFFS SHAFT MINE
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1. GENERAL:

The production in 1959 was 362,434 tons, compared to the estimate of 352,500 tons. A small stockpile over-run was realized in May when the remainder of a small pile of crushed #1 grade was loaded out. Operations were on a schedule of 2-8 hour shifts per day, five days per week, throughout the year. The mine was idle for approximately 17 weeks, from July 15th to November 9th, because of the industry-wide strike. The strike was halted by government injunction under the Taft Hartley Act, and operations were continuing under this provision at the close of the year. A new labor agreement was negotiated with the union early in 1960.

The Cost of Production was $4.475, and the Total Cost at Mine was $6.147, compared with $4.728 and $6.322 respectively in 1958. The lower costs in 1959 are attributable to increased efficiency resulting from a more normal work schedule, in contrast to the previous year when operations were on a curtailed basis. Increases in the cost of some supply items, plus an increase in the cost of living adjustment, were absorbed by increased efficiency. Economies affected in various departmental costs are reflected in a considerably reduced General Mine Expense. The higher efficiency is reflected in the increase in tons per man per day to 8.63 compared with 8.55 in 1958.

Strict grade controls were in effect throughout the year as evidenced by the analysis of both production, and shipments. Numerous changes in contract locations were made as grade requirements and reserves dictated. However the number of these contract relocations was down from 1958. The labor force was reduced slightly as a result of normal attrition.

The average number of contracts working remained the same as at the close of the previous year. A number of mining areas were depleted; however, better than budget production was maintained by re-entering old workings to recover relatively small areas, and continuing a pillar recovery program.

Shipments totalled 402,968 tons, leaving a balance of 88,017 tons on stockpile at the close of the year. This compares with 128,551 tons at the end of 1958.

Screening the mine run at 2" was continued throughout the year, and the ratio of lump and fines was 57%, and 43% respectively.

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2. PRODUCTION:

a. Production by Grade and Months

Month	Optg. Days	CLIFFS SHAFT Lump	CLIFFS SHAFT Crushed No. 1	BANCROFT Lump	BANCROFT Crushed No. 1	SECTION 10 Lump	SECTION 10 Crushed No.1	Total	Rock
Jan.	21	13,824	10,835	2,482	1,945	7,441	5,833	42,360	906
Feb.	20	14,814	11,440	2,188	1,689	7,420	5,732	43,283	692
Mar.	21	14,665	11,298	3,937	3,032	7,122	5,487	45,541	276
Apr.	22	16,341	12,446	3,395	2,591	7,081	5,385	47,239	770
May	21	16,167	11,143	2,898	2,000	7,006	4,828	44,042	1856
June	22	14,979	11,265	3,740	2,813	6,981	5,250	45,028	2858
July	9	8,510	6,147	1,432	1,032	3,307	2,388	22,816	144
Aug.	-	-	-	-	-	-	-	-	-
Sept.	-	-	-	-	-	-	-	-	-
Oct.	-	-	-	-	-	-	-	-	-
Nov.	15	11,354	8,266	899	654	4,560	3,320	29,053	2056
Dec.	21	14,607	10,546	2,362	1,706	6,364	4,595	40,180	40
Sub Total		125,261	93,386	23,333	17,462	57,282	42,818	359,542	9598
Current Year's Stkp. Overrun		-	1,788	-	352	-	752	2,892	-
Total	172	125,261	95,174	23,333	17,814	57,282	43,570	362,434	9598

b. Shipments

	Pocket Tons	Stockpile Tons	Total Tons 1959	Last Year Tons
Cliffs Shaft Lump	62,359	86,752	149,111	169,974
Cliffs Shaft Crushed #1	44,932	53,990	98,922	92,578
Bancroft Lump	11,995	16,347	28,342	35,258
Bancroft Crushed #1	8,377	10,620	18,997	18,997
Section 10 Lump	28,085	37,409	65,494	66,841
Section 10 Crushed #1	19,396	22,706	42,102	37,372
Total	175,144	227,824	402,968	421,020

C. Ore Statement

	On Hand 1-1-58	Output For Year	Overruns	Total	Shipments	Balance on Hand
Cliffs Shaft Lump	38,218	125,261	-	163,479	149,111	14,368
C. S. Crushed #1	44,183	93,386	1,788	139,357	98,922	40,435
Bancroft Lump	7,500	23,333	-	30,833	28,342	2,491
Banc. Crushed #1	8,610	17,462	352	26,424	18,997	7,427
Section 10 Lump	14,420	57,282	-	71,702	65,494	6,208
Sec. 10 Crushed #1	15,620	42,818	752	59,190	42,102	17,088
Total	128,551	359,542	2,892	490,985	402,968	88,017
Total Last Year	101,459	448,112	-	549,471	421,020	128,551

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2. PRODUCTION: Cont'd

d. Working Schedule

The table below shows a comparison of working schedules for the past five years:

Year	Schedule
1959	2 8-hour shifts per day with hoisting on 1 8-hour shift per day, 5 days per week.
1958	2 8-hour shifts per day with hoisting on 1 8-hour shift per day, 4 days per week January 1 through February 28; 4 days per week for 3 out of every 4 weeks March 1 through September 30; 4 days per week October 1 through December 7; 5 days per week December 8 through December 31.
1957	2 8-hour shifts per day with hoisting on 1 8-hour shift per day, 5 days per week.
1956	2 8-hour shifts per day with hoisting on 1 8-hour shift per day, 5 days per week.
1955	3 8-hour shifts per day with hoisting on 2 8-hour shifts per day, 4 days per week January 1 through April 15; 5 days per week April 16 through November 28; then 2 8-hour shifts per day with hoisting on 1- 8-hour shift per day for the balance of the year.

e. Production Delays

There were no significant delays to production. The hoisting plant was used only 64% of the available time, and there is ample reserve capacity so that maintenance on the system can be done without effecting production. Most maintenance work on flowsheet equipment was also done on days when the hoisting plant was not in use. Because of this premium, labor expense was almost totally avoided.

3. ANALYSIS:

A. Average Mine Analysis of 1959 Output:

	Iron Dried	Phos.	Silica
Combined Cliffs Shaft Lump	61.32	.111	6.90
Combined Cliffs Shaft Crushed #1	55.99	.110	12.17

b. Average Analysis of Shipments for 1959:

Grade	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moisture
(*) Lump Ore	62.14	.111	6.22	0.20	2.20	1.00	0.90	.006	1.40	0.93
(*) Crushed Ore #1	56.43	.110	11.71	0.30	2.39	1.20	1.27	.009	1.90	2.20

(*) Cliffs Shaft, Bancroft and Section 10 ores are combined.

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3. ANALYSIS: (Cont'd)

c. Average Analysis of Ore in Stock Dec. 31, 1959:

	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Combined C.S. Lump Dried	60.85	.112	7.36	0.20	2.15	0.85	0.80	.006	1.30	-
Nat'l	60.24	.111	7.29	0.20	2.13	0.84	0.79	.006	1.29	1.00
" C.S. Crushed #1 Dried	55.84	.110	12.98	0.30	2.40	1.10	1.20	.011	1.85	-
Nat'l	54.72	.108	12.72	0.29	2.35	1.08	1.18	.011	1.81	2.00

4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING:

Comparative Mining Costs

	1959 362,434		1958 448,112	
	Amount	Cost/Ton	Amount	Cost/Ton
Underground Costs	$ 1,297,056.83	$ 3.579	$ 1,613,058.31	$ 3.599
Surface Costs	126,069.62	0.348	159,481.16	0.356
General Mine Expense	198,574.77	0.548	346,291.31	0.773
Cost of Production	1,621,701.22	4.475	2,118,830.78	4.728
Depreciation	418,911.47	1.156	395,258.49	0.882
Taxes	146,437.82	0.403	276,618.00	0.618
Loading & Shipping	40,857.35	0.113	42,438.08	0.094
Total Cost at Mine	$ 2,227,907.86	$ 6.147	$ 2,833,145.35	$ 6.322
Budget Cost of Production		$ 4.865		$ 4.800
Number of Shifts and Hours		2-8 Hour		2-8 Hour
Number of Days Operated		172		168
Average Daily Product		2,107 Tons		2,652 Tons

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4. COST OF OPENING, EQUIPPING, DEVELOPING & OPERATING: (Cont'd)

Detailed Costs- Idle Expense on account of strike

		Amount
Underground Costs		
Tramming	$	1,583.01
Ventilation		624.92
Pumping		4,001.45
Compressors and Air Lines		8,052.82
Crushing and Screening--UG		172.92
Underground Superintendence		33,762.88
Maint: Pockets and Chutes		74.50
" Mining Equipment		3,790.28
" Shaft		486.85
Telephones & Safety Devices		948.51
Holiday Allowance		51.24
Vacation Pay		25,524.45
O.A.B. & Unemployment Taxes		879.56
Total Underground Costs		79,953.39
Surface Costs		
Hoisting		5,232.53
Crushing and Screening--Surf.		269.22
Timber Yard		7.27
Dry House		3,888.07
General Surface		6,722.16
Maint: Other Mine Buildings		435.89
Telephones & Safety Devices		126.32
Vacation Pay		4,503.50
O.A.B. & Unemployment Taxes		252.44
Total Surface Costs		21,437.40
General Mine Expenses		
Mining Engineering Department		5,227.48
Mechanical Engineering Department		1,145.90
Safety Department		2,086.64
Research Laboratory		42.90
Analysis & Grading--Laboratory		3,290.20
" & " --Shipping		1,166.79
Special Expense -- Hygiene Clinic		864.35
Ishpeming Office		27,843.77
Mine Office -- Supt. & Clerks		10,829.97
Central Warehouse Overhead		3,014.93
Insurance -- Property		1,326.17
" -- Group, Health & Life		1,243.48
" -- Group Annuity		2,673.21
" -- Catastrophe		779.62
Personal Injury -- Comp. & Doctors		2,004.77
Electrical Engineering Department		1,583.57
Supplemental Unemployment Benefits		210.10
Total General Mine Expenses		65,333.85
COST OF PRODUCTION		166,724.64

4. COST OF OPENING, EQUIPPING, DEVELOPING & OPERATING: (Cont'd)

Detailed Cost Comparison

	Total 1959		Total 1958	
	Amount	Per Ton	Amount	Per Ton
Underground Costs				
Development	$ 5,413.59	.015	22,299.43	.050
Mining	701,501.52	1.935	812,104.80	1.813
Tramming	141,970.02	.392	195,143.84	.435
Ventilation	4,403.89	.012	5,572.70	.013
Pumping	16,271.52	.045	11,783.32	.026
Compressors & Air Lines	27,019.08	.075	43,979.46	.098
Crushing & Screening - UG	23,047.54	.064	50,902.49	.113
Underground Superintendence	73,877.34	.204	136,685.54	.305
Maint: Pockets & Chutes	31,133.47	.086	30,329.14	.067
Mining Equipment	119,348.97	.329	155,439.62	.347
Shaft	3,853.97	.010	1,013.80	.002
Telephones & Safety Devices	23,002.41	.063	16,180.92	.037
Holiday Pay	28,037.71	.077	38,649.42	.086
Vacation Pay	56,788.35	.157	92,973.83	.207
O.A.B. Unemployment Taxes	41,387.45	.115	-	-
Total Underground Costs	1,297,056.83	3.579	1,613,058.31	3.599
Surface Costs				
Hoisting	25,593.81	.071	56,008.21	.125
Crushing & Screening - Surface	8,264.88	.023	10,493.48	.024
Stocking	17,991.38	.049	15,398.56	.035
Timber Yard	9,129.66	.025	2,752.27	.006
Dry House	22,308.65	.062	18,620.44	.041
Policing	-	-	1,408.59	.003
General Surface	18,758.70	.052	20,917.46	.047
Maint: Headframe Bldg. & Equip.	2,018.31	.006	4,161.92	.009
Other Mine Buildings	2,451.02	.006	5,143.68	.011
Telephone & Safety Devices	847.89	.002	1,439.16	.003
Holiday Pay	4,975.40	.014	6,738.39	.015
Vacation Pay	10,021.60	.028	16,399.00	.037
O.A.B. Unemployment Taxes	3,708.32	.010	-	-
Total Surface Costs	126,069.62	.348	159,481.16	.356
General Mine Expenses				
Mining Engineering Department	15,793.83	.043	23,397.45	.052
Mechanical Engineering Department	2,304.07	.007	4,941.67	.011
Safety Department	4,479.09	.013	6,250.49	.014
Research Laboratory	240.45	.000	834.73	.002
Analysis & Grading - Laboratory	15,721.81	.044	25,085.58	.055
" & " - Shipping	2,504.59	.007	4,407.38	.010
Special Expense - Retirements	-	-	5,061.23	.011
" " - Hygiene Clinic	3,023.68	.008	4,680.20	.011
Ishpeming Office	59,768.09	.165	75,493.69	.169
Mine Office - Supt. & Clerks	25,105.12	.069	36,527.87	.081
Central Warehouse Overhead	4,478.26	.012	9,184.53	.020
Insurance - Property	3,283.07	.009	4,058.80	.009
" - Group, Health & Life	23,322.18	.064	37,467.12	.084
" - Group Annuity	4,134.30	.011	8,415.99	.019
" - Catastrophe	1,009.70	.003	4,089.25	.009
Personal Injury - Comp. & Doctors	11,818.12	.033	25,876.15	.058

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4. COST OF OPENING, EQUIPPING, DEVELOPING & OPERATING: (Cont'd)

Detailed Cost Comparison	Total 1959 Amount	Total 1959 Per Ton	Total 1958 Amount	Total 1958 Per Ton
General Mine Expenses (Cont'd)				
Taxes - Unemployment Insurance	-	-	13,473.61	.030
" - Old Age Benefit	-	-	26,525.65	.059
Electrical Engineering Dept.	5,214.94	.015	6,102.23	.013
Employees Insurance & Compensation	-	-	4,706.77	.011
Operating Research Laboratory	-	-	366.13	.001
Supplemental Unemployment Benefits	16,373.47	.045	19,344.79	.044
Total General Mine Expenses	198,574.77	.548	346,291.31	.773
COST OF PRODUCTION	1,621,701.22	4.475	2,118,830.78	4.728

Underground Costs - This expense decreased slightly compared to last year, chiefly because of the higher effeciency realized under a normal working schedule in contrast to last year when operations were on a curtailed basis.

In the Mining account the increase resulted from a greater proportion of production being realized from scram mining operations. Re-entering old areas to recover relatively small tonnages was done on a larger scale in 1959.

Development expense decreased substantially because of the smaller program, and Tramming costs were lower due to less maintenance work. In the Underground Superintendence account, costs were substantially lower because of the reduction in the number of supervisors.

Lower costs were realized in the Crushing and Screening and also the Mining Equipment accounts, because of the improved maintenance experience.

Surface Costs - This expense decreased slightly and the reduction was mostly in the Hoisting account. There was no hoist rope charges in 1959. Fixed expenses, such as heating and maintenance, caused Dry House costs to increase slightly.

General Mine Expenses - There was a substantial improvement in this expense because of reductions in some departmental costs, such as Mining Engineering and Analysis and Grading. Charges in the Insurance accounts for Group, Health and Life, and Group Annuity, were lower and there was a large reduction in the Personal Injury expense, because of the lower accident rate. There were no charges under General Mine costs this year for O. A. B. Unemployment Taxes, as this cost is now expensed into the Underground and Surface costs. This change accounts partly for the reduction in total General Mine Expenses.

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4. COST OF OPENING, EQUIPPING, DEVELOPING & OPERATING: (Cont'd)

Expenditure & Authorization Summary

E. & A. CC-10 - J. Deere Model 440 Diesel Front End Loader

This E. & A. was requested to cover the purchase of another front end loader for underground use. A Deere Model #440 was the first loader given a trial on option to purchase, but the performance of this unit did not meet our standard. Subsequently, a Case Model #600 front end loader was obtained and the trial of this unit was still underway at year end. Many changes have been made on this machine to improve its' performance. Very likely another make of loader will be given a trial before a selection is made of the best loader for our purpose. The project amount authorized was $8,750.00, there were no expenditures against this account.

E. & A. CC-28 - Ford Pickup Truck

This E. & A. covered the purchase of a 3/4 ton, four wheel drive pickup truck to replace a 1952 model pickup truck that was worn out. The project amount authorized was $3,606.00, and the total expenditure was $3,309.21.

5. ESTIMATE & ANALYSIS OF ORE RESERVES

The reserves are estimated on the basis of the following factors:

High Grade of First Class Ore	- 8 cu. ft. per ton
Second Class Ore	- 9 cu. ft. per ton
Conglomerate & Second Class Ore	-10 cu. ft. per ton

The increase in the estimated reserves is due largely to the method employed in making up the tax estimates. Experience has shown that extension of proven ore reserves for any considerable distance away from a working area is an unreasona ble assumption at this property due to the complex mine geology. Therefore, much of the proven ore reserves and additions are based on an accumulated group of standard breast extensions. This practice accounts for nearly the same magnitude of proven ore reserves each year fluctuating somewhat according to depletion and ore development. No significant ore reserve additions were realized this year.

The following table shows a comparison of developed ore with the previous year as reported to the State Tax Commission:

	Cliffs Shaft	Bancroft	Section 10	Total Lease	Total Tons
Estimated Reserves-Dec. 31, 1958	500,365	28,102	190,042	218,144	718,509
Less 1959 Production	220,435	41,147	100,852	141,999	362,434
Balance as of 1958 Estimate	279,930	13,045	89,190	76,145	356,075
Estimated Reserves-Dec. 31, 1959	501,900	36,555	211,446	248,001	749,901
New Developed Ore	221,970	49,600	122,256	171,856	393,826

Expected Average Analysis of Ore Reserves

	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moisture
Natural	57.50	.107	10.00	.35	2.10	.80	.80	.014	1.20	.85

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5. ESTIMATE & ANALYSIS OF ORE RESERVES: (Cont'd)

A review of the estimated proven and probable ore reserves shows 1,229,275 tons as of December 31, 1959. This compares with an estimated 1,343,567 tons a year ago. Substantial changes in the interpretation of the various ore structures brought about by the mining and development has resulted in a redistribution of reserves to 70% in Fee and 30% in Lease property. Previous estimates of proven and probable ore indicated a smaller proportion of the reserves in Fee lands.

6. LABOR AND WAGES:

Labor relations have been quite satisfactory throughout the year, although the Grievance Committee submitted several complaints and one formal grievance. Three grievances were handled in 1959, two of which were carried over from 1958. Two grievances were settled in arbitration and the third was not allowed on the basis that it was not timely.

Summary of Grievances

Name	Nature of Grievance	Step of Grievance Procedure
Reino Bessola	Disputes demotion from electrical crew while trainee and higher-rated craftsmen, all with less seniority, were retained.	Denied in arbitration.
Joseph Amel, et al	Protests retention of sub-supervisor in employment with less company service than the grievants.	Denied in arbitration.
Clarence Shimmin	Disputes demotion from welding crew while higher-rated craftsmen, all with less seniority, were retained.	(2) Not allowed, Time limit expired.

Employment

Number of men beginning of year		256
Separations	8	
Transferred in	1	
Decrease in men	7	7
Total End of Year		249
Average number of men as per labor statement (statistical)		180¾
Average absenteeism		17.65

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6. LABOR AND WAGES: (Cont'd)

Employment

The following tabulation shows a classification of the separations in 1959:

Nature of Separation	No. of Men
Quit	1
Retired	4
Transfers	1
Lay-offs	1
Discharged	-
Deceased	1
Absent for 2 years or more due to illness	-
Total	8

During 1959, there were 80 employees eligible for 3½ weeks of vacation, 145 for 3 weeks of vacation, 20 for 2½ weeks of vacation, 4 for 2 weeks of vacation, and none for one week of vacation.

Statement of Wages

a. Average Wages Per Day

	1959	1958
Total surface and underground	27.37	27.46

b. Average Wages Per Month

	1959	1958
Total surface and underground	581.61	400.92

The mine operated an average of 21¼ days per month as compared to 14.6 days per month in 1958.

c. Tons Per Man Per Day

	1959	1958
Total surface and underground	8.63	8.55

d. Labor Cost Per Ton

Total surface and underground	3.17	3.21

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7. NEW CONSTRUCTION & INSTALLATIONS:

A guard was devised and installed in the bottom of the shaft in each of the skip roads. It is designed to give protection against damage to the hoisting system, in case the tail ropes shift or swing widely from their normal operating position. The guard is electrically interlocked with the hoist control system causing the emergency brakes to be applied when any abnormal action occurs in the tail rope loops near the shaft bottom.

A trial was conducted with a new DuPont powder (Hi-Cap) in several stoping areas during the year. This explosive is a cap sensitive ammonium nitrate. Limited testing indicated that the powder was of little use except for blasting light slice holes. It was felt that any savings effected by the use of this powder for light slicing would be lost due to the need of additional handling, and separate storage.

A rebuilt motor was installed in the No. 132 Euclid truck and the motor of the Caterpillar D-8 tractor was also rebuilt.

An experimental air cylinder powered chute was constructed underground on No. 21 raise. After several weeks of trial and some minor changes, the operation of the chute proved to be very satisfactory and far superior to its manually operated counterpart. More of these chutes will be constructed in the future.

The original set of cage hoist ropes were replaced with new ropes in July. Test samples were taken from the discarded ropes, these samples will be tested and examined by the rope manufacturer. If a favorable report is received on the test samples, the ropes will be put into further service. The original set of cage ropes were in service 39 months.

During the strike, the supervisory force laid approximately 750' of new 60# track on 10th level and approximately 800' of new 40# track on 8th and 10th levels, replacing worn out rail. A great deal of salvage work was also done at this time.

Heavy repairs were made on the 85-B electric shovel and a new automatic oiling system was also installed.

Due to the abrasive nature of the hard ore, considerable maintenance on the flowsheet has been necessary. Repairs have consisted of replacing worn out deck plates on the screens and feeders, and bearings and gears on the drive mechanism. Jaw plate replacement has been frequent on the primary crusher and a motor bearing had to be replaced. A test of a rubber covered deck plate on the picking feeder has been completed and the results show a life approximately three times as great as anything previously tried. A second and similar plate is now being tested. A rubber covered screen plate has been purchased and will be tested on the screen at the end of the flowsheet. A considerable amount of maintenance and rebuilding of the chutes and pockets in the flowsheet was also necessary. By year end, the primary scalping screen was virtually worn out. It will be replaced with the secondary scalping screen in 1960 and the original unit will be rebuilt.

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8. UNDERGROUND:

a. General

The development program has continued on a small scale due to lack of new areas to develop for mining. Attention has been given to old rock fill areas which contain sufficient recoverable tonnage to warrant moving the fill. A few of these projects were undertaken in 1959 and additional ones are planned for 1960. Continued stress on analysis, depletion of a number of stoping areas and lack of possible ore exploration areas all contributed to a program of continual stoping area changes and revisions. At the end of the year, there were fifty active contracts in the mine, the same as in 1958. Pillar recovery continued throughout the year but at a lower rate than in 1958. The proportion of contracts on this type of work decreased from 25% at the beginning of the year to approximately 20% by the end of the year. The contracts included in this category are not confined entirely to pillar recovery work, but perform predominantly this type of work during the year. Pillar recovery has been carried on in all map areas during the year, although only on a small scale in the Section 10 Lease.

The mine is split into mapping areas in which "A" and "B" Shaft map units represent the inlying areas in which a large proportion of the contracts are mining in old stopes. Bancroft and "A" Shaft Northeast, "A" Shaft East and the Section 10 Lease and Moro Mine represent the outlying or fringe areas which must be depleted prior to the inlying areas for orderly mining.

b. Mining Area

1. "A" Shaft East - (East of 2800 E and extending from the South boundry of the Bancroft Lease to 1200 S)

No development was done in the "A" Shaft East area this year. All known ore areas are presently being mined. There are two contracts working in this area, the same number as last year.

The remaining reserves here lie between the 1st and 8th levels. Emphasis on mining the fringe areas will continue to be stressed in accordance with the plan to deplete the outlying ore structures before retreating towards shaft.

2. "B" Shaft - (West of 400 E)

Development in "B" Shaft consisted of driving a short raise through a sub-level floor between two stopes to facilitate ore handling. This work was done above 1st level elevation.

The number of contracts working in this area remained at 10, the same as last year. The bulk of the reserves remaining in this area are in the form of upright and floor pillars. The only new areas remaining are those presently being developed and mined on the 1220' sub-level. Of the 10 contracts in this area, only 4 are working below 1st level elevation.

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YEAR - 1959

8. UNDERGROUND: (Cont'd)

b. Mining Area (Cont'd)

3. "A" Shaft - (400 E - 2800 E, between the Bancroft and Section 10 Leases)

In the "A" Shaft area, development consisted of one short sub-level drift that was driven to provide easier access to some ore on the back and side of an old stope.

There were 17 contracts working in this area during 1959, of which 5 contracts have no reserves other than upright and floor pillars. The reserves are dispersed and, in part, tied up by tramming operations. During the year, mining of floor pillars continued on the 5th and 6th levels. Another section of the 8th level floor pillar plus a section of the 10th level floor pillar was made available for mining in 1960. Mining of the new section of the 8th level floor pillar is scheduled to start in the first quarter. Removal of rock fill from two old stopes is to start in early 1960. Preliminary work in both areas has been completed. Rock fill removal in a third stope was completed and pillar mining had commenced. Rock fill removal in all three areas is being done to make available additional pillar reserves.

4. Bancroft Lease and "A" Shaft Northeast - (North of "A" Shaft)

Development in the Bancroft Lease and "A" Northeast area consisted of driving two short sub-level drifts to develop small orebody extensions. A short raise was driven through a sub-floor between two stopes to permit the partial recovery of a pile of broken ore, which was previously buried under a heavy rock fall. All of this work was confined to 10th level elevation and below.

The number of contracts working in this area remained the same as in 1958, at nine. Of these nine contracts, three have only pillars as ore reserves. The balance of the reserves here are concentrated between the 9th and 11th levels with only small tonnages remaining at the 6th level elevation. Mining above 9th level elevation should be completed in 1960. The largest reserve in this area, which remains to be mined, is in the vicinity of the 10th level powder magazine.

5. Section 10 Lease and the Moro Mine - (Ease of 2800 E and South of 1300 S)

Development in the Section 10 Lease was fairly extensive during the year and consisted entirely of sub-level drifting. Development on two elevations between 8th and 10th levels has continued and, to date, a fairly large mining area has been outlined on both elevations. Development in this area is now virtually complete. Any future development will consist of minor sub-level extensions. The Moro Mine was pumped almost dry during the year and than allowed to fill up again to a bout 30' below 10th level elevation. This pumping was done primarily to determine the configuration of the old stopes below 10th level elevation.

The number of contracts working in this area remained at twelve. Mining, during the year, ranged in elevation from 3rd to 10th levels with crews spread throughout the area. By the end of 1959, reserves remaining above 5th level elevation consisted of a 4th level floor pillar. This floor pillar will be mined out in 1960. Between 5th and 8th levels, 4 contracts continue to work, while the remaining 7 contracts are working between 8th and 10th level elevations. Ore reserves here were considerably reduced on the basis of the new estimate and now account for 26% of the total mine reserves. The bulk of the remaining reserves are contained between the 8th and 10th level elevations and one structure alone accounts for about 30% of the tonnage. Mining is now

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8. UNDERGROUND: (Cont'd)

b. Mining Area (Cont'd)

5. Section 10 Lease and the Moro Mine (Cont'd)

being accomplished at the fastest possible rate so that operations in this lease will not interfere with the mining of remaining reserves in the "A" Shaft area. There will be very little pillar recovery work following the regular mining operations since this work is currently being carried on in the normal course of mining.

c. Delimiting Ore

The underground diamond drilling program was completed in 1955. There was no drilling done underground or on surface for hard ore reserves in 1959.

d. New equipment and Major Supply Items

A reduced amount of new equipment and supply items were purchased for maintenance of plant and equipment, compared to last year. However, the fact that no hoist lines or jaw crusher plates were purchased in 1959 accounts for approximately all of the reduction in this type of expenditure. The major expenditures were: one rebuilt Euclid truck motor, repair parts for the main pumps, and 24,295 board feet of used fir timbers. A list of the more significant items is shown below:

Item	Amount
6 - Switch stands - Tramming	$ 239.40
1 - Storage battery - Undgr. battery locomotive	944.55
1 - Flygt Pump - Auxiliary pumping	1,032.60
1 - Wright gasoline powered saw	211.50
2 - Sets of shanking dies - Drill steel	604.50
248 - Cap lamp cells - M.S.A.	2,588.47
1 - Spray machine - Surface	157.57
16 - Wooden Blocks - Hoisting	390.00
2 - Resistors - Hoisting	260.00
2 - Relays - Hoisting	87.06
2 - Key plates - Jaw Crusher	489.00
1 - Armorite plate - Feeder deck	422.00
1 - Rubber Covered Screen deck - Screens	215.00
1 - Set of "V" Belts - Feeders	203.50
1 - Drive belt - Jaw Crusher	490.43
1 - Small fan - Ventilation in surface pocket	120.00
1 - Power saw - Underground chutes	314.95
2 - Aluminum Ladders - Barring	155.00
2 - Recaped Tires - Euclids	380.60
1 - Rebuilt motor - #132 Euclid	2,584.04
1 - Air cooled compressor - 85-B Shovel	486.90
1 - Cylinder Head - Euclid motor	166.57
Various pump parts - pumping	3,577.09
Repair parts - D-2 Traxcavator	887.07
Repair parts - OC-4 Tractor-Loader	778.80
Overhaul of D-8 Tractor Motor	842.32
24,295 Bd. Ft. of used fir timber - Chutes	1,700.65
Total	$ 20,329.57

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8. UNDERGROUND (Cont'd)

e. Explosives

The price of powder increased from $19.69 per cwt. to $21.00 per cwt., but the cost of the miscellaneous blasting supplies remained relatively constant. Explosives costs per ton increased over the previous year, this is due to more ore mined by scramming operations and some increase in secondary blasting.

TABLE I

Cost of Explosives - Operating

	Quantity	Avg. Price	1959	1958
Powder, Lbs., All Kinds	282,550	$19.84	$56,047.98	$59,229.20
Misc'l Supplies (Caps, Fuse, Testers, Etc.)			27,309.56	31,609.09
Total			83,357.54	90,838.29

TABLE II

Unit Cost and Consumption of Explosives

	1959	1958
Pounds of Powder Per Ton of Ore	.780	.671
Tons of Ore Per Pound of Powder	1.283	1.490
Cost Per Ton For Powder	.155	.132
Cost Per Ton For Blasting Supplies	.075	.071
Cost Per Ton For All Explosives	.230	.203

f. Tungsten Carbide Bits

Production tests of Copco, Vascoloy, and Kennametal bits have been underway throughout much of the year. The results of this series of tests will not be available until early in 1960. Two other production tests were commenced in December, these include a test of Zivco bits and a test of a new grade of carbide in a Rok bit. Data pertaining to the latter tests will probably not be available until late 1960.

During the latter part of 1960, Kennametal stopped making tungsten carbide bits under 3" size. Thus our current production test of 1-3/8" Kennametal bits is now wholly academic.

A comparison of carbide bit experience is shown in the following table.

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8. UNDERGROUND (Cont'd)

f. Tungsten Carbide Bits (Cont'd)

Description	Quantity	Price	Amount-1959	Amount-1958
Ingersoll Rand, Series 113 - 1-3/8"	1,392	$10.60	$14,776.00	$13,853.20
Ingersoll Rand, Series 115 - 1-3/4"				374.89
Ingersoll Rand, Series 115 - 2"				144.50
Rok-Bits, Series - 113 - 1-3/8"	100	10.49	1,049.00	2,681.40
Rok-Bits, Series - 113 - 1-5/8"				243.00
Rok-Bits, Series - 115 - 1-5/8"				13.50
Rok-Bits, Series - 115 - 2-1/4"				141.42
Kennametal, Series 113 - 1-3/8"	100	10.90	1,090.00	1,090.00
Kennametal, Series 113 - 1-5/8"	8	9.50	76.00	-
Copco, Series 113 - 1-3/8"	100	10.00	1,000.00	-
Vascoloy, Series 113 - 1-3/8"	30	9.80	293.70	-
Zivco, Series - 113 - 1-3/8"	40	10.50	420.00	-
Total	1,770	$10.57	$18,704.70	$18,541.91

Production - Tons	362,434	448,112
Cost Per Ton of Ore Produced	.052	.041
Feet Drilled - Rock and Ore	342,072	411,944
Average Feet Drilled Per Bit	193	260
Cost Per Foot of Hole	.055	.045

The average feet drilled per bit figure is down from 1958 due to the fact that there were a relatively large proportion of new bits in service this year because of the testing programs. This also had an adverse effect upon the cost per foot of hole. Bit costs next year should show improvement since a greater proportion of the current used bit inventory is relatively new bits.

g. Pumping

The automatic pumping system operated satisfactorily throughout the year, but costs were up over last year. In 1958, maintenance was very light, while in 1959, heavy maintenance was experienced.

No. 3 pump motor required major repairs due to an unbalanced condition in the armature. Bearings in the motor were also replaced and a weak bed plate structure was renovated and reinforced. A claim for an adjustment in the cost of motor repair was honored by the manufacturer. The adjustment was on the basis of a 50-50 split of repair costs.

Some foreign material got into the No. 3 pump rotating element necessitating the replacement of these parts. A spare rotating element for the No. 1 and No. 2 pumps was rebuilt and bearings on the No. 1 pump also repaired.

9. TAXES:

Comparative data for 1959 and 1958 is shown below:

	1959		1958	
	Valuation	Taxes	Valuation	Taxes
Realty	$ 2,106,600	$ 100,484.82	$ 2,655,000	$ 123,192.00
Personal Property	1,405,000	67,018.50	1,161,100	53,875.04
Lot 2, Section 3, 47-27 Bancroft	185,000	8,824.50	330,000	15,312.00
Lot 174, Nelson's Addition	-	-	100	4.64
S. 35, 91' of Lot 179	-	-	50	2.32
S½ of NW¼ of Section 10, 47-27	560,000	26,712.00	630,000	29,232.00
Total Cliffs Shaft Mine	$ 4,256,600	$ 203,039.82	$ 4,776,250	$ 221,618.00
Taxes per Ton Produced		$ 0.560		$ 0.495
Taxes per Ton Shipped		$ 0.504		$ 0.526

The above statement shows a comparison of the actual realty and personal property taxes paid in 1959 and 1958. The total taxes shown on the mining cost statements include the actual 1959 taxes plus the estimated 1960 personal property taxes.

10. ACCIDENTS AND PERSONAL INJURY:

There were 10 compensable injuries in 1959 and the total lost time accidents was 476 days. In the previous year, the total lost time was 6,364 days. The Cliffs Shaft ranked second on safety in 1959 among the underground mines.

The comparison of Frequency and Severity in 1959 and 1958 is as follows:

Year	Frequency	Severity
1958	37.04	15,727
1959	49.87	1,461

Frequency Rate - Number of accidents for every 1,000,000 man hours worked.
Severity Rate - Number of days lost per 1,000,000 man hours worked.

A summary of the compensable accidents is listed below:

#1394 - Floyd Palmer (Contract Miner) - January 29, 1959

Struck a glancing blow on the head and than upon the left foot by a piece of "loose" which fell from the back. Contusions on top of left foot and fractures of the 4th and 5th toes on left foot. Time lost - 33 days.

#1396 - Toivo Pesola (Stope Scraperman) - April 2, 1959

Struck on the left foot by a chunk, which rolled off the car he was loading at a chute. Fractured 5th toe on left foot. Time lost - 22 days.

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10. ACCIDENTS AND PERSONAL INJURY: (Cont'd)

#1397 - Stanley Franson (Contract Miner) - April 17, 1959

Jumped off a top timber slide to the ground about 9' below, when a fall of ground in the stope above startled him. Bruised heels. Time lost - 10 days.

#1398 - Conrad Trosvig - (Stope Scraperman) - April 23, 1959

Struck on the calf of the left leg by a chunk which rolled down the pile he was caving into the scraper rut. Bruised calf of left leg. Time lost - 28 days.

#1399 - Jeremiah DeCaire (Stope Scraperman) - February 18, 1959

Fell while moving away from a mill he had just barred down. Injured continued to work until April 30th when shoulder commenced to bother him. Bruised right shoulder. Time lost - 142 days.

#1400 - Waino Nyman (Contract Miner) - May 20, 1959

Fell while trying to climb on chute to bar down some chunks. Injured landed on plat in front of chute amongst some chunks. Fracture of the second metatarsal - left foot. Time lost - 53 days.

#1401 - Edwin Penhale (Contract Miner) - June 23, 1959

Slipped and fell upon some chunks in the scraping rut while moving out from the vicinity of an ore pile he had just caved down. Contused muscles - right anterior chest. Time lost - 15 days.

#1402 - David Martin (Motor Brakeman) - June 25, 1959

Thrown against an underground car when the moving train, he was riding, jumped the track and struck the timbers of "B" Shaft on 5th level. Lumbo sacral strain-cervical myositis. Time lost - 155 days.*

#1403 - Orville Dishno (Contract Miner) - July 6, 1959

Squeezed left arm between the machine and the breast when a drill rod broke as he was drilling. Teno-synovitis of the left lower arm. Time lost - 10 days.

#1404 - Olaf Hallgren (Stope Scraperman) - December 2, 1959

Struck on the left foot by a chunk, which rolled off the car he was loading at a chute. Cut on top of big toe at juncture with the foot, left foot. Time lost 8 - days.

* Time lost in 1959 actual. Balance until man returns to work is estimated.

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YEAR - 1959

11. POWER:

	1959	1958
Total Cost	$ 51,453.67	$ 52,361.35
K.W.H.	5,877,379	6,320,441
Average Cost Per K.W.H.	$ .0087544	$ .0082844
K.W.H. Per Ton	16.2	14.1
Cost Per Ton	$ 0.142	$ 0.117

The total K.W.H. consumption is slightly below that of 1958 due to the strike. The increase in the power cost per ton is the result of power consumption, during the strike, continuing at about 45% of normal operating load, while there was no production in this period. The pumping system, cage hoist operation, and haulage equipment were the major users of power during the strike.

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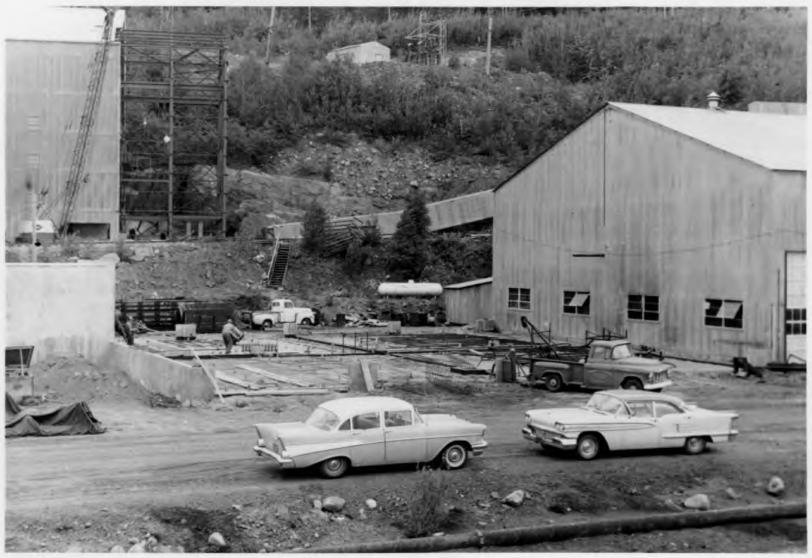
I N D E X



SHOPS ADDITION - AUGUST 1959

SHOPS ADDITION - DECEMBER 1959

CRUSHING PLANT ADDITION
AUGUST 1959

CRUSHING PLANT ADDITION
DECEMBER 1959

MILL ADDITION LOOKING WEST
AUGUST 1959

MILL ADDITION LOOKING WEST
DECEMBER 1959

PELLET PLANT - LOOKING EAST
AUGUST 1959

PELLET PLANT - LOOKING EAST
DECEMBER 1959

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

1. GENERAL

There was no production from the Humboldt Mine during the year 1959, although 82,280 tons of concentrate were shipped from the stockpile at the mine.

Throughout the year, the Mine Superintendent, assisted by Department Heads and other Company personnel, worked closely with the Western Knapp Company and the A. G. McKee Company on the design of expansion facilities. This group of Company personnel also was responsible for the final design of the Garage-Shops-Dry addition, the general surface layout, the new tailings pond layout, power supply and distribution additions, fresh water installations, a pit development program, and the purchase of mining and shops equipment. Because of the large quantities of data that had to be assembled and transmitted to the contractors, and because of the limited preliminary engineering that had been completed, it became necessary to have this technical committee meet weekly throughout the year.

General construction work on the project was started in May by the contractors and the tailings pond and general surface development was started by the Humboldt Mining Company crews in November. This late start on the latter projects was caused by the USW strike that was stopped by injunction on November 7, 1959. No work was attempted previous to the strike to remove any possibility of creating a labor problem for the contractors. At the end of the year the project had progressed satisfactorily, although bad weather conditions throughout the fall season had delayed the construction schedule approximately six weeks.

The following is a brief monthly breakdown indicating the progress of the major design and construction work accomplished at Humboldt during 1959.

JANUARY

The Proksch Construction Company poured 153.5 cubic yards of concrete for a rod mill footing and an oil storage tank foundation. Most of this preliminary work was completed in December to comply with regulations pertaining to a rapid depreciation of the Humboldt facilities.

This period was mostly taken up in sessions with design personnel from the contracting firms, which permitted the transfer of information involving Humboldt research and operating experience to this group. Similar meetings were held by the C.C.I. personnel alone to facilitate design work on other phases of the overall expansion project.

FEBRUARY

Design meetings continued and progressed to the discussion of electrical and piping details which permitted the initial layouts of the plants to be completed for study by the CCI technical group.

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

1. GENERAL (Cont.)

Major equipment approved for purchase was the Allis Chalmers Hydrocone crusher and the Hardinge primary rod and ball mills.

Most of the crushing plant layouts, as well as the balling section of the pellet plant, were received by the end of February. On this latter section a major decision involved the use of four 9 x 30 drums as the means of manufacturing green balls.

Work involving the exact location of the plant and the required floor elevations was started in February.

The initial layouts of the new track system were completed and the final water balance, indicating the need for 1000 gpm from the Escanaba River, 1600 gpm from Lake Lory and approximately 4000 gpm from two tailings ponds, was outlined.

MARCH

Design work was now well underway on all phases of the project.

One of the important studies underway at this time involved the regrind mills and filters. In March Hardinge $10\frac{1}{2}$ x 16' ball mills were selected.

Meetings with the McKee Company concerning the handling of oversize from the balling drums, as well as the problems involved in the proposed pellet plant wet section were conducted.

Negotiations with the U.S.C.S. and the Michigan State Geological Survey representatives were conducted in March in a continuing effort to gain information to permit the design of the pumphouse required on the Escanaba River.

Survey work for the new tailings pond was conducted at this time.

APRIL

Design work was started on the crushing plant and mill heating and ventilating system.

The exact locations of all new and expanded buildings was set. A space was left between the buildings to accomodate the installation of a boring bar for the pellet plant if necessary.

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

1. GENERAL (Cont.)

Controlling the feed to the grate was a topic of major study during April.

The final layout of the new stocking area, the sanitary and storm sewers and the concentrate reclaim system was started.

MAY

Both contractors moved into the Humboldt area and began preliminary construction work. Details involving the location of shacks, use of power and water, hiring personnel and parking facilities were satisfactorily arranged.

A major change in building design involved the modification of the mill roof of the present grinding bay to conform to the improved single slope layout of the new unit.

A major decision on equipment was the choice of Eimco disc filters for the regrind section.

Pellet Plant design continued although the control of the grate feed and handling of grate undersized material was not settled.

JUNE

Primary and secondary crushing plants modificationsand additions were well underway in June.

Pellet Plant construction was slowed because of difficulties with muck and boulders.

A major equipment approval was made involving the purchase of Stephens-Adamson idlers for all mill conveyors.

Crushing plant and mill design was 44% completed at this time, with the pellet plant design approaching the 50% mark.

JULY

Construction work was concentrated on the crushing plants. Mill work involved the forming and pouring of the footings for the new storage bins, and removing equipment in the old unit that was to be replaced or moved.

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

1. GENERAL (Cont.)

The pellet plant area was completely excavated to ledge, backfilled and the driving of piling was well underway by the end of the month.

A small number of footings were poured along the east end of the building. Mill design had reached a stage where the slurry pumps and equipment piping were under study. Pellet plant design reached the point of being 60% completed.

The Franz Menze Company of Marquette, Michigan was awarded the contract to build the Garage,Shop & Dry Addition.

AUGUST

A concentrated effort was being made by all contractors to form and pour major building and machinery footings. The crushing plant design was 93% completed and the mill design was 60% completed. A major change in the mill involved the addition of 18 feet in the grinding bay and 5 feet in the flotation and filter bays to assure adequate space for future duplex flotation facilities.

Mill design work had advanced to electrical equipment, final pump layouts and launders. Pellet plant design was 80% completed, although efforts were being slowed due to a lack of certified information from Allis Chalmers on the grate-kiln details. At this time Allis Chalmers were making a major design change in the grate and cooler layouts to effect a better air seal.

After a series of meetings with the various State departments involving the consumption of water from streams, agreements were reached that will eventually permit the Humboldt Mining Company to utilize 1000 gpm of water from the Escanaba River.

The Edens Company was selected to construct the necessary power lines for the expanded operation.

A Buycrus Erie 150-B shovel was selected as the new production shovel for the pit.

SEPTEMBER

The secondary crusher addition was nearly enclosed in September. Work was started on erecting the new ore silos. Forming and pouring foundations remained the principal work, although structural steel was also being erected in the balling area of the pellet plant.

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

1. GENERAL (Cont.)

Crushing plant and mill design was 82% completed with the pellet plant design being slightly more advanced.

OCTOBER

Cold wet weather conditions retarded construction work. A major job near completion was the installation of the new Hydrocone crusher. The installation of major items of equipment in the mill was started with the placing of the new flotation machines.

Pellet plant work continued to be limited to foundations and structural steel.

The design of connecting tunnels between the mill and pellet plant were completed.

Minor contracts for clearing and grubbing for pole and pipe lines as well as for drilling water wells were let.

NOVEMBER

Extremely cold weather and heavy snow retarded all phases of the project. An injunction ended the steel strike, permitting a program of stripping and dike construction for the new tailings pond to start on November 11th.

Design work on the crushing plants, mill and pellet plant was over 90% completed, with studies being reduced to details largely involving piping and electrical layouts.

The shops and dry additions were enclosed.

DECEMBER

Mild weather prevailed, which permitted the contractors to gain on the work schedule after falling behind during October and November.

At the end of the year, 7200 cubic yards of concrete had been poured for the entire project, which with the exception of the floors, was the entire quantity expected. The crushing plant additions and modifications were near completion with the exception of heating and dust collecting installations.

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

1. GENERAL (Cont.)

Structural steel was partially erected in the grinding and flotation sections of the mill and the three new storage silos were completed. Machinery installation in the mill was limited to the flotation section.

One kiln was in place in the pellet plant and the structural steel and bins in the balling area were completely erected.

The garage, shops, dry additions were 80% completed and the power line additions were 90% completed.

The Cherne Company of Ironwood, Michigan, was awarded a contract for all exterior piping, including the lines to the new tailings pond and to the Escanaba River. Western Knapp was awarded the contract to construct the pump houses at the new pond and at the River.

The major design problem in the pellet plant involving the control of the feed to the grate was temporarily set aside to wait for the benefit of operating experience. All necessary facilities to permit the easy installation of control equipment were designed into the plant.

The tailings pond project was 50% completed. A total of 189,474 cu.yds. of material had been hauled to the dike system, of which 170,474 cu.yds. were stripped from the pit area and 19,000 cu.yds. were from borrow pits.

A major decision in the field of mining equipment involved the purchase of four Dart production trucks and a Michigan rubber-tired bulldozer.

Because of many changes made in design throughout the year, meetings were held in December to negotiate the costs involved in such improvements. Since the bulk of these changes concerned the crushing plants and mill, these efforts were closely associated with the Western Knapp Company.

HUMBOLDT MINE
ANNUAL REPORT
YEAR 1959

2. SHIPMENTS, INVENTORIES & ANALYSES

	Tons	Iron	Phos.	Sil.	Sul.	Moist
On hand 12-31-58	96,467	61.81	.074	9.70	.015	6.67
Stockpile to Presque Isle	76,300	61.57	.077	10.38	.011	4.43
Stockpile to Allied Chemical	3	61.81	.077	9.70	.011	6.67
Stockpile to Pilot Plant	2,328	61.75	.077	9.74	.011	6.40
Stockpile Pellets to Presque Isle	2,057	62.48	.077	10.06	.011	2.50
Loss due to Pelletizing	800					
Stockpile to Escanaba	792	61.80	.073	10.10	.008	4.85
On hand 12-31-59	14,187	61.81	.074	9.70	.015	6.67
Total shipments from Mine	82,280					

3. EXPLORATION AND RESEARCH

Diamond drill hole HM #8 was drilled South 2° East at -45° from the 5003 South, 7899 W coordinates to explore the eastward extension of the Humboldt ore body in the Weber Lease. No significant runs of ore were encountered in this hole, which was collared in the hangingwall quartzite and remained largely in intrusive until it encountered the footwall silicates.

Diamond drill hole HM #9 was drilled South 29° West at -45° from the 6763 S, 9942 W coordinates to explore the probable westward ore extension from the southern portion of the pit toward the Foxdale Shaft. This hole was collared in the hangingwall quartzite and encountered 300 ft. of mineralized quartzite and oxidized iron formation averaging approximately 34.7% Fe. The footwall material in the bottom of the hole was an unoxidized iron formation. Results from this drilling made it necessary to plan for the continued exploration of the Foxdale ore extension.

The most important research work conducted during the year involved the operation of the pilot plant grate-kiln utilizing Humboldt concentrates. Of major importance was the discovery that operating with limestone as an additive will create rings in the kiln.

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MATHER MINE "A" SHAFT
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YEAR 1959

1. GENERAL:

Production for the Mather Mine, "A" Shaft for the year 1959 was 516,966 tons. Shipments from the stockpile were started on April 24th and were continued throughout the year. Shipments from the pocket were started on April 16th and were continued throughout the year also. December shipments from the pocket and stockpile were sent to the Ore Improvement Plant. A total of 490,060 tons was loaded out during the periods shown. All of the product was of Standard grade.

Operations during the month of January were on a two shift per day, four day per week basis. Beginning February 1st and continuing up to the strike in July, operations were on a two shifts per day, five days per week basis. With the resumption of operations on November 9th, the mine went on a one shift per day, five days per week schedule which continued for the remainder of the year.

The analysis of the Mather Mine, "A" Shaft product for the year was 58.71 iron, 8.62 silica and .011 sulphur dried analysis. The analysis of the shipments for the year was 52.80 iron natural.

Headframe screening at 1/2" was initiated during the year on an experimental basis. An Inland rod screen deck was fabricated at the General Shops and installed on the existing headframe screen. Temporary chutes were installed to properly handle the coarse and fine products. During the shipping season 38,201 tons of fines and 24,236 tons of coarse material were produced.

The cost of production was $5.103 as compared to $4.619 in 1958, an increase of $.484. The unit production decreased from 10.10 tons per man per day to 8.65 tons per man per day.

Block caving continued as the principal mining method and steel sets continued as the principal means of ground support. Yielding steel sets were used in the caving drifts and both square and arched rigid sets were used in transfer drifts. Main level drifts were supported with square steel sets or with rock bolts.

Mining operations were conducted principally on the 8th and 9th Levels. Crosscut development was begun on the 10th Level. Production from the 8th Level was 262,110 tons and from the 9th Level 254,856 tons.

Belt conveyors continued as the principal haulage method between the transfer or gathering drifts and the mine central crushing station. 83.7% of the total production was handled by belt conveyor while the remaining 16.3% was handled partially by belt conveyor and partially by rail haulage. Increased use of chain conveyors was made in the transfer or gathering drifts. All of the mine product was crushed underground.

Capital expenditure for development was continued in the 12th to 9th Level belt conveyor incline and on the 10th Level. In addition, preparations were begun to sink the cage and service compartments of the shaft down to the 12th Level. By the end of 1959 the 12th to 9th Level inclined drift had reached a distance of 2577' from the upper terminal and was 325' below the 10th Level elevation. A total of 2257' of belt conveyor was installed in the inclined drift at the end of the year.

The 1959 diamond drilling program totaled 5,438'. The main objectives of the drilling were to outline 9th Level ore, outline 10th Level ore, and locate structure and ore below the 10th Level.

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1. GENERAL: (Continued)

Labor relations, aside from the strike, were satisfactory during the year with only one formal grievance being presented. During the strike, which lasted from July 14th to November 9th, there was very little picketing and everything was conducted in an orderly manner. Supervisory personnel performed the necessary maintenance work at the mine.

Pumping increased over 1958 due to the fact that the Cambria-Jackson mine water is now being pumped through the Mather Mine "A" Shaft. The average rate increased from 325 gallons per minute in 1958 to 581 gallons per minute in 1959.

The physical inventory at the end of 1959 was $288,979.57 or $57,183.67 higher than at the end of 1958. A several months' supply of steel sets arrived in December thus pushing the inventory value up higher than normal.

Surface and shop work was of a routine nature for the first half of the year. During the second half of the year both pinion shafts were replaced on the skip hoists. In addition, a considerable amount of work was accomplished in the shops on equipment and material for the shaft sinking project. Among other things, sets for the shaft were made and a four-boom shaft sinking jumbo was fabricated.

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2. PRODUCTION:

a. Production by Grade and Months:

Grade	Product	Stockpile Overrun	Total	1958 Total
Mather	516,966	-	516,966	823,860
Mather Special	-	-	-	-
Total	516,966	-	516,966	823,860
Rock			21,439	37,235

Months	Ore	Rock
January	61,838	2,288
February	71,350	1,518
March	68,125	2,409
April	69,993	3,674
May	73,823	1,606
June	86,082	3,773
July	25,261	1,221
August	-	-
September	-	-
October	-	-
November	22,858	1,276
December	37,636	3,674
Total	516,966	21,439

b. Shipments:

	Pocket	Stockpile	Total	1958 Total	Decrease
Mather	121,384	368,676	490,060	583,382	
Mather Special	-	-	-	-	
Total	121,384	368,676	490,060	583,382	93,322

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2. PRODUCTION: (Continued)

c. Ore Statement:

	Mather	Mather Special	Total	1958 Total
On Hand January 1, 1959	459,744	-	459,744	219,266
Output for Year	516,966	-	516,966	823,860
Transfers	-	-	-	-
Overruns	-	-	-	-
Total	976,710	-	976,710	1,043,126
Shipments	490,060	-	490,060	583,382
Balance on Hand	486,650	-	486,650	459,744
Decrease in Output			306,894	526,341
Increase in Output				
Decrease in Ore on Hand				
Increase in Ore on Hand			26,906	240,478

Working Schedule:

1959 - 2-8 hr. shifts, 4 days per week, Jan. 1st to Feb. 1st.
2-8 hr. shifts, 5 days per week, Feb. 1st to Jul. 15th.
1-8 hr. shift, 5 days per week, Nov. 9th to Dec. 31st.

1958 - 3-8 hr. shifts, 4 days per week, Jan. 1st to Mar. 1st.
3-8 hr. shifts, 4 days per week, 3 weeks a month with every 4th week idle, Mar. 1st to Oct. 6th.
2-8 hr. shifts, 4 days per week, Oct. 6th to Dec. 31st.

1957 - 3-8 hr. shifts, 5 days per week, Jan. 1st to Nov. 3rd.
3-8 hr. shifts, 4 days per week, Nov. 3rd to Dec. 31st.

1956 - 3-8 hr. shifts, 5-1/3 days per week, Jan. 1st to Nov. 11th.
3-8 hr. shifts, 5 days per week, Nov. 11th to Dec. 31st.

1955 - 2-8 hr. shifts, 4 days per week, Jan. 1st to Apr. 18th.
2-8 hr. shifts, 5 days per week, Apr. 18th to Aug. 1st.
3-8 hr. shifts, 5-1/3 days per week, Aug. 1st. to Dec. 31st.

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2. PRODUCTION: (Continued)

d. Division of Product by Levels and Months:

Months	Eighth (2590') Level	Ninth (2810') Level	Total	Rock
January	38,601	23,237	61,838	2,288
February	43,438	27,912	71,350	1,518
March	40,281	27,844	68,125	2,409
April	37,667	32,326	69,993	3,674
May	31,193	42,630	73,823	1,606
June	33,093	52,989	86,082	3,773
July	9,914	15,347	25,261	1,221
August	-	-	-	-
September	-	-	-	-
October	-	-	-	-
November	11,302	11,556	22,858	1,276
December	16,621	21,015	37,636	3,674
Total	262,110	254,856	516,966	21,439

e. Production Delays:

Delays due to mechanical or electrical difficulties during the year were few and minor, with no delays of more than a single shift duration.

The industry wide steel strike interrupted operations from July 15th to November 8th. Work was resumed on November 9th.

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3. ANALYSIS:

a. Average Mine Analysis on Output:

Grade	Iron	Phos.	Silica	Sulphur
Mather	58.71	-	8.62	.011

b. Average Analysis of Shipments:

Grade	Iron	Phos.	Silica	Mang.	Alum.	Sulphur	Lime	Mag.	Loss	Moist.
Mather	58.76	.095	8.39	.41	3.08	.016	.60	1.10	2.05	10.15

c. Average Analysis of Ore in Stock: (Natural)

Grade	Tons	Iron	Phos.	Silica	Mang.	Alum.	Sulphur	Lime	Mag.	Loss	Moist.
Mather	486,650	52.48	.095	8.35	.40	3.03	.023	.60	1.10	2.05	10.72

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING:

Capital account expenditures amounted to $476,415.15, which brought the total at the end of the year to $13,749,798.22. The total figure does not include an additional $318,223.11 charged in a prior year to Negaunee Mine Company "Idle Expense". By including the "Idle Expense" the grand total expended to date amounts to $14,068,021.33.

Capital Expenditures for the Year

E&A NM-147	Two Chain Conveyors	$ 5,036.52
E&A NM-150	12th to 9th Level Conveyor System	5,323.38
E&A NM-155	Main Level Development	175,139.82
E&A NM-156	Diamond Drilling	49,669.16
E&A NM-157	12th to 9th Level Conveyor System	156,949.30
E&A NM-158	10th to 12th Level Winze and Shaft Sinking	52,140.59
E&A NM-164	Experimental Headframe Screening	16,255.41
E&A NM-165	Byron-Jackson Pump	1,858.09
E&A NM-166	Two 1500 H.P. Westinghouse Motors	14,042.88
	Total Capital Expenditures	$476,415.15

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Continued)

Comparative Mining Costs:

		1959	1958
Product		516,966	823,860
Underground Costs		3.840	3.323
Surface Costs		.596	.497
General Mine Expense		.667	.799
Cost of Production		5.103	4.619
Depreciation:	Pre-Production Development	.016	.016
	Plant & Equipment	.271	.255
	Movable Equipment	.013	.011
	Development	.104	.104
	Amort. of Defense Facilities	.000	.006
	Current Year's Development	.670	.454
Taxes		.630	.655
Administration		.050	.050
Loading and Shipping		.088	.050
Total Cost at Mine		6.945	6.220
Budget - Cost of Production		4.854	4.516
Budget - Total Cost at Mine		6.053	5.635
Number of Shifts and Hours		36 1-8 hr. 131 2-8 hr.	30 1-8 hr. 74 2-8 hr. 90 3-8 hr.
Total 8 Hour Operating Shifts		298	448
Number of Operating Days		167	165
Average Daily Product		3,096	3,711

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Continued)

		Proportion of Labor and Supplies	
Labor	$1,744,791.24	3.375/ton	54%
Supplies	1,499,235.27	2.900/ton	46%
Total Cost At Mine	$3,244,026.51	*6.275/ton	100%

* Does not include Amortization of Defense Facilities and Allowance Under Section 616.

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Continued)

Detailed Cost Comparison:

	1959		1958	
	Amount	Per Ton	Amount	Per Ton
Underground Costs:				
Development	346,062.79	.670	655,452.29	.796
Mining	816,448.42	1.579	940,568.27	1.142
Tramming	318,537.36	.616	448,686.22	.544
Power Adjustment			592.00	.001
Ventilation	11,907.53	.023	15,774.95	.019
Pumping	45,020.50	.087	55,335.37	.067
Compressors and Air Lines	35,580.14	.069	56,342.63	.068
Crushing and Screening - UG	14,574.87	.028	22,972.64	.027
Underground Superintendence	104,131.32	.202	155,193.07	.189
Maintenance:				
Pockets and Chutes	1,663.79	.003	8,825.14	.011
Mining Equipment	49,185.36	.095	98,383.79	.119
Levels and Cross-cuts	18,131.06	.035	45,800.03	.056
Shaft	5,666.98	.011	6,806.74	.008
Telephones and Safety Devices	20,196.60	.039	32,751.73	.040
Vacation Pay	79,328.84	.153	129,917.18	.158
Holiday Allowance	44,840.53	.087	64,224.21	.078
Social Security Taxes	73,867.37	.143		
Total Underground Cost	1,985,143.46	3.840	2,737,626.26	3.323
Surface Costs:				
Hoisting	108,116.08	.209	158,911.22	.194
Crushing and Screening - Surface	5,511.05	.011	10,211.53	.012
Stocking	50,334.52	.097	66,949.92	.081
Timber Yard	30,584.10	.059	44,549.08	.054
Dry House	37,020.58	.072	38,305.76	.046
Policing	13,425.96	.026	14,517.38	.018
General Surface	20,279.21	.039	18,039.30	.022
Maintenance:				
Headframe Bldg. & Equipment	1,317.54	.003	7,407.43	.009
Other Mine Buildings	1,204.12	.002	7,612.85	.009
Telephones and Safety Devices	2,454.28	.005	1,160.02	.001
Vacation Pay	19,832.21	.038	32,479.54	.039
Holiday Allowance	7,218.96	.014	9,658.58	.012
Social Security Taxes	10,906.04	.021		
Total Surface Cost	308,204.65	.596	409,802.61	.497

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Continued)

Detailed Cost Comparison: (Continued)

	1959		1958	
	Amount	Per Ton	Amount	Per Ton
General Mine Expenses:				
Geological Department	9,163.65	.018	13,771.87	.017
Mining Engineering Department	24,896.43	.048	48,125.34	.058
Mech. Engineering Department	4,870.10	.009	8,517.31	.010
Safety Department	7,427.44	.014	10,775.35	.013
Research Laboratory	9,263.09	.018	21,322.45	.026
Analysis & Grading - Laboratory	19,574.93	.038	33,513.91	.041
" " " - Shipping	3,078.72	.006	6,225.39	.008
Project Engineering			556.31	.001
Special Expense - Retirements			8,732.63	.011
" " - Hygiene Clinic	4,722.02	.009	9,366.69	.011
Ishpeming Office	99,435.46	.192	129,353.67	.157
Mine Office - Supt. & Clerks	34,330.81	.066	64,355.76	.078
Central Warehouse Overhead	13,666.68	.027	18,596.54	.023
Insurance - Property	3,153.42	.006	4,454.02	.005
" - Group, Health & Life	38,959.32	.075	63,178.04	.077
" - Group Annuity	4,416.16	.009	11,752.87	.014
" - Catastrophe	1,859.88	.004	7,719.68	.009
Personal Injury - Comp. & Doctors	36,454.62	.071	52,783.54	.064
Operating Research Department			10,602.59	.013
Taxes - Unemployment Insurance			35,068.54	.043
" - Old Age Benefit			49,292.13	.060
Electrical Engineering Department	4,475.11	.009	8,346.19	.010
Employees Insurance & Compensation			8,120.95	.010
Supplemental Unemployment Benefit	24,931.61	.048	33,292.20	.040
Total General Mine Expenses	344,679.45	.667	657,823.97	.799
COST OF PRODUCTION	2,638,027.56	5.103	3,805,252.84	4.619

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Continued)

Detailed Cost Comparison: (Idle Expense Due to Strike)

The industry wide steel strike interrupted operations from July 15th to November 8th. Work was resumed on November 9th.

	Amount
Underground Costs:	
Development	2,053.10
Mining	3,238.02
Tramming	2,130.64
Ventilation	4,165.26
Pumping	25,570.30
Compressors and Air Lines	16,500.18
Crushing and Screening - UG	1,325.72
Underground Superintendence	56,037.45
Maintenance:	
Pockets and Chutes	13.70
Mining Equipment	1,224.20
Shaft	17.46
Telephones and Safety Devices	2,908.15
Vacation Pay	35,895.60
Holiday Allowance	25.47
Social Security Taxes	477.63
Total Underground Cost	151,582.88
Surface Costs:	
Hoisting	30,191.67
Crushing and Screening - Surface	238.35
Stocking	904.96
Timber Yard	2,320.92
Dry House	6,645.90
Policing	3,450.84
General Surface	3,467.34
Maintenance:	
Other Mine Buildings	119.14
Telephones and Safety Devices	75.06
Vacation Pay	8,973.90
Holiday Allowance	151.22
Social Security Taxes	142.10
Total Surface Cost	56,681.40

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4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Continued)

Detailed Cost Comparison: (Idle Expense Due to Strike) Continued

	Amount
General Mine Expenses:	
Geological Department	2,947.88
Mining Engineering Department	11,530.21
Mech. Engineering Department	2,904.19
Safety Department	3,460.18
Research Laboratory	3,200.10
Analysis and Grading - Laboratory	5,510.31
" " " - Shipping	1,410.50
Special Expense - Hygiene Clinic	2,003.22
Ishpeming Office	46,323.35
Mine Office - Supt. and Clerks	14,315.81
Central Warehouse Overhead	7,441.19
Insurance - Property	1,505.98
" - Group, Health and Life	2,119.17
" - Group Annuity	4,579.16
" - Catastrophe	1,821.62
Personal Injury - Comp. & Doctors	7,546.88
Electrical Engineering Department	1,384.00
Total General Mine Expenses	120,003.75
Total Cost as Above	328,268.03
Proportion of Taxes	153,635.00
Depreciation - Movable Equipment	2,436.15
Loading and Shipping	1,057.21
TOTAL IDLE EXPENSE	485,396.39

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5. ESTIMATE AND ANALYSIS OF ORE RESERVES:

The net ore reserves as of December 31, 1959 were 7,218,875 tons. This is an increase of 311,701 net tons from the 1958 estimate.

ESTIMATED ORE RESERVES BY LEVELS

	City of Ishpeming	City of Negaunee	Total
Seventh Level	10,567		10,567
Eighth Level	914,368	120,833	1,035,201
Ninth Level	1,563,452	190,271	1,753,723
Below Ninth Level	5,316,764		5,316,764
Gross Tons June 30, 1959	7,805,151	311,104	8,116,255
Less 10% Mining Loss	780,515	31,110	811,625
Net Tons June 30, 1959	7,024,636	279,994	7,304,630
Less Production July 1 - Dec. 31, 1959	85,653	102	85,755
Net Tons December 31, 1959	6,938,983	279,892	7,218,875

Estimated net reserves as of December 31, 1958	7,424,140
Production January 1, to December 31, 1959	516,966
Net reserves as of December 31, 1959 by subtraction	6,907,174
Estimated net reserves as of December 31, 1959	7,218,875
Net increase in reserves	311,701

Expected Average Natural Analysis of Ore Reserves as of December 31, 1959

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Mather - Underground Development.....	7,218,875	51.62	.100	8.75	0.20	2.45	1.00	.50	.050	2.25	11.00

There was a decrease in tonnage on the 7th, 8th & 9th Levels due to mining. Below 9th Level the reserves were increased as a result of new ore found by diamond drilling.

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6. LABOR AND WAGES:

a. Employment:

The total mine payroll at the end of the year was 327 with a decrease of 105 men from the previous year.

Number of Men 1/1/59.....	432
Added to Roll During the Year.....	79
Total.....	511
Separations.....	184
Total on Payroll 12/31/59.....	327
Average Number of Men as per December Labor Statement.....	320

The separations and additions to the roll as indicated in the table above were as follows:

Laid Off	72
Transferred Out	95
Died Natural Causes	2
Quit	6
Retired	7
Disability Pension	2
Total Separations	184
Transferred In	77
Rehired	2
Total Additions	79

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6. LABOR AND WAGES: (Continued)

b. Statement of Wages:

	1959	1958	Increase or Decrease
Average Wages Per Day			
Surface	$24.51	$24.44	$ .07
Underground	27.62	27.85	.23
Total	$26.99	$27.11	$ .12
Average Wages Per Month			
	(14 Days)	(13-3/4 Days)	(1/4 Day)
Surface	$343.14	$336.05	$ 7.09
Underground	386.68	382.94	3.74
Total	$377.86	372.76	$ 5.10
Tons Per Man Per Day			
Surface	42.81	46.44	3.63
Underground	10.84	12.91	2.07
Total	8.65	10.10	1.45
Labor Cost Per Ton			
Surface	$ .573	$ .526	$ .047
Underground	2.548	2.157	.391
Total	$3.121	$2.683	$ .438

c. Labor Relations:

Labor relations were satisfactory during the year. One grievance reached Step IV. Arthur Spears, an electrician starter, who had been injured in the mine and subsequently laid off due to a reduction in personnel, filed a grievance asking that he be retained because of an alleged disability despite the fact that he did not have sufficient length of service. As a result of the Step IV meetings, the union and the company mutually agreed to overlook length of service and rehired Spears as a transfer scraperman as the electrical crew was already at full strength with better qualified employees.

There was no formal shut-down period for vacation during the year. The men benefited by seven paid holidays, New Year's, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas, in accordance with the provisions of the labor contract.

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7. SURFACE:

Buildings:

All work consisted of routine repairs.

Headframe and Trestles:

Screening at 1/2" was begun in the headframe on an experimental basis. An Inland rod screen deck was fabricated in the companys' General Shops and installed on the existing screen in the headframe. Temporary chutes were installed to handle the coarse and fine products. Screening was carried on during the shipping season with 38,201 tons of fines and 24,236 tons of coarse product being produced.

Engine House:

New pinion shafts were installed on the skip hoist. This work was done during the strike by supervisory personnel. Other engine house work consisted of cleaning and dipping the armatures on the hoisting equipment as routine preventative maintenance. Some work was also done on the compressors and on the cooling pond facility.

Hoist Ropes:

A new rope was put on the cage in June and the used cage rope was installed on the north skip.

Shops:

Most of the work in the shops was of a routine nature. Additional projects completed during the year were the fabrication of steel sets and a four-boom jumbo for the shaft sinking operation. Fabrication of a part of the "B" Shaft steel set requirements was begun at the end of the year.

Subsidence:

Microseismic activity over the subsidence area was very low during the year indicating that the area remained relatively stable. Water levels in the three subsidence holes remained fairly constant and air movement tests were negative. The iron pin grid system revealed no evidence of subsidence during the year.

MATHER MINE "A" SHAFT
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8. UNDERGROUND:

Block caving with the radial drilling system of undercutting continued as the mining method.

Steel sets continued as the principal means of support. Three types of sets were used during the year. A yielding arch set was used in the undercutting drifts, rigid arch sets were used for tugger rooms and transfer drifts, and square sets were used for main level drifts where required as well as for sub-level transfer drifts. During the latter part of the year use of the rigid arch set was limited and use of square sets was increased with the plan being that eventually rigid arch sets would no longer be used.

The use of steel raise tube sections to line transfer raises was continued. Osmose treated cribbing was used in relatively permanent travel and supply raises.

Mining operations were confined to the 8th and 9th Levels. Development continued on the 10th Level and in the 12th to 9th Level inclined belt drift. Preparations for sinking of the cage, ladder and pipe compartments of the main shaft were begun at the end of the year.

8th Level:

Production from the 8th Level during the year totaled 262,110 tons. This represented 50.7% of the mine total. The total tonnage to date from this level is now 2,123,765.

The tonnage came from one area in Section 1 and eight areas in Section 2. Production by areas was as follows: #9B Cross-cut (Section 1) - 14,866 tons; #3 Cross-cut - 48,388 tons; #7 Cross-cut - 28,936 tons; #811 Block - 57,171 tons; #812 Block - 36,467 tons; #822 Block - 31,059 tons; #823 Block - 24,273 tons; #883 Block - 1,355 tons.

All of the ore from the 8th Level is transferred to the 9th Level through a raise in the #5 cross-cut. Sixty-seven per cent of the 8th Level ore was handled by belt conveyor with the remainder being transported by rail.

9th Level:

Production from the 9th Level amounted to 254,856 tons or 49.3% of the mine total. Total tonnage to date from the level is 639,163 tons.

Four areas were in production during the year. Development of additional areas was in progress. Production by areas was as follows: #921 Block - 62,611 tons; #941 Block - 102,269 tons; #942 Block - 54,999 tons; #946 Block - 34,105 tons. Development is proceeding in the #931 and #934 Blocks.

All ore mined between the 8th and 9th Levels is transported to the 9th Level crushing station by a system of sub-level belt conveyors.

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8. UNDERGROUND: (Continued)

Development Below the 9th Level:

On the 10th Level the footwall drift was advanced 492 feet. The entire drift was driven naked. On June 30th, the Mather "B" rock drift crew effected a connection to this heading. During the last quarter of this year, the 10700 Cross-cut was driven 235 feet, with the use of steel supports.

The advance of the 12th to 9th Level inclined belt drift amounted to 697 feet. During the last quarter extremely hazardous ground conditions were encountered. The drift required steel sets as supports. At the end of the year, the heading reached a distance of 2,577 feet from the drive pulley, and was 325 feet below the 10th Level elevation.

Initial work started in preparing the shaft cage and service compartments for shaft sinking. With the Mather Mine "A" Shaft hoisting only on the day shift, the sinking will proceed on the remaining two shifts.

Diamond Drilling:

A total of 5,439 feet of diamond drilling was done in 1959. This footage represents 20 holes: 5 from 8th Level, 6 from 9th Level, and 9 from 10th Level. The main objectives of the drilling program were:

1. Outlining and detailing 9th Level ore.
2. Outlining 10th Level ore.
3. Locating ore and structure below 10th Level.

8th Level

Three holes were drilled on the 11650 W. coordinate to locate possible ore and outline structure above and south of the 3200 S. area. No ore was cut, but valuable information was gained on the structure in the area. Two holes were drilled downward from the same location to outline ore and structure below the 8th Level. It was found that there was an 80' thick layer of ore on the footwall at the -2000' elevation, 3800 S. coordinate.

9th Level

Six holes were drilled to determine the ore height above 9th Level between the N-S dike and the 11000 W. coordinate. These holes showed a good height of ore extending 200' to 400' south of the point where 8th Level mining stopped.

10th Level

Eight holes were drilled from the 10th Level to look for ore on the Jackson Fault between the 9950 W. and 10600 W. coordinates above the 10th Level. This drilling showed an orebody high on the footwall, at the 9950 W. coordinate, which extends downward and westward to the 10500 W. coordinate where it drops below 10th Level. One hole was drilled at the 10600 W. coordinate to outline this orebody between 10th and 11th Levels.

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8. UNDERGROUND: (Continued)

Diamond Drilling: (Continued)

The following table shows the drilling for the year:

Holes Drilled From 8th Level		Ore Drilled	Depth
Hole Number:	497	0	284
	501	0	142
	502	0	283
	506	0	235
	508	107	1130
Holes Drilled From 9th Level			
Hole Number:	530	32	130
	531	15	112
	534	73	201
	536	81	195
	538	111	222
	540	21	51
Holes Drilled From 10th Level			
Hole Number:	496	281	351
	504	228	305
	509	60	152
	512	76	297
	516	0	225
	519	127	367
	524	10	297
	527	79	350
	539	0	110
	20	1,301'	5,439'

Percent Ore Cut - 23.9%

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8. UNDERGROUND: (Continued)

Statement of Timbering Supplies Used in Operating Accounts

ITEM	AMOUNT	COST PER TON
Cribbing	$ 5,761.76	$.0111
Lagging	7,988.17	.0155
Poles	5,324.70	.0103
Steel	116,400.63	.2252
Total 1959	$135,475.26	$.2621
Total 1958	$311,114.38	$.3777

Explosives:

The following tables show the cost of explosives used in mining 516,966 tons of ore (Table I), the unit costs and consumption of explosives (Table II), and the cost per ton for explosives used in Development for Mining as compared to the cost per ton for Mining (Table III).

TABLE I

Cost of Explosives - Operating

	1959	1958
Powder - All Kinds and Miscellaneous Blasting Supplies (Fuse, Caps, Bags, etc.)	$68,916.64	$106,412.01

TABLE II

Unit Costs and Consumptions of Explosives

	1959	1958
Pounds of Powder Per Ton of Ore	0.407	0.426
Tons of Ore Per Pound of Powder	2.460	2.347
Cost Per Ton for All Explosive Supplies	$0.133	$0.129

TABLE III

	1959	1958
Cost Per Ton in Development for Mining	$0.053	$0.043
Cost Per Ton in Mining	0.080	0.086
Total	$0.133	$0.129

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8. UNDERGROUND: (Continued)

Pumping:

Pumping of underground water increased 79% in 1959 from 325 gallons per minute to 581 gallons per minute. The reason for the increase was that in May the Mather Mine "A" Shaft began pumping Cambria-Jackson water.

Level	1959 G.P.M.	1958 G.P.M.
3rd	95	63
6th	486	262
Total	581	325

All mine discharge water is carried through a 16" pipe line and then by ditch to the Carp River, approximately two miles towards the west. In the event of emergency pumping conditions, a second pipe line will provide additional capacity and allow water to discharge at the west end of the timber tunnel.

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9. TAXES:

Taxes for the year totaled $441,971.51, which is $32,115.67 more than in 1958. Valuation for 1959 was increased $432,550.00 and the tax rate was increased from $46.40 per $1,000.00 of assessed valuation to $47.70 per $1000.00 of assessed valuation.

	1959		1958	
	VALUATION	TAXES	VALUATION	TAXES
Mather Mine "A" Shaft including Stockpiles, Supplies & Equipment as placed by State Mine Appraiser:				
Real Estate	$5,020,000	$239,454.50	$6,570,000	$304,848.00
Personal Property	4,245,000	202,486.00	2,260,000	104,864.00
Pipeline - Cloverdale Tract NE-NE, Sec. 3, 47-27	650	31.01	650	30.16
			2,450	113.68
Total Mather Mine "A" Shaft (City of Ishpeming)	$9,265,650	$441,971.51	$8,833,100	$409,855.84

	1959		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total Operating - Assessed	$287,281.48	$0.556	$0.586
Total Idle - Assessed	154,690.03	0.299	0.315
Total - Assessed	$441,971.51	$0.855	$0.901

	1958		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total Operating - Assessed	$409,855.84	$0.497	$0.703

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10. ACCIDENTS AND PERSONAL INJURY: There were 18 compensable injuries during the year with a lost time of 824 days. There were 5 non-compensable injuries, which added 11 days of lost time which makes a grand total of 835 days for the year as compared to 6,825 in 1958. The severity was 1,502 and the frequency was 41.38 compared with company averages for underground mines of 2,765 in severity and 49.71 in frequency. The total hours worked was 555,859 as compared with 708,236 in 1958 for a decrease of 21.5%.

DATE	NAME	NATURE OF INJURY	NUMBER OF DAYS LOST
1/ 7/59	Carl O. Carlson	Fracture of Right Index Finger	44
1/ 8/59	William Harju	Contusion of Right Lower Leg	64
1/26/59	Walter Cox	Fracture of Left Maxilla	25
2/16/59	Toivo Koski	Fracture of 4th Metacarpal Right Hand	26
3/20/59	Toivo Dahl	Fracture of 4th Right Finger	23
3/26/59	William J. Jandreau	Contusion of Left Chest	13
5/ 8/59	John Juidici	Laceration Right Side of Face	7
5/12/59	John Coskie	Contusion of Left Foot	32
5/27/59	Sulo Ruotsala	Strain of Left Knee	105
6/ 3/59	William White	Laceration & Contusion Right Ring Finger	53
6/ 3/59	Arthur Ayotte	Fracture of Right Ankle	160
6/ 8/59	Leonard Haapala	Fracture 2nd Metacarpal of Left Hand	41
6/15/59	Elmer Segerson	Contusion of Back	110
7/14/59	Arvo Johnson	Contusion of Right Foot	13
11/13/59	Myles Marietti	Fracture of Left Index Finger	36
11/16/59	Paul Nummikoski	Sprain of Left Wrist	31
11/18/59	Clyde Sarasin	Fractured Rib	28
12/ 9/59	Nicholas Picciano	Laceration & Contusion of Left Arm	13
		Total Days Lost	824

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11. POWER:

	CONSUMPTION K. W. HOURS	AVERAGE MAX. DEMAND	AVERAGE DEM. FACTOR	COST OF CURRENT	AVERAGE PRICE PER K.W. HOUR
1959	13,619,009	3785 K.W.	41%	$216,329.79	$.0159
1958	14,918,766	4250	41%	197,306.03	.0132
1957	19,663,002	4200	54%	219,090.30	.0111
1956	18,229,341	3120	68%	164,413.16	.0090
1955	16,245,161	3620	52%	150,266.76	.0092

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1. GENERAL:

The production for the year was 209,718 tons as compared with 339,300 tons in 1958. Of this total, 47% was mined from Fee Lands and 53% came from Leased Lands. Total shipments were 193,288 tons, with 63,672 tons in stockpile at the mine on December 31, 1959. Shipments in 1958 were 335,215 tons.

The reduction in production and shipments was due to the steel strike with the Morris Mine stopping production on the 14th of July and resuming production on the 9th of November. During the strike period, maintenance work was performed by the salaried supervisory personnel. From November 9 through December 19, the usual schedule of 2 - 8 hour shifts per day, 5 days per week was increased to 2 - 8 hour shifts per day, 6 days per week in an effort to recoup some of the lost production. Adverse weather limited shipments and the shipping season ended on December 2.

In Fee Lands, underground between 9th and 10th Levels, the #101 stope was mined out and development of a raise to recover by sub-level caving a pillar on the east end of the orebody near the 9th Level elevation progressed. The #102 and #103 stopes were in production throughout the year. Contract #104 completed stope development and stoping operations were commenced. The #105 stope development was converted to sub-level caving. Also on the west end of the 10th Level, in Chase Lease #9, the main drift was advanced with one cross-cut being driven south into the ore.

Above 9th Level in Chase Leases #9 and #24, mining by sub-level caving continued. In 1960, several contracts, having worked out areas above 9th Level, will be moved to the 10th Level.

The estimated ore reserves increased 70,355 tons; the Chase Leases had a loss of 25,788 tons which was offset by an increase of 96,143 tons in The Cleveland-Cliffs Iron Company's Lands. The major decrease in Chase Lease reserves was attributed to large unrecoverable pillars which were written off in the 1959 estimate. New development work on the 10th Level increased Cliffs' reserves above and below the level. One other reversal occurred in D.D.H. #14 in Chase Lease #9 above the 9th Level. The drill hole had intersected 60' of ore which was interpreted as an extension of Deposit 75C, adding substantial mineable ore. However, an exploratory drift in the area drew a blank and mining plans above the 9th Level were abandoned. Additional testing of D.D.H. #14 revealed that the hole had veered to the east and downward and was actually 35' below the 9th Level elevation. As of October 1, 1959, total reserves were 3,288,679 tons.

Deep well surface pumping has been continued and an average of 679 g.p.m. was pumped compared with 640 g.p.m. in the previous year. The

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1. GENERAL: (continued)

volume of underground water averaged 1702 g.p.m. as compared with 1654 g.p.m. in 1958. Pumping costs were $.08 per ton for surface drainage and $.87 per ton for underground pumping, a total of $.95 per ton. Pumping costs in 1958 were $.03 per ton for surface and $.56 per ton underground for a total of $.59 per ton. During the strike, the pumps were operated at capacity with no ore being produced, resulting in increased pumping costs for the reduced tonnage produced in 1959.

2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Production

Year	Grade	Tons
1959	Morris	209,718
1958	Morris	339,300
1957	Morris	309,150

The 1959 production came from Fee and Leased Lands in the following proportions:

	Fee	Leased	Total
Production - Tons	98,671	111,047	209,718
Percentage - 1959	47.05%	52.95%	100.00%
Percentage - 1958	36.7%	63.3%	100.00%

Leased Land production was as follows:

Chase Lease #9	89,966
Chase Lease #24	21,081
Total 1959	111,047

A summary of the total production, Fee and Lease, since the Inland Steel Company took over the Morris Mine Lease is listed below:

	Tons	Percent
Lease Ore Production 1933-1959	6,025,332	74.45
Fee Ore Production 1933-1959	2,067,986	25.55
Total	8,093,318	100.00

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (continued)

b. Shipments

Grade	Pocket	Stockpile	Total
Morris	43,038	150,250	193,288

Grade	Fee	Lease	Total
Morris	85,193	108,095	193,288

The following table shows the shipments for the past five years:

1959	193,288
1958	335,215
1957	295,685
1956	302,710
1955	335,939

Total shipments since Inland acquired the lease in 1933 - 8,020,079 tons.

c. Ore in Stock, December 31, 1959

Grade	Tons
Morris	63,672

d. Production by Months

Month	Days Worked	Average No. of Men	Tons Per Man Per Day	Production
January	21	179	6.26	23,530
February	20	179	6.58	23,548
March	21	183	6.61	25,408
April	22	184	7.16	28,966
May	21	183	6.05	23,249
June	21	183	6.38	24,535
July	9	183	5.79	9,537
August	0	0	0	0
September	0	0	0	0
October	0	0	0	0
November	19	181	6.47	22,265
December	24	181	6.60	28,680
Total	178	181.8	6.48	209,718

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (continued)

e. Working Schedule

The mine operated 2 - 8 hour shifts per day, 5 days per week from January 1 through July 14. At the end of the afternoon shift on the 14th of July, the mine ceased production as the result of the nationwide steel strike. Operations were resumed on November 9 as the men returned to work in compliance with the Taft-Hartley injunction. A work schedule of 2 - 8 hour shifts per day, 6 days a week was maintained from November 9 through December 19. The normal schedule of 2 - 8 hour shifts per day, 5 days per week was followed for the balance of the month.

3. ANALYSIS:

a. Shipments

Grade	Tons	Iron Dried	Iron Nat'l	Moisture
Morris	193,288	56.896	50.433	11.36

b. Ore in Stock, December 31, 1959 (Natural)

Grade	Tons	Iron Dried	Iron Nat'l	Phos.	Silica	Mang.	Moisture
Morris	63,672	56.98	50.71	.068	10.55	.42	11.00

c. Ore Reserves - Expected Natural Analysis

Grade	Tons	Iron	Phos.	Silica	Mang.	Alum.	Sulphur	Moisture
Morris	3,068,360	49.00	.075	11.75	.42	2.40	.015	12.00
Hi-Sul	220,319	49.06	.090	12.00	.40	2.40	.385	12.00

4. ESTIMATE OF ORE RESERVES:

The estimated reserves, after allowance for ore mined in 1959, shows 70,355 tons of new ore developed.

The Cleveland-Cliffs Iron Company's Lands had an increase of 96,143 tons. New development on the 10th Level increased the reserves in Deposits #84 and #84A between 8th and 10th Levels by 90,151 tons and also in Deposit

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4. ESTIMATE OF ORE RESERVES: (continued)

#84, below 10th Level, by 30,614 tons. In Deposit #87, between 8th and 9th Levels, a loss of 24,622 tons occurred as areas above the -170' sub-level became inaccessible for mining. Deposits #33S and #87, below 9th Level, and Deposits #33 and #76, between 8th and 9th Levels, had no change in reserves.

The Chase Leases decreased 25,788 tons. In Chase Lease #24, in Deposit #79 (high sulphur) between 8th and 9th Levels, mining exceeded the estimate by 5,564 tons. The remaining deposits in this lease are the same as the previous year. In Chase Lease #9, Deposit #33 between 8th and 9th Levels and between 9th and 10th Levels, new information indicated a reduction of 14,075 tons. In Deposits #75C and #86, between 8th and 9th Levels, the reserve was decreased 46,760 tons by large unrecoverable stope pillars. Mining operations increased Deposits #75C and #86, between 9th and 10th Levels, 21,570 tons. In Deposit #87, between 8th and 9th Levels, mining exceeded the estimate by 5,421 tons. Deposit #87, between 9th and 10th Levels, decreased 175 tons. In Deposit #79 (high sulphur), above 8th Level, 2,667 tons of ore were mined from an area not previously estimated.

Description of Deposits	Engineer's Reserve Estimate 9/1/58	Division 9/1/58 to 9/1/59 Production Estimated from Various Leases and Deposits	Ore Reserve 9/1/59 by Deducting Production	Engineer's Reserve Estimate 9/1/59	Net Gain or Loss in Reserve 1959
Total Chase Lease #24	39,342	---	39,342	39,342	---
Total Chase Lease #24 (High Sulphur)	239,157	24,402	214,755	220,319	5,564
Total Chase Lease #9	1,758,478	124,765	1,633,713	1,599,694	34,019
Total Chase Lease #9 (High Sulphur)	---	2,667	2,667	---	2,667
Total Chase Leases	2,036,977	151,834	1,885,143	1,859,355	25,788
Total C.C.I.Co. Lands	1,444,649	111,468	1,333,181	1,429,324	96,143
Grand Total	3,481,626	263,302	3,218,324	3,288,679	70,355

5. LABOR:

The number of men employed at the mine was reasonably stable; the lowest number of men was 179 and the highest was 184, with an average of 182. The average of 182 men in 1959 compares with the yearly average of 185 in 1958.

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6. SURFACE:

In the past two years variable pumping schedules were used with the surface well pumps. This program ranged from two pumps out of service to a complete shutdown of all pumps for a one month period. A reduction in pumping was followed by a raise in the elevation of the water table and an increase in the amount of underground water pumped. As the result of this program, wells and pumps have been renovated and a full pumping schedule maintained.

A check was made to determine if any water loss occurred in the surface drainage system. Between the settling basin and North Lake, a loss of approximately 400 g.p.m. was measured. Installation of a metal flume is being considered to rectify this condition.

A new hoisting rope was installed on the cage.

RECAPITULATION OF SURFACE AND UNDERGROUND PUMPING FOR 1959

Month	Surface Pumping G.P.M.	Underground Pumping G.P.M.
January	847	1698
February	814	1688
March	796	1676
April	793	1664
May	917	1681
June	637	1683
July	229*	1698
August	375*	1739
September	750	1750
October	783	1751
November	512**	1710
December	698**	1687
Average 1959	679	1702

* Nos. 3, 3A and 10 surface wells shut down for experimental purposes from July 1 to August 24, inclusive.

** Nos. 3A and 10 surface wells shut down for repairs from: November 3 to (still not in operation) - #3A
November 5 to November 14 - #10

Pumping cost for surface drainage was $.08 per ton in 1959 as compared to $.03 per ton in 1958.

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7. UNDERGROUND:

a. Pumping

The following table shows a comparison of the mine water pumped over a seven year period:

Year	Total
1959	1702
1958	1654
1957	1644
1956	1600
1955	1535
1954	1574
1953	1621

The following table shows a comparison of underground pumping cost per ton for the last nine years:

Year	Cost Per Ton
1959	$.87
1958	.56
1957	.56
1956	.61
1955	.51
1954	.46
1953	.55
1952	.65
1951	.49

b. Mining and Development

Production in Fee Lands came from one sub-level caving operation above 9th Level and from four stopes between 9th and 10th Levels, all in Deposit #84.

Contract #101 completed mining the #101 stope in April. The remainder of the year was spent driving a double cribbed raise up from the transfer drift. This raise will be used to recover, by sub-level caving, an estimated 50,000 tons of ore remaining in the upper eastern extremity of Deposit #84. Three sub-levels, with the top sub-level 15' below the 9th Level, will be developed.

Contract #102 was in production throughout the year. Long hole drilling and blasting was employed to enlarge the stope in which the contract was mining.

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7. UNDERGROUND: (continued)

b. Mining and Development (continued)

Contract #103 continued drawing ore from the stope in which it was mining.

Contract #104 completed stope development work and started to mine from all sub-levels.

Mining plans for the #105 stope were changed when stope development work encountered dike and jasper seams. Contract #105 drove a raise up to and connected with a dogdrift on the 9th Level. A sub-level was cut at the -340' elevation below 9th Level and a transfer drift was driven south. From this transfer drift, cross-haul drifts will be driven and used to sub-level cave the ore which originally would have been stoped.

Contract #107 developed a top timber drift above 10th Level and then drove a double cribbed raise which will connect with 9th Level early in 1960.

Contract #20 developed a sub-level caving operation at top timber elevation above 9th Level. This mining was between the #105 and #107 Contracts which were developing below from 10th to 9th Levels, but provided immediate production from this area.

Contract #102A performed miscellaneous development work, raises and drifts in the #102 and #103 stope areas.

An average of 9 contracts worked in the Chase Leases.

In a major development on 10th Level, in Chase Lease #9, Contract #150 drove 878' of main level drift. Approximately half of this advance was due west in the drift in slate and the remainder was in a cross-cut due south. The south cross-cut went through iron-formation and intersected 140' of ore, interspersed with small dikes and jasper seams.

Two contracts worked in Chase Lease #24 in Deposit #79. Contract #30 sub-caved from the -150' sub-level below 8th Level. When mining is completed from the -150' sub-level, Contract #30 will develop a new sub-level at the -220' elevation and continue mining in the same ore deposit. Contract #4 raised up from top timber over 9th Level to the -280' sub-level. A lengthy drift to the west, between jasper on the north and an old stope to the south, was successfully mined. Because of an adverse exploration to the north, future mining will be conducted due east at the same elevation.

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7. UNDERGROUND: (continued)

b. Mining and Development (continued)

Six contracts worked in Chase Lease #9 above 9th Level.

Contract #17, top timber above 9th Level in Deposits #86 and #75C, mined a pillar on the north side of the old #24 stope and then mined east of the stope. Two sub-levels were developed above the transfer in a small stoping operation.

Contract #2 sub-caved in Deposit #75C immediately above 9th Level.

Contracts #3, #5 and #7 completed sub-level caving from the -220' elevation in Deposits #33 and #87 and continued mining the same areas from the -250' sub-level.

Contract #12 sub-caved in Deposits #86 and #33 from the -220' sub-level.

In a section of the shaft at 3rd Level, the old wooden sets, which are deteriorating, are being replaced by steel sets. Worn shaft runners are also being replaced wherever necessary throughout the shaft. This work is scheduled for weekends when the mine is out of production.

At the Morris property, continuous pumping of 1600 - 1700 g.p.m. of water from underground to surface is necessary to dewater the mine. In the event of a major electrical power failure on an off shift a six-man crew is immediately called out to the mine to put the stop-log dam in place on 8th Level and close the steel hinged water door on 9th Level, as these measures prevent flooding of the electrical pumping stations and the shaft itself. Development of the 10th Level required the installation of another water door. A new door was designed to eliminate the costly time and labor required to make use of the older types. The conventional door frame, concrete poured in hitches blasted in the floor, ribs and back of the drift, was employed with one exception, another pocket was blasted on the east side of the drift to hold the steel door when not in use. The double-walled, prefabricated steel door was suspended on a slightly inclined overhead track. Rubber gaskets make the door watertight and a three-foot section of track is easily removed. One man can now easily roll this massive steel door horizontally into position in a short time. An air hoist is employed to move the door from its closed position up the inclined overhead track to the pocket in the side of the drift.

Respectfully submitted,

Ralph E. Magnuson, Jr.

Ralph E. Magnuson, Jr.
Chief Mining Engineer

DPI:jcj

April 20, 1960

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I. INTRODUCTION

The Ohio Mine was idle during the first quarter, although plans were under study for operating during the summer.

The dewatering of the pit was started on April 3rd, and repairs to the plant began on the 6th. The dewatering program was completed during the first week of June and more permanent pumping stations were immediately set up as the inflow of water was much heavier than was recorded during the last operating season. Electrical difficulties and heavy rains greatly hampered the dewatering operation.

Stripping was started in June and continued until the strike terminated all work on July 15th.

The mill was completely repaired and ready for handling the crude ore by early June. However, because of the pending strike by the United Steelworkers, the opening of the mine was delayed until a settlement might be reached.

During October a single permanent pumping station was erected to permit a winter pumping operation as the continuing strike prohibited the opening of the mine during the 1959 season. Following the termination of the strike in November, the mill was prepared for the winter and the property remained idle for the remainder of the year.

II. OPEN PIT

a. Dewatering

Dewatering of the Ohio Pit commenced on April 6th with the installation of three 500 gpm horizontal type pumps and one 1000 gpm horizontal type pump. On April 10th, a 2500 gpm submersible pump was placed in operation, and later in the month a 3600 gpm deep-well vertical type Pomona pump was added. It is estimated that the combined capacity of these pumps was approximately 7000 gpm. Pit dewatering operations were completed during the early part of June; however, it was necessary to maintain a substantial pumping program to handle the large volume of seepage occurring from the adjacent swamp areas, tailings area and old mine workings.

During October a permanent pumping station was erected in the western end of the pit to serve for pit pumping operations during the winter months.

b. Stripping Operations

		Detail of Costs		
E&A Number	Rock Cubic Yards	Surface Cubic Yards	Total Cubic Yards	Amount Expended
CC-2	6,877	113,589	120,466	$ 8,021.44 Rock
				48,298.82 Surface
Total				56,320.26
Cost per Yard	$ 1.166	$ 0.425	$ 0.468	

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II. OPEN PIT (Cont.)

Cost Comments

The 1959 cost per cubic yard of rock at $1.166 includes 15,793 cubic yards which were blasted but not loaded out. Had this yardage of rock been removed during the year, the 1959 cost per cubic yard of rock would have been greatly reduced. The surface stripping cost of $0.425 per cubic yard was quite satisfactory, as extremely difficult stripping conditions were encountered in the eastern section of the pit. This portion of the pit was extremely wet and the overburden contained numerous large boulders, necessarily requiring a considerable amount of secondary blasting.

Details of Stripping

Stripping operations at the Ohio Mine commenced on May 20th, on a one shift basis and continued on that schedule until May 26th, at which time a second shift was added. A third shift was added on June 2nd. During the early stages of operations, a total of 17,295 cu.yds. of surface material was removed from road construction operations, along the south main haul road, and from the construction of a temporary haul road from the south main road to the +1570 elevation.

The scheduled operating date for the Ohio Mine was postponed from early June until July 15th, pending the settlement of labor negotiations with the AFL-CIO. As a result of this postponement, stripping operations were directed toward completely preparing the eastern portion of the pit above the +1550 elevation for ore production. A total of 96,294 cu.yds. of overburden and 6,877 cu.yds. of rock was removed from this area.

Stripping operations were terminated on July 15th by the industry-wide strike.

III. PLANT

During the plant repair period that lasted from April 6th through early June, practically all equipment in the mill received attention. This action was required because the plant had been idle since the fall of 1957 and because many items of machinery had been utilized at other properties.

Heavy maintenance was necessary on the truck dump hopper, screens, conveyors and chutes. Since most of the belting had been removed, the replacing of the conveyor belts was also a major project.

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IV. LABOR & WAGES

a. Labor Statistics

Man days stripping	866
Man days W.& I. Repair	1500
Yards per man per day stripping	139.10
Cost per yard for labor	$ 0.178
Average daily wage	$ 24.64
Total Wages - Idle repair	$ 36,622.52
Total Wages - Stripping	$ 21,439.69

b. Comments

A total of 47 men was employed at the Ohio Mine at the peak of the stripping and repair work in May and June. At this time four crews were hauling dirt from the pit which accounted for two thirds of the personnel at the mine. Because all open pit employees were working during the period, several men from the Underground District were employed.

There were no grievances or work stoppages throughout the working period.

V. ORE RESERVES

Studies made of the pit following the dewatering program indicated a reserve of 226,000 tons of concentrate at a 40% recovery factor. This tonnage involves developing the pit to the 7000 W coordinate and to a depth along the east half of the pit to 1475 feet.

VI. TAXES

	1959		1958	
	Valuation	Taxes	Valuation	Taxes
Real Estate-Mine Appraiser	$ 230,000	$ 10,400.07	$ 281,000	$ 13,725.05
Personal-Mine Appraiser	$ 95,000	$ 4,295.68	$ 111,000	$ 5,421.64
Taxes-Mine Appraiser Valuations	$ 325,000	$ 14,695.75	$ 392,000	$ 19,146.69
Local Assessor				
Timber on Mine Real Estate	$ 800	$ 36.18	$ 600	$ 29.30
Webster Mine Real Estate	$ 600	$ 27.13	$ 600	$ 29.30
Total Ad Valorem Taxes	$ 326,400	$ 14,759.06	$ 393,200	$ 19,205.29
Spurr Township Tax Rate per M		$ 44.77		$ 48.36

All of the above taxes include the 1% collection fee added by the Township Treasurer.

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VII. IDLE EXPENSE

Pit Expense	$ 39,000.75	
Crushing & Screening	9,925.08	
Milling Expense	9,815.17	
Tailings Disposal	241.61	
Stocking Expense	1,842.47	
General Mine Expense	19,210.83	
Vacation Pay	5,787.84	
Rental of Equipment	13,610.51	(credit)
Holiday Pay	687.08	
Total	$ 72,900.32	
Taxes	18,731.93	
Depreciation	2,362.82	
Total Cost	$ 93,995.07	

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1. GENERAL:

The Republic Mine operated for the equivalent of eight months and one week out of the year on a three shift per day, seven day per week schedule. Operations were discontinued from July 15th to November 9th due to the strike by the U. S. W. of A. (CIO) Union.

Ore hauling from the pit and crushing required one to one and a half shifts per day, 7 days per week. Primary drilling was done on a three shift per day basis, five days per week except that no primary drilling was done during July and November. The concentrator operated three shifts per day, seven days per week with a shutdown of one shift per week or less generally for repairs. Stripping was done by the afternoon shift pit crew after completing ore haulage requirements. In addition, a small day shift crew operated part of the year on stripping.

No major construction programs were undertaken during the year. Under E&A MI-47, the remaining houses were removed or vacated from the Park City-West Republic area and on the north from the area between the pit and the railroad tracks. The old hospital building just west of the school remained to be moved. Under E&A MI-54, major improvements were started on the dust collection systems in the primary crushing and the fine crushing buildings.

Except for the delay due to the strike, both pit and plant facilities performed in an excellent manner. Operating time continued to be high and improvements over previous years were made both in production rates and operating costs. The analysis of concentrate was higher in iron and lower in silica and moisture content than specified in the guarantee.

A request was submitted in October to the County Road Commission to vacate the section of old highway M-95 that passes through the pit area as well as other roads adjacent to the pit and in the Park City-West Republic area. By the end of the year, the necessary legal procedures had been completed for the abandonment.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Operating Schedule:

	No. of Days	Shifts Per Day	Hours Per Shift	Total Shifts
Hauling & Crushing	239	1 & 2	8	380
Mill Operating	241	1, 2 & 3	8	715

b. Production by Months:

Month	Tons of Crude Crushed	Tons of Crude Milled	Tons of Concentrate
January	126,602	125,985	58,029
February	109,153	110,088	51,539
March	126,179	125,613	60,773
April	108,883	109,461	54,141
May	123,390	120,302	59,155
June	126,725	126,037	59,540 *
July	51,294	52,301	24,989
August	-0-	-0-	-0-
September	-0-	-0-	-0-
October	-0-	-0-	-0-
November	85,036	85,391	42,841 *
December	119,607	123,727	64,331
TOTAL YEAR - 1959	976,869	978,905	475,338 *
TOTAL YEAR - 1958	1,006,120	1,005,436	462,435

*Not included in above - 185 tons to Pilot Plant
51 tons to Swindell-Dressler Corp.
Total - 236 tons

c. Production Averages:

	Year 1958	Year 1959
Average Crude Ore Per Day	3672 Tons	4087
Average Concentrates Per Day	1657 Tons	1972
Tons Per Man Per Day - Crude Ore	44.47 Tons	51.11
Tons Per Man Per Day - Concentrate	20.44 Tons	24.87
Average Weight Recovery	45.99 Percent	48.56

d. Tonnage and Analysis of Concentrate Produced and Shipped:

	Tons	Iron	Sil.	Moist.
On Hand December 31, 1959	58,901	63.76	7.60	6.67
Produced Year 1959	475,338	63.36	8.35	6.07
Pocket to Pellet Plant	442,731	63.36	8.35	6.04
Stockpile to Pellet Plant	24,874	63.31	8.38	4.98
On Hand December 31, 1959	66,634	63.59	7.87	6.46
Not Included in Above Production or Shipments:				
Shipment to Pilot Plant	185	63.50	9.77	4.90
Shipment to Swindell-Dressler Corp.	51	63.30	8.38	4.90

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (Cont'd.)

e. Estimated Production and Analysis:

	Tons	Iron	Phos.	Sil.	Sul.	Moist.
Dried		63.10	.028	8.82	.013	-
Natural	640,868	59.00	.026	8.25	.012	6.50

3. ESTIMATE OF ORE RESERVES:

a. Estimated Reserves:

Some adjustment was made in ore reserves based on the diamond drilling done in the Park City area along with some changes in previously assumed contacts. After test work is completed on the diamond drill cores and interpretation has been reviewed, additional changes in the reserve picture will probably be made. A factor disclosed by diamond drilling was that the weight recovery on the ores in the Park City area shall be reduced to 40% from the 50% previously used.

Main Pit - Surface to 1100' elevation - concentrates calculated at 50% weight recovery.
Park City - Surface to 1200' elevation - concentrates calculated at 40% weight recovery.

Main Pit

Level	Tons Crude	Tons Conc.
Surface to 1500'	20,246,931	10,123,465
1500' to 1400'	20,960,129	10,480,064
1400' to 1300'	21,220,318	10,610,159
1300' to 1200'	21,505,530	10,752,765
1200' to 1100'	21,827,162	10,913,581

Park City

Surface to 1500'	3,379,307	1,351,723
1500' to 1400'	7,320,471	2,928,188
1400' to 1300'	8,096,723	3,238,689
1300' to 1200'	8,364,732	3,345,893
Total	132,921,303	63,744,527
Less Tons Mined Prior 8/5/52	-3,410,514	-1,705,257
Total Reserve 12/31/59	129,510,789	62,039,270

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3. ESTIMATE OF ORE RESERVES: (Cont'd.)

a. Estimated Reserves: (Cont'd.)

Elevation	Stripping		Cu. Yds.
	Cu. Yds. Stripping	Cu. Yds. Rock	Equiv. Stripping *
1500	661,686	644,866	2,144,878
1400	741,039	2,966,742	7,564,546
1300	602,344	4,976,437	12,048,149
1200	718,963	8,654,711	20,624,798
1100	1,013,751	8,623,810	20,848,514
Total	3,737,783	25,866,566	63,230,885

* Rock calculated at a factor of 2.3 for equivalent stripping.

b. Estimated Analysis:

	Iron	Phos.	Sil.	Sul.	Moist.
Dried	63.10	.028	8.82	.013	-
Natural	59.00	.026	8.25	.012	6.50

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4. LABOR AND WAGES:

a. General:

The mine payroll fluctuated between 114 and 120 people of which six were salaried and the remainder on hourly rate. In addition, there were four salaried employees on the general roll and one on the Cleveland roll. Also, an engineer and surveyor were assigned to the mine on a full time basis and a geologist on a part time basis from their respective departments.

Mr. Richard Smith, plant metallurgist, resigned in January to accept other employment. He was replaced by Mr. Robert Berkhahn, who was in turn transferred to Humboldt on June 15th. He was replaced by Mr. Calvin Bjorne who was transferred from the Pilot Plant. Mr. Don Lukkari, geologist, was transferred out in October and replaced by Mr. Paul Sheerer.

There were many changes in hourly rate employees because people were transferred to the Ohio, Tilden and Humboldt Mines, most of who returned to Republic at the end of the season. In their absence, jobs were filled by layed off personnel.

A cost of living increase of .01 per hour went into effect on January 1, 1959, bringing the total cost of living adjustment to .17 per hour.

Other than the general strike, labor relations at the mine were generally satisfactory. No grievances were processed during the year.

b. Report of Men Hired, Transferred and Separated:

Month	Total Beginning of Month	Rehires and New	Trans. Fr. Other Mines	Total Men	Trans. to Other Mines	Lay-Off	Quits	Total End of Month
January	115	1		116			1	115
February	115	4	1	120			1	119
March	119	1		120				120
April	120	2		122	8			114
May	114	11	1	126	12			114
June	114	7		121			1	120
July	120			120				120
August	120			120				120
September	120			120				120
October	120			120			3	117
November	117	1	19	137	5	14	2	116
December	116	1		117				117
Total Year	115	28	21	164	25	14	8	117

* The above table includes only hourly and salaried men on the Republic Mine payroll.

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4. LABOR AND WAGES: (Cont'd.)

c. Report of Vacations Paid:

	Year	No. Men	Total Hours	Total Amount	Avg. Rate Per Hour
Actual	1956	35	2080	$ 5728.48	$ 2.754
Actual	1957	87	4870	12652.86	2.598
Actual	1958	89	5660	15456.67	2.731
Estimate	1959	108	9420	25905.00	2.750
Actual	1959	122	9047½	26166.43	2.892
Estimate	1960	125	10740	29500.00	2.747

d. Annual Statement of Labor:

	Stat. Men	Hours	Amount	Avg. Rate
Hourly Employees				
Straight Time	77½	149709	$ 404103.99	2.699
Overtime		3100	4340.22	1.400
Shift Diff. - Aft.		52372	4308.88	0.082
Shift Diff. - Nite		15874½	2035.86	0.128
Sunday Premium Time		11924½	7990.97	0.670
Holiday Allowance		5208	14344.57	2.754
Physicals & Allowed Time		154	452.17	2.936
Vacation Pay			33512.08	
Total Hourly Employees	77½	149709	471088.74	3.147
Salaried Employees				
Mine Payroll	6⅞	12955⅞	50047.41	3.896
Total Mine Payroll	84¼	162664⅞	521136.15	3.204
General Payroll				
Salaried Straight Time	4¼	8347	24792.12	2.970
Overtime	-	-	-	-
Labor from other Mines	4¼	8266	32714.47	3.958
TOTAL LABOR	92⅞	179277⅞	578642.74	3.228
Distributed as Follows:				
Operating Republic Mine	79	152890⅞	485018.83	3.172
Strike Expense	3½	6701½	33304.56	4.970
Stripping	8	15120	44461.03	2.941
Uncompleted Construction	1⅝	2692½	9622.54	3.574
Other Mines	⅞	1497	5059.20	3.380
Other Accounts	0	376	1176.58	3.129
Total as Above	92⅞	179277⅞	578642.74	3.228

4. LABOR AND WAGES: (Cont'd.)

e. Labor Cost:

	Year 1958	Year 1959
Production of Concentrates - Long Tons	462,435 Tons	475,338 Tons
Number of Days Operated	279	241
Number of Shifts Operated	808	715
Average Daily Production - Concentrates	1657	1972
Average Production Per Shift	572	665
Tons Concentrate per man per day	20.44	24.87
Average Wages Per Man Per Day	$ 23.83	$ 25.82
Average Job Class	10.7	10.5
Total Amt. Paid for Labor (Production)	$538,385.90	$485,018.83
Labor Cost Per Ton of Concentrate	$1.164	$1.020

5. GENERAL SURFACE:

a. Buildings and Repairs:

A steel frame structure was erected in December by the shop steel crew on the south side of the primary crusher building to support a new dust collector and fan. At the same time, miscellaneous repairs were made to the roof and walls of this building by the steel crew.

Kielinen & Son completed construction in February of the extension of "E" line retaining wall on the north side of the mill.

Miscellaneous repair and maintenance jobs consisted of repairs to the shop building roof by Pellow and Son, painting of flashing on the shop building and painting of wooden doors in the mill.

The body from an old box car was purchased from L. S. & I. R.R. and installed southwest of the Driox unit for storing ammonium nitrate.

b. Roads and Grading:

The north footwall pit haulage road was extended westerly across the ore body on a -8% slope from the 1600' bench at 2100 N. 1630 E. to the 1560' bench.

Stripping rock was hauled to the proposed stocking area southeast of the loading pocket to extend the fill for a length of 450' and a width of 130'. A total of 61,800 cu. yds. of rock and earth were used for fill.

Other grading consisted of a 100' x 70' fill for the ammonium nitrate storage box car and a 225' x 40' fill for a manganese steel scrap storage area along the railroad track southwest of the Driox unit.

c. Water Supply:

Because of freezing damage, several lengths of fire line in the vicinity of the primary crusher were replaced.

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5. GENERAL SURFACE: (Cont'd.)

c. Water Supply: (Cont'd.)

Samples were taken at four points on a monthly basis to determine the solids content of water overflowing from the tailing dam system.

d. Tailing Disposal

The level of tailings at the point where the line discharges into the dam area was raised 5.1' during 1959.

Approximately 14,600 cu. yds. of rock and earth stripping was hauled to No. 9 dike to raise this dike seven feet, bringing the top elevation to 1538.5'. A new dike, designated as 9A, which is 200' long by 6' deep was built in a low area east of No. 9 dike with 2500 cu. yds. of stripping material. A section of the south dike road was raised and a fill was made which will accommodate an extension of the tailing line.

The cyclone tailing plant which is used to pump thickened tailings to No. 3 and 4 dikes was operated from mid May until the shutdown due to the strike.

e. Miscellaneous:

Approximately 1100' of fence was installed in the vicinity of the junction of the mine access road and old highway M-95 under R & M MI-16. This project was delayed by the strike but will be completed in the spring of 1960.

A used electric tugger was rebuilt and installed under the concentrate loading pocket to pull railroad cars through the pocket.

The No. 91 54-B shovel which was used for stockpile loading was returned to the Humboldt Mine in May and the old No. 100 Marion shovel was brought from Humboldt to Republic for the same service.

Makela Forest Products removed the merchantable timber from 14 acres of land on the south end of the pit.

During the year, 15 houses were moved from areas adjacent to the mining area by Schuette, Inc. In addition, tear-down agreements were made with three house owners and four houses were purchased for less than the moving cost. Eight houses were sold for salvage during the year.

6. OPEN PIT:

a. Stripping:

As shown in the summary under 6 b., all of the funds authorized were not expended during the year. This is attributed primarily to the strike.

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6. OPEN PIT: (Cont'd.)

a. Stripping: (Cont'd.)

The areas in which stripping was done are shown on the map attached to this report and are summarized in the following tabulations:

Rock -	1600 North Footwall	(1750 E., 2250 N.) - (1400 E., 2550 N.)	-	61,354 cu. yds.
	1560 Hangingwall	(1900 E., 1550 N.) - (2000 E., 1800 N.)	-	14,608 cu. yds.
		Total Rock	-	75,962 cu. yds.
Earth -	North end over orebody			17,782 cu. yds.
	North end footwall dragline	(2250 N., 1900 E.) - (2800 N., 1400 E.)	-	40,008 cu. yds.
	South end cleanup over orebody-dragline	(1100 N., 800 E.)		2,091 cu. yds.
	South end shovel for south access road	(600 N., 1200 E.) - (200 N., 450 E.)		6,420 cu. yds.
	1560 Hangingwall (old ramp)	(1600 N., 900 E.) - (1700 N., 1100 E.)		3,009 cu. yds.
		Total Earth	-	69,310 cu. yds.

Five large hole blasts were fired in rock during the year.

The following tabulation summarizes the stripping operations:

Month	Cu. Yds. Surface	Cu. Yds. Rock	Total Cu. Yds.	Yds. Per Man Days	Man Days	Before Depr'n Cost Per Yard
January	11917	10505	22422	77.99	287½	$ 0.629
February	4828	11275	16103	69.33	232¼	1.035
March	4046	15466	19512	86.24	226¼	0.798
April	1972	17468	19440	68.39	284¼	0.836
May	119	8228	8347	99.96	83½	0.457
June	11237	7766	19003	107.97	176	0.294
July	17391	2464	19855	108.63	184½	0.512
August	0	0	0	0	0	0
September	0	0	0	0	0	0
October	0	0	0	0	0	0
November	10490	2430	12920	55.99	230¾	1.000
December	7310	360	7670	42.61	185	1.080
Total 1959	69310	75962	145272	76.86	1890	0.712
Total 1958	115089	48753	163842	95.2	1721¾	0.572
Total 1957	179882	80725	260607	93.4	2789¼	0.498
Total 1956	361282	35480	396762	133.1	2981	0.474
Total 1955	165635	0	165635	154.4	1073	0.395

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6. OPEN PIT: (Cont'd.)

b. Stripping Expenditures:

E&A: MI-46:	Amount Authorized	Amount Expended	Amount Unexpended
Stripping	$ 175000.00	$ 103380.80	$ 71619.20
Depreciation	25300.00	15750.00	9550.00
Grand Total	$ 200300.00	$ 119130.80	$ 81169.20

Detail:

	Authorized			Expended		
	Cu. Yds.	Rate	Amount	Cu. Yds.	Rate	Amount
Earth	96000	$ 0.41	$ 39360.00	69310	$ 0.400	$ 27756.58
Rock	134200	1.01	135640.00	75962	0.996	75624.22
Total	230200	$ 0.76	$ 175000.00	145272	$ 0.712	$ 103380.80
Depreciation			25300.00			15750.00
TOTAL			$ 200300.00			$ 119130.80

c. Open Pit Mining:

The road to the 1560 bench was completed (Par. 5b.) and the faces were advanced north and south from this road, opening an area 120' by 340' on both sides of the road. This bench produced 365,639 tons or 37.3% of the crude ore mined during the year.

The 1600 north face advanced 200 feet to 2600 N. and produced 341,129 tons or 34.9% of the tonnage.

The 1600 South face produced 100,101 tons (10.2%) and moved 125' to the south.

One small blast of 22,136 tons was made on the 1640 north bench (2.3% of tonnage).

The remaining production of 149,900 tons came from 1560' clean-up (79,500 tons), pit stockpile (35,400 tons) and Air Trac blasts (33,364 tons).

The jet piercer produced 96.4% of the ore mined during the year. The remaining tonnage was produced with the 3" wagon drill.

Fourteen major field blasts were fired during the year. The continued use and improvement of the 4" submersible pump made it possible to increase the amount of prilled ammonium nitrate to 78.2% of the total explosives used. The remaining powder consisted of various sizes of EP 152 and the EP 158 (pellets).

In ore loading, one Marion 4161 shovel was normally used to load into two

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6. OPEN PIT: (Cont'd.)

c. Open Pit Mining: (Cont'd.)

or three 34-Ton Euclid trucks for haulage to the primary crusher. A dozer worked in conjunction with the loading operation. When blending of ore was required, the loading crew would switch from one shovel to the other in order to obtain the proper mix.

Summary of Pit Production:

	Year 1958	Year 1959
Crude from pit to crushing plant	1,006,120 tons	976,769 tons
Crude from stockpile to crushing plant	-0-	-0-
Total crude from pit to crushing plant	1,006,120 tons	976,869 tons
Waste rock, pit to dump - yards	-0-	-0-
Total Footage drilled jet piercing machine	33,882	28,384 ft.
Total Footage drilled wagon drills	20,158	13,111 ft.
Total Footage drilled Joy drilling machine	539	3,890 ft.
Total Footage drilled 6¾" Down-the-Hole Drill	369	-0-
Average Grade of crude ore, Iron	36.24%	37.88 %
Average Grade of crude ore, Silica	46.7 %	44.3 %
Cost Per Ton of Crude Ore	$ 0.494	$ 0.437

Summary of Powder Used

Type	Quantity	Unit Cost/100	Total Cost
EP 152	67,500 #	20.05	13,533.34
EP 158 (Tyrox)	25,200 #	20.72	5,222.24
EP 146	850 #	19.63	166.88
Herco Prills	354,550 #	3.89	13,804.54
M.S. 17 Connectors	600 Pcs.	50.50	303.00
Wirebound Primacord	48,300 Ft.	4.76	2,301.16
Regular Primacord	59,200 Ft.	3.33	1,973.98
XC 45 Boosters	2,384 Pcs.	55.00	1,311.00
Total			38,616.14

Material broken (Ore & Rock) 952,117 Tons

Powder Cost per Ton of Material Broken 0.041

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6. OPEN PIT: (Cont'd.)

c. Open Pit Mining: (Cont'd.)

Summary of Jet Drill Holes Blasted:

Date	No. of Holes	Average Depth	Average Spacing	Powder Factor *	Gross Tons Ore	Cu. Yds. Rock
1 - 8	43	44.2	18.0 x 17.9	1.82	56,904	4,600
1 - 19	11	37.9	18.3 x 18.2	2.44	13,810	-
1 - 27	58	44.7	18.4 x 18.5	1.93	87,020	5,400
2 - 5	41	40.1	18.5 x 18.6	1.88	52,038	-
3 - 3	75	43.7	18.8 x 18.8	2.14	117,097	2,300
3 - 10	51	35.3	17.5 x 17.5	2.23	63,395	-
4 - 2	34	44.5	18.7 x 18.6	2.16	56,706	-
4 - 28	41	43.6	17.9 x 18.1	1.97	59,478	-
5 - 19	35	44.2	19.4 x 19.4	2.23	58,108	4,800
5 - 26	50	44.7	18.7 x 18.8	2.24	84,424	-
6 - 2	42	25.0	15.7 x 15.8	1.85	22,136	-
11- 13	11	42.1	18.5 x 29.3	2.69	22,000	-
11- 30	41	35.8	16.7 x 17.3	1.72	40,623	-
12- 14	63	43.9	18.2 x 18.2	2.21	73,266	-
Total	596			2.15	807,005	17,100

* Tons of material broken per pound of powder used.

Summary of Joy Drill Holes Blasted:

1 - 19	21	45.0	18.0 x 18.0		10,360
2 - 19	33	25.0	17.8 x 17.8		9,800
3 - 24	18	42.9	19.9 x 19.9		11,400
4 - 14	22	41.5	17.2 x 17.2		10,100
5 - 14	12	43.2	18.7 x 18.7		7,200
	106				48,860
					17,100
Total - Rock					65,960

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6. OPEN PIT: (Cont'd.)

c. Open Pit Mining: (Cont'd.)

Summary of Footages Drilled

Month	Jet Piercing	Joy Drilling	Wagon Drilling	Down-the-Hole
January	4968	1259	1925	
February	5186	587	300	
March	3729	1021	3305	
April	2904	1023	1710	
May	2463		2891	
June	4809		2580	
July	-			
August	-			
September	-			
October	-			
November	-		210	
December	4325		190	
Total 1959	28384	3890	13111	
Total 1958	33882	539	20158	369
Total 1957	22021	-	29176	-
Total 1956	15390	1731	22052	-

6. OPEN PIT: (Cont'd.)

c. Open Pit Mining: (Cont'd.)

Summary of Jet Piercer Operating Costs

Month	Oxygen	Fuel Oil	Misc. Optg. Supplies	Maint. Supplies	Royalty	Maint. Labor	Optg. Labor	Total Cost	Feet Drilled	Cost Per Ft.
January	9157.64	1898.92	380.96	4651.23	1752.10	2178.99	2042.89	22062.73	4968	4.441
February	9794.15	2091.11	1338.22	1988.71	2064.31	2064.67	2161.78	21502.95	5186	4.146
March	8187.86	1812.50	490.91	2070.11	1517.06	1997.35	2074.82	18150.61	3729	4.869
April	7147.31	1482.08	393.42	2799.84	1291.41	1949.57	1835.60	16899.23	2904	5.819
May	6491.90	889.98	432.38	3734.82	1103.36	1580.45	1619.23	15852.12	2463	6.436
June	9472.22	1091.53	350.97	2316.22	1892.85	1930.76	2420.15	19474.70	4809	4.050
July	-	-	17.50	60.74	-	401.59	2.73	482.56	-	-
August	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-
November	-	-	-	5.82	-	118.54	-	124.36	-	-
December	9667.94	1591.55	310.79	1732.34	1899.20	1895.33	2159.62	19256.77	4325	4.452
Year--1959	59919.02	10857.67	3715.15	19359.83	11520.29	14117.25	14316.82	133806.03	28384	4.714
Year--1958	81247.21	13177.49	5429.64	20908.46	15023.94	23853.64	19284.97	178925.35	33882	5.281
Year--1957	49259.96	7916.78	2278.65	13220.35	10832.97	10915.51	14401.04	108825.26	22021	4.942

	Year 1958	Year 1959
Total Drilled Footage Jet Drilled Holes	33,882	28,384
Cost Per Foot of Drilled Footage	5.281	4.714
Total Tons Drilled Ore and Waste	1,061,667	1,006,496
Total Cost Per Tons Ore Drilled	0.169	0.133
Hours Jet Operated	3915.0	3216

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7. PLANT:

a. General:

The performance of both the crushing and concentrating plants was generally very good through the year. Repair projects were of a routine nature and delays due to breakdowns were maintained at a minimum. Operating time was 98.7% compared to 97.0% in 1958. Feed rates to the concentrator and concentrate production rate showed improvement over 1958.

The grade of concentrate at 63.36% iron and 8.35% silica, dry, with 6.07% moisture (Shipping Dept. figures) exceeded the guarantee in iron content by .26% and was below the guarantee in silica and moisture by .47% and .43% respectively. Weight recovery on a natural basis was 48.56% compared to the budget estimate of 48.0%. The requirement to limit collector additions to not more than 1.25 pounds per ton of crude ore continued to have an adverse effect on recovery with some of the ores treated.

Steel consumption and reagent consumption showed slight increases over the previous year. In the case of reagents, there was a reduction in cost of .023 per ton of crude ore over 1958 due to the use of a crude form of fatty acid and a general price decline in the cost of this commodity.

A number of changes were made in flowsheet and equipment which have contributed toward general improvement of the plant operation.

b. Production by Months:

Month	Tonnage	% Fe	% SiO_2	% H_2O
January	58029	63.46	8.35	6.51
February	51539	63.19	8.55	6.42
March	60773	63.29	8.54	6.23
April	54141	63.28	8.55	5.90
May	59155	63.15	8.63	5.76
June	59540	63.20	8.59	5.66
July	24989	63.60	7.98	5.59
August	-0-			
September	-0-			
October	-0-			
November	42841	63.50	7.80	6.02
December	64331	63.70	7.85	6.23
* Total - 1959	475338	63.36	8.35	6.04
Total - 1958	462435	63.38	8.19	6.73

Note: Tonnages not included in above production:

	Tons	% Fe	% SiO_2	% H_2O
Shipment to Pilot Plant	185	63.50	9.77	4.90
Shipment to Swindell-Dressler Corp.	51	63.30	8.38	4.90

7. PLANT (Cont'd.)

c. Metallurgical Balance:

Product	% Wt.	% Wt. Crude	% Fe	% Fe Unit Recovery	% Fe Unit Recovery (Flot. Circuit)
Concentrator					
Concentrate		47.02	63.43	78.76	
Tailing		52.98	15.18	21.24	
Head		100.00	37.88	100.00	
Unit One					
Concentrate	52.12	47.41	63.41	79.61	85.11
Flotation Tailing	47.88	43.55	12.08	13.93	14.89
		90.96	38.83	93.54	100.00
Slime Tailing		9.04	26.96	6.46	
Head		100.00	37.77	100.00	
Unit Two					
Concentrate	50.03	46.64	63.46	77.91	81.70
Flotation Tailing	49.97	46.59	14.23	17.45	18.30
	100.00	93.23	38.86	95.36	100.00
Slime Tailing		6.77	26.04	4.64	
Head		100.00	37.98	100.00	

The slight difference in iron analysis between the yearly production shown under "2. d. and 7. b." compared to the metallurgical balance is due to the difference in method of weighting analyses used by the shipping department and mill office.