

OHIO MINE
ANNUAL REPORT
YEAR 1956

1. INTRODUCTION:

The winter stripping program was terminated January 13, 1956.

The Ohio Mine was inactive until May 1st when dewatering of the West Pit commenced. By May 15th the water level had dropped sufficiently to allow churn drilling of blast holes on some of the higher benches.

On May 14th repair crews were organized to begin plant repairs.

Additional manpower was recalled on May 24th to provide crews for the loading and shipping of Ohio Mine heavy media rejects to the Eagle Mills Agglomerating plant for stockpile sollar. Earth stripping east of the developed portion of the West Pit was started on May 28th on a 2 shift basis.

On completion of the season's production at the Tilden Mine the last of the Ohio personnel was recalled for starting the production of Ohio Mine concentrates on June 19th. Stripping of surface material and hanging wall rock was carried on in conjunction with production of crude ore.

The Ohio Mine was idle from June 30th to August 7th due to a national steel strike.

Production of concentrates was terminated on October 26th at which time a 3 shift, 5 day week stripping program was scheduled.

Stockpile leading began on October 27th and shipments of Ohio concentrates were completed on November 14th.

Stripping of earth and hanging wall rock continued through December 31st. Earth was removed from an area east of the developed portion of the West Pit whereas hanging wall rock was taken from the developed portion of the West Pit.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. <u>Operating Schedule</u>	<u>No. of Days</u>	<u>Shifts Per Day</u>	<u>Hours Per Shift</u>	<u>Total Shifts</u>
Pit Operating	68	1, 2 & 3	8	109
Mill Operating	72	1, 2 & 3	8	194

b. Pit:

	<u>Tons</u>
Ohio-Norwood Crude Ore - Pit to Surge Pile	202,647
Beaufort Crude Ore - Pit to Surge Pile	<u>23,352</u>
Total Crude Ore - Pit to Surge Pile	225,999

Average Total Crude Ore Per Day	3,323
Average Total Crude Ore Per Shift	2,073
Average Total Crude Ore Per Man Day	50.38

c. Mill:

Crude Ore - Surge Pile to Mill	225,999
Ohio-Norwood Concentrates - Produced	111,951
Beaufort Concentrates - Produced	<u>10,450</u>
Total Ohio Concentrates - Produced	122,401

Average Total Concentrates Per Day	1,700
Average Total Concentrates Per Shift	631
Average Total Concentrates Per Man Day	27.29
Percent of Recovery	52.08

d. Shipments: (Gross Tons)

	<u>From Pocket</u>	<u>From Stockpile</u>	<u>Total Year</u>	<u>Remaining Ore in Stock</u>
Beaufort Concentrates	10,450	-	10,450	-
Ohio-Norwood Concentrates	<u>88,794</u>	<u>23,157</u>	<u>111,951</u>	-
Total Concentrates	99,244	23,157	122,401	-

e. Stockpile: (Gross Tons)

	<u>Gross Tons</u>
In Stock January 1st	-
Placed in Stockpile	<u>23,157</u>
Total	<u>23,157</u>
Removed from Stockpile During Year	23,157
Stockpile Balance December 31st	-

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

f. Production by Months:

	<u>Crude Ore</u>	
	<u>Ohio-Norwood</u>	<u>Beaufort</u>
June	24,927	-
July	Strike	Strike
August	42,024	23,352
September	74,256	-
October	<u>61,440</u>	-
Total Tons	202,647	<u>23,352</u>

	<u>Concentrates</u>	
	June	15,709
July	Strike	Strike
August	20,995	10,450
September	38,606	-
October	31,934	-
	<u>4,707*</u>	-
Total Tons	111,951	<u>10,450</u>

*Stockpile Overrun

3. ANALYSIS:

a. Analysis of Pit Crude Ore:

	<u>Tons</u>	<u>Iron</u>
Ohio-Norwood	202,647	-
Beaufort	<u>23,352</u>	-
Total	225,999	43.68

b. Tonnage and Analysis of Concentrates Produced and Shipped:

Ohio Mine Concentrates

<u>From</u>	<u>To</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil</u>	<u>Sul</u>	<u>Moist</u>
Pkt.	Presque Isle	99,244	52.28	.209	7.26	.143	6.91
Stkp.	Presque Isle	23,157	52.07	.213	7.17	.135	6.21
Concentrates Out Put		122,401	52.28	.210	7.26	.151	6.78

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4. COST OF OPERATIONS:

a. Combined Operating and Budget Costs:

	<u>Actual</u>	<u>Budget</u>
<u>Total Ohio Mine:</u>		
Production - Concentrates (Tons)	122,401	85,000
- Crude Ore (Tons)	225,999	-
 <u>Cost of Production: (Cost Per Ton)</u>		
Pit Expense	\$0.646	\$0.709
Crushing and Screening	0.214	0.298
Milling Expense	0.348	0.570
Stocking Expense	0.006	0.014
General Mine Expense	0.369	0.498
Winter and Idle Expense	<u>0.591</u>	<u>0.633</u>
Cost of Production	<u>\$2.174</u>	<u>\$2.722</u>
 Taxes	 \$0.064	 \$0.220
Depletion - Original Cost	0.089	-
Depreciation	0.567	-
Amortization of Stripping	-	-
Shipping Expense	<u>0.068</u>	<u>0.076</u>
Total Cost at Mine	<u>\$2.962</u>	<u>\$3.018</u>

5. LABOR AND WAGES:

a. Comments

Labor relations between the Cleveland-Cliffs Iron Company and the Ohio Mine Union Local number 4681 remained very good throughout the year.

A strike was in effect from July 1st to August 6th. A \$0.075 general increase plus \$0.003 increment increase between job classes was effective August 6, 1956.

b. Report of Vacations Paid:

	<u>No.</u> <u>Men</u>	<u>Total</u> <u>Hours</u>	<u>Total</u> <u>Amount</u>	<u>Avg. Rate</u> <u>Per Hour</u>
One Week - 42 Hrs. - Vacation Paid	18	756	\$1,929.44	\$2.552
Two Week - 84 Hrs. - Vacation Paid	28	2,352	\$6,021.05	2.560

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5. LABOR AND WAGES: (Cont'd)c. Statement of Production and Wages: (Operating - Ore)

	<u>Year 1956</u>
Production - Concentrates	122,401
Number of Days Operated	72
Number of Shifts Operated	194
Average Daily Product (Tons)	1,700
Average Product Per Shift (Tons)	631
Average Number of Men Employed	47
Product Per Man Per Day	27.29
Average Wages Per Man Per Day	\$18.30
Total Amount Paid for Labor During Operating Season	\$113,990.14
Labor Cost Per Ton	\$0.777

(No E&A work was included in the above figures)

d. Annual Statement of Labor:

	<u>Stat.</u> <u>Men</u>	<u>Hours</u>	<u>Amount</u>	<u>Avg.</u> <u>Rate</u>
<u>Mine Payroll:</u>				
<u>Hourly Employees:</u>				
Straight Time	54 $\frac{3}{4}$	60316 $\frac{1}{2}$	\$136,909.01	\$2.270
Overtime	8 $\frac{1}{4}$	9251	10,627.75	1.149
Shift Differential - Aft.	16 $\frac{1}{4}$	17893 $\frac{1}{2}$	1,173.53	0.066
Shift Differential - Nite	10	10980 $\frac{1}{2}$	1,033.63	0.094
Holiday Allowance	1 $\frac{1}{2}$	1528	3,498.04	2.290
Worked - Premium Time Only	-	124	278.98	2.250
Sub Total	54 $\frac{3}{4}$	60136 $\frac{1}{2}$	153,521.94	2.545
Vacation Pay Accrual			8,538.19	
Sunday Premium	2 $\frac{1}{2}$	2792	656.44	0.235
Total Hourly Employees	54 $\frac{3}{4}$	60136 $\frac{1}{2}$	162,716.57	2.697
Average Job Class				9;1
<u>Salaried Employees:</u>				
Mine Payroll	2 $\frac{1}{2}$	2755 $\frac{1}{2}$	8,746.10	3.174
Total Mine Payroll	57 $\frac{1}{4}$	63072	171,462.67	2.719
<u>General Payroll:</u>				
Salaried: Straight Time	3	3191 $\frac{1}{2}$	8,365.85	2.621
Salaried: Overtime	-	180	187.41	1.041
Labor from Other Mines	8 $\frac{1}{4}$	9474	27,529.60	2.906
Grand Total Labor	68 $\frac{1}{2}$	75737 $\frac{1}{2}$	\$207,545.53	\$2.740
<u>Distributed as Follows:</u>				
Idle Expense	$\frac{1}{2}$	672 $\frac{1}{2}$	\$1,878.89	\$2.794
Operating Mine	32 $\frac{3}{4}$	35888	95,123.13	2.651
Winter and Idle	6 $\frac{3}{4}$	7522	16,988.12	2.258
Stripping	24	26437 $\frac{3}{4}$	81,508.85	3.083
Uncompleted Construction	1 $\frac{1}{2}$	484 $\frac{3}{4}$	1,209.48	2.496
Other Mines	3	3304 $\frac{1}{4}$	7,733.02	2.340
Other Accounts	1 $\frac{1}{4}$	1428 $\frac{3}{4}$	3,104.04	2.173
Grand Total As Above	68 $\frac{1}{2}$	75737 $\frac{1}{2}$	\$207,545.53	\$2.740

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5. LABOR AND WAGES: (Cont'd)

d. Annual Statement of Labor: (Cont'd)

Average Year	<u>Hourly</u> 44	<u>Salaried</u> 2	<u>Average Number of Men</u>		<u>Hourly</u> <u>Job Rate</u> 9.1
			<u>General</u> <u>Payroll</u> 2	<u>Total</u> 48	
	<u>Days Mine</u> <u>Operated</u>	<u>Tons Ore</u>	<u>Cu. Yds.</u> <u>Stripping</u>	<u>Units</u> <u>Per Man Day</u>	<u>Labor</u> <u>Cost Per Unit</u>
Pit Crude Ore	68	225,999		50.38	
Mill Concentrating	72	122,401		27.29	\$0.777
Stripping	149		359,755	108.85	0.227
Days Total Year	138				

6. OPEN PIT:

a. Stripping Operations:

<u>E&A Numbers</u>	<u>Rock</u> <u>Cubic Yards</u>	<u>Surface</u> <u>Cubic Yards</u>	<u>Total</u> <u>Cubic Yards</u>	<u>Amount Expended</u>
712 - 778 - 844	244,041	115,714	359,755	\$149,985.56 Rock 43,373.23 Surface
Cost Per Yard	\$0.615*	\$0.375*		

*Includes a depreciation rate of \$0.058 per cubic yard.

b. Cost Comments:

The cost per cubic yard of rock and earth stripping was within the estimated E&A cost per cubic yard.

Pit costs were greater in 1956 than the previous year. The additional cost was due to such factors as increased labor and supply costs, a deeper pit and the high maintenance cost of keeping the Ohio Euclid trucks on the road.

The installation of a new Pioneer heavy duty scalping screen effected an overall efficiency and a subsequent reduction in the overall milling costs.

c. Stripping:

Ohio-Norwood (West Pit)

Stripping continued throughout the year with the exception of the two periods from January 13th to May 28th and July 1st to August 6th. Hanging wall rock was removed in the developed portion of the West Pit down to an elevation of 1555. Earth stripping was done in the swamp area to the east of the developed portion of the West Pit.

Once pit operations were started dewatering pumps operated on a 24 hour, 7 day week schedule.

During the production season it was necessary to do stripping over the weekends to make crude ore available for the following weeks mill concentrate production.

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6. OPEN PIT: (Cont'd)

d. Open Pit Mining: (West Pit)

The ore season began on June 19th, mining in the Beaufort and Ohio-Norwood parcels. The 10,450 tons of Beaufort concentrates produced in 1956 was the last of the developed Beaufort reserves. The remainder of the production was taken from the Ohio-Norwood.

Mining of crude ore was done in an area extending 1,100 feet east of the western boundary of the Norwood parcel. Pit depth had reached an elevation of 1558.

7. BENEFICIATION:

a. Plant Operations:

Plant delays for the 1956 season represented 8.8% of the mill operating time.

Major sources of delay were due to cold weather, tunnel feeder repairs, media wash and drain screen repairs, pump repairs, power failures and conveyor breakdowns.

The 91.2% of operating time reflects the advantage of having an experienced crew in the mill from the start to the end of the production season. A program of preventative maintenance was also a large contributing factor to the high percent of operating time.

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7. BENEFICIATION: (Cont'd)

b. Plant Delays

<u>Source of Delay</u>	<u>Hours</u>	<u>% Total Delays</u>	<u>% 1636 Work Hours</u>
Startup and Shutdown of Plant	4.50	3.11	.27
Power Failures	10.33	7.14	.63
No. 7 Conveyor	7.25	5.01	.44
Stacker Conveyor	8.67	5.99	.53
No. 1 Conveyor	5.50	3.80	.34
Conveyors	9.99	6.90	.61
Magnetic Separators	2.42	1.67	.15
Chutes Plugging	2.42	1.67	.15
Drum Separator	2.00	1.38	.12
Tailing Pump	.50	.35	.03
Sump Pump	.25	.17	.02
Wash Water Pump	1.50	1.04	.09
Media Pump	1.00	.69	.06
Underflow Pump	13.70	9.47	.84
3 x 10 Screen	4.25	2.94	.26
Ripl-Flo Screen	18.00	12.44	1.10
Media Drain Screen	5.37	3.71	.32
Lo-Head Screen	.58	.40	.04
Building up Gravity	5.00	3.46	.31
Symons Crusher	6.09	4.21	.37
Tunnel Feeder	11.81	8.16	.72
Cold Weather	23.07	15.94	1.41
Hydroseparator	.50	.35	.03
Total	144.70	100.00	8.84

Operating Time 1956 Season - 91.16%

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7. BENEFICIATION: (Cont'd)

c. Surge Pile Balance

	<u>Tons</u>	<u>% Fe</u>	<u>% SiO2</u>
Crude Ore on Surge Pile June 1, 1956	None		
Crude Ore on Surge Pile from Pit during 1956 Season	225,999	43.68	
Crude Ore from Surge Pile to Plant during 1956 Season	225,999	43.68	
Crude Ore on Surge Pile November 1, 1956	None		
 <u>Concentrate Stockpile Balance</u>			
Concentrate Stocked during 1956 Season	23,157	52.07	7.17
Concentrate Shipped from Stockpile during 1956 Season	23,157	52.07	7.17
Stockpile Balance November 1, 1956	None		
 <u>Heavy Media Reject Pile Balance</u>			
H.M. Reject Pile 7:00 A.M. May 1, 1956	418,937	32.73	
H.M. Rejects to Pile during 1956 Season	67,544	29.88	
H.M. Reject Pile 7:00 A.M. December 1, 1956	486,481	32.33	
Less 9,600 tons used in Road Building	9,600		
12,120 tons shipped to Pelletizing Plant	12,120		
Balance	464,761		

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7. BENEFICIATION: (Cont'd)

d. Structure of Concentrates

<u>Size</u>	<u>% Wt.</u>	<u>Cuml. % Wt.</u>	<u>% Fe</u>	<u>% SiO₂</u>	<u>% Phos.</u>	<u>% Sul.</u>
+ 1"	24.20	24.20	51.69	9.33	.193	.097
+ 3/4"	20.70	44.90	51.43	8.64	.198	.065
+ 1/2"	13.00	57.90	52.89	6.13	.211	.107
+ 3/8"	10.95	68.85	54.07	5.66	.224	.214
+ 3 Mesh	6.46	75.31	55.07	5.18	.233	.129
+ 6 Mesh	7.56	82.87	52.43	5.44	.252	.187
+ 8 Mesh	2.54	85.41	49.47	9.90	.227	.241
+ 10 Mesh	1.92	87.33	47.60	10.77	.232	.245
+ 14 Mesh	1.96	89.29	46.65	10.96	.233	.195
+ 20 Mesh	2.05	91.34	46.63	10.89	.234	.209
+ 28 Mesh	1.88	93.22	47.59	10.03	.232	.215
+ 35 Mesh	1.42	94.64	49.37	8.85	.230	.244
+ 48 Mesh	1.57	96.21	50.34	8.96	.225	.240
+ 65 Mesh	1.02	97.23	49.48	9.76	.221	.234
+100 Mesh	1.15	98.38	50.50	9.64	.238	.245
-100 Mesh	1.62	100.00	53.56	8.55	.232	.293
Total	100.00	-	51.95	7.91	0.214	0.137

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8. GENERAL SURFACE:a. Buildings and Repairs:

(NONE)

b. Roads, Transmission Lines, Etc:

(NONE)

9. ESTIMATE OF ORE RESERVES:

	<u>Proven Plus Probable</u>	<u>Prospective</u>	<u>Total</u>
<u>Webster</u> Ore Reserves (Tons)	-	-	-
<u>Portland</u> Ore Reserves (Tons)	-	-	-
<u>Ohio-Norwood</u> Ore Reserves (Tons)	400,347	-	400,347
<u>Beaufort</u> Ore Reserves (Tons)	-	-	-
<u>Total Ohio Mine</u> Ore Reserves (Tons)	400,347	-	400,347

Developed Ore - Factors Used:

	<u>Cubic Feet Per Ton of Crude</u>	<u>Rock Deduction</u>
Beaufort Concentrates	15	-
Ohio-Norwood Concentrates	15	-

Estimated Analysis for 1957:

	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
Ohio-Norwood Conc. (Dried)	52.50	0.250	7.50	0.150	-
Ohio-Norwood Conc. (Natural)	48.83	0.230	6.98	0.140	7.00

10. EXPLORATION AND FUTURE EXPLORATION:

(NONE)

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11. TAXES:

a. Comparative Statement of Taxes for the Year 1956 and 1955:

SPURR TOWNSHIP, BARAGA COUNTY	1956		1955	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Ohio Mine, includes Webster, etc. Real	\$207,800	\$9,870.50	\$220,600	\$13,090.42
Ohio Mine Personal Property	76,000	3,610.00	195,000	11,571.30
Collection Fee		134.81		246.62
Total Spurr Township	<u>\$283,800</u>	<u>\$13,615.31</u>	<u>\$415,600</u>	<u>\$24,908.34</u>
Tax Rate		\$47.50		\$59.34

b. Detail of Valuation and Taxes:

	<u>1955</u>	<u>1956</u>	<u>Increase</u>	<u>Decrease</u>
Value	415,600	283,800	-	131,800
Taxes	24,908.34	13,615.31	-	11,293.03

12. ACCIDENT AND PERSONAL INJURY:

The Ohio Mine placed 7th in the annual open pit safety record based on the severity rating.

The one compensable accident was a stumbling injury with a subsequent loss of 25 days.

13. PROPOSED NEW CONSTRUCTION:

(NONE)

14. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT:

a. Equipment Received:

The Joy 60 blast hole drill (District Equipment) tested at the Humboldt Mine, Republic Mine and on the Minnesota Range was effectively used in drilling crude ore and rock blast holes at the Ohio.

The installation of the new heavy duty 4 x 10 Pioneer scalping screen reduced lost time in the primary crushing section considerably.

The purchase of a 1/2 ton pickup truck made for better service between the Ohio and the general offices and shops in Ishpeming.

b. Proposed New Equipment:

- 3 - 22 Ton Euclid Trucks
- 1 - Standby conveyor belt for #1 Conveyor
- 1 - 2 Ton Service Truck
- 1 - Portable Welder
- Pit Dewatering Pump

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1. GENERAL:

During 1956, the construction work under E&A MI-491 was completed and the mine went into production. The break-in of the plant was started in March with the first sustained crushing on March 1st. Feed was delivered to the first concentrator unit on the 12th and to the second unit on the 23rd. The first concentrate was filtered on March 13th.

Hennes Trucking Company completed their contract for the erection of machinery and miscellaneous steel in February. Cloverland Contracting Company also finished the work under their electrical and piping contract in February. Illinois Painting Company was awarded a contract for the painting of plant steel and piping which they started in February, finishing the inside work in March and returning in June to complete the outside work. Schuette Builders Company was awarded the contract for moving houses from the vicinity of the mine area to the new addition south of the Village of Republic. They started this work in June and by early September they had completed moving the 22 houses scheduled for the year. An additional ten houses were purchased of which nine had been torn down or removed by the former owners by the end of the year. The pumphouse at Milwaukee Lake and the first aid room in the shop building were completed in February by Pajula and Maki.

A five-day per week schedule was followed through the year. Stripping was done on a one, two and three-shift per day schedule, depending on the availability of men and equipment. Ore loading and crushing were on a single shift basis and the plant on a three-shift per day basis, except during the start-up period and during the regrinding of concentrates.

Production was stopped from July 1st to August 7th due to a strike by the United Steelworkers. Salaried personnel worked as watchmen, on area grading and on miscellaneous plant repair work during this period.

A failure of No. 4 tailing dam dike occurred on May 30th. The plant was down from this date to June 7th while repairs were being made. In addition to the repair work during June and August, the whole dike system was raised and reinforced.

After the pelletizing plant started up, it was found that the concentrates as normally produced were too coarse for effective balling. In order to produce a concentrate of sufficient fineness, production was discontinued at the Republic Mine on November 20th and for the remainder of the year the grinding circuit was used for regrinding stockpiled concentrates which were dewatered and shipped to Eagle Mills, according to the daily requirements.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Operating Schedule:

	<u>No. of Days</u>	<u>Shifts Per Day</u>	<u>Hours Per Shift</u>	<u>Total Shifts</u>
Mining	133	1 & 2	8	159
Hauling & Crushing	133	1 & 2	8	159
Mill Operating	138	1, 2 & 3	8	384

b. Production by months:

<u>Month</u>	<u>Tons of Crude</u>		<u>Tons of Concentrates</u>
	<u>Crushed</u>	<u>Milled</u>	
March			
April	41155	40279	20917
May	69786	66558	36691
June	47266	50308	28300
July	-	743	371
August	63495	59074	32794
September	61912	62170	36065
October	78000	77133	41733
November	33571	38920	20295
December	-	-	-
Year	<u>395185</u>	<u>395185</u>	<u>217166</u>

c. Production Averages:

Average Crude Ore Per Day	2971 Tons
Average Concentrates Per Day	1574 Tons
Tons Per Man Per Day - Crude Ore	33.15 Tons
Tons Per Man Per Day - Concentrate	18.22 Tons
Average Weight Recovery	54.95 %

d. Tonnage and Analysis of Concentrate Produced and Shipped:

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
On Hand Dec. 31, 1955	0	-	-	-	-	-
Produced Year 1956	217166	63.27	.038	8.03	.006	5.32
Pocket to Pellet Plant	49428	63.35	.037	7.99	.006	5.60
Stockpile to Pellet Plt.	33611	64.46	.043	6.49	.006	7.53
On Hand Dec. 31, 1956	134127	63.24	.039	8.10	.006	5.26

e. Estimated Production and Analysis:

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
Dried	454900	63.10	.028	8.82	.013	-
Natural	454900	59.00	.026	8.25	.012	6.50

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2. PRODUCTION, SHIPMENTS AND INVENTORIES (CONT'D.)

f. Stockpile Regrind:

	<u>Year 1956</u>	<u>End of Regrind Jan. 5, 1957</u>
Stockpile Regrind Produced	29811 tons	33642
Loss	<u>2100 tons</u>	<u>2115</u>
Feed to Mill	31911 tons	35757
Ending Inventory in Bins	<u>3237 tons</u>	<u>-0-</u>
	35148 tons	35757

Operating Schedule:

	<u>No. of Days</u>	<u>Shifts Per Day</u>	<u>Hours Per Shift</u>	<u>Total Shifts</u>
Hauling & Crushing	21	1	8	21
Mill Operating	27	1, 2 & 3	8	51

Production Averages

Average Stockpile to crusher per day	1674
Average Conc. Produced	1574
Tons Per Man Per Day from Stockpile	28.74
Tons per Man Per Day Produced	24.37

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3. ESTIMATE OF ORE RESERVES:

a. Estimated Reserves:

Using a conversion factor of 15 cubic feet per ton.

		<u>Total Crude</u>	<u>Total Concentrates</u>
Proven Ore	(1500 Elevation	19,421,541	9,710,770
	(1400 Elevation	21,252,106	10,626,053
	(1300 Elevation	22,012,163	11,006,081
	(1200 Elevation	22,417,859	11,208,930
	(1100 Elevation	19,439,582	9,719,791
	Total	<u>104,543,251</u>	<u>52,271,625</u>

Using 50% recovery for concentrateable material.

	<u>STRIPPING</u>		
	<u>Cu. Yds. Surface</u>	<u>Cu. Yds. Rock</u>	<u>Cu. Yds. Total Equiv. Stripping</u>
1500 Elevation			
1400 Elevation	2,045,934	3,554,028	10,230,199
1300 Elevation	2,648,272	8,153,465	21,417,261
1200 Elevation	3,421,235	16,034,176	40,451,138
1100 Elevation	4,380,986	26,380,986	64,348,168
	Total	<u>54,122,655</u>	<u>136,446,766</u>

b. Estimated Analysis:

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

4. LABOR AND WAGES:

a. General:

The crew was increased from 42 men in January to 98 in July, which was the number of men required while on a production basis.

The United Steelworkers Union became the representative of the hourly rate employees following termination of the strike, which lasted from July 1st to August 7th.

One grievance was filed which was allowed in the second step.

A wage increase went into effect on August 8th which amounted to a general increase of 7.5¢ plus a .003 increment increase between job classes.

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4. LABOR AND WAGES: (CONT'D.)

b. Report of Men Hired, Transferred and Separated:

<u>Month</u>	<u>First of Month</u>	<u>Hires</u>	<u>Trans. Fr. Other Mines</u>	<u>Separated</u>	<u>Trans. to Other Mines</u>	<u>End of Month</u>
January	42	-	28	-	-	70
February	70	10	2	-	-	82
March	82	1	1	2	21	61
April	61	34	6	-	10	91
May	91	19	5	-	1	114
June	114	8	-	4	21	97
July	97	1	-	-	-	98
August	98	-	-	-	-	98
September	98	-	-	-	-	98
October	98	-	1	1	-	98
November	98	-	-	17	7	98
December	74	-	-	4	1	69
Totals	42	73	43	28	61	69

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

c. Report of Vacations Paid:

<u>Year</u>	<u>No. Men</u>	<u>Total Hours</u>	<u>Total Amount</u>	<u>Avg. Rate Per Hour</u>
1956	35	2080	\$ 5728.48	\$ 2.754

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4. LABOR AND WAGES: (CONT'D.)d. Annual Statement of Labor:

	<u>Stat.</u> <u>Men</u>	<u>Hours</u>	<u>Amount</u>	<u>Average</u> <u>Rate</u>
<u>Hourly Employees</u>				
Straight Time	73 $\frac{3}{4}$	151079 $\frac{1}{4}$	\$340585.72	2.254
Overtime	3 $\frac{3}{4}$	7661 $\frac{1}{4}$	8882.21	1.159
Sunday Premium Time	$\frac{1}{4}$	316	71.76	0.227
Shift Diff. - Aft.	18 $\frac{1}{4}$	37501 $\frac{1}{2}$	2293.13	0.061
Shift Diff. - Nite	9 $\frac{1}{4}$	18940 $\frac{1}{2}$	1725.07	0.091
Holiday Allowance	1 $\frac{1}{2}$	3060	7055.79	2.306
Vacation Pay	1	2080	5728.48	2.754
Total Hourly Employees	73 $\frac{3}{4}$	151079 $\frac{1}{4}$	366342.16	2.424
<u>Salaried Employees</u>				
Mine Payroll	5	10214 $\frac{3}{4}$	33318.46	3.262
Total Mine Payroll	78 $\frac{3}{4}$	161294	399660.62	2.477
<u>General Payroll</u>				
Salaried Straight Time	4 $\frac{1}{2}$	9399 $\frac{1}{2}$	23044.43	2.451
Overtime	-	153	263.16	1.720
Labor from other mines	8 $\frac{1}{2}$	17160 $\frac{1}{4}$	50707.03	2.954
Total Labor	91 $\frac{3}{4}$	187853 $\frac{3}{4}$	473675.24	2.521
<u>Distributed as Follows:</u>				
Operating Republic Mine	46 $\frac{1}{2}$	95356	232836.29	2.441
Stockpile Re grind	4 $\frac{3}{4}$	9783 $\frac{1}{2}$	26153.27	2.673
Idle Expense	1 $\frac{1}{4}$	2278 $\frac{3}{4}$	6363.20	2.793
Stripping	11 $\frac{3}{4}$	23845 $\frac{3}{4}$	65633.28	2.752
Uncompleted Construction	24 $\frac{1}{4}$	49559	125215.86	2.526
Other Mines	$\frac{1}{2}$	948	2879.43	3.037
Other Accounts	3	6083	14593.91	2.399
Total as Above	91 $\frac{3}{4}$	187853 $\frac{3}{4}$	473675.24	2.521

e. Labor Cost:

Production of Concentrates - Long Tons	217,166 Tons
Number of days operated	138 Tons
Number of Shifts Operated	384 Tons
Average daily Production - Concentrates	1,574 Tons
Average Production Per Shift	566 Tons
Tons Concentrate Per Man Per Day	18.22
Average Wages Per Man Per Day	20.17
Average Job Class	10.20
Total Amount Paid for Labor (Production)	232,836.29
Labor Cost Per Ton of Concentrate	1.072

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5. GENERAL SURFACE:

a. Roads & Grading

The haulage road extending from the primary crusher to the 1600' bench was extended westward to the hangingwall side and thence to the south to connect with the south pit road. A connection was made from the waste dump to the road leading to the stocking ground. Much of the stripping material was hauled along this road for grading the stocking area and to widen the railroad grade south of the loading pocket.

The parking area in front of the shop-office-dry building and part of the area between this building and the mill was surfaced with blacktop by Payne and Dolan in August. To prevent erosion of sloped areas in the same vicinity, some of these were sodded by Snowden Company in August.

b. Water Supply

A pump house was built by Pajula & Maki at Milwaukee Lake in which the pumps were installed by mine personnel. This system will be used as soon as return water starts flowing from the tailing dam to the lake.

c. Tailings Disposal

The following tabulation shows the amounts of fill placed on the tailing dam dikes by months:

<u>Month</u>	<u>Cu. Yds.</u>	
January	52,560	
May	3,840	
June	175,920	
August	44,100	
September	2,380)	Rock to
October	6,460)	toe
November	5,080)	3, 4 & 5

On May 30th, a 161 ft. section on the south end of No. 4 dike washed out. This occurred at the deepest section where the dike was over 40' deep with a top width averaging about 80 feet. There was 30' of water behind the dike at the time. Water in the river was raised several feet in the vicinity of the outlet of the tailing area but lower down on the river the rise was limited to six or seven inches. River water became discolored but no damage was reported to any property along the river. As a result of this failure, the entire dike system was raised three feet and the side slopes were built up to a one on four slope. In addition, the downstream side of dikes 2, 3, 4 and 5 was re-inforced with coarse pit rock to provide further stability.

The tailing line from the mill to the tailing dam was completed in February.

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5. GENERAL SURFACE (CONT'D.)

d. Miscellaneous

The Driox oxygen storage unit was installed by Linde in February and the distribution piping from this unit to the pit area was completed by mine personnel during the same month.

A powder magazine was built in a small clearing near the south gate.

6. OPEN PIT:

a. Stripping:

The stripping program for the year consisted of removing overburden from the site of the ore body both to the north and south of the present haul road and the removal of rock and overburden necessary to start the 1560' bench on the hangingwall side.

The work on the hangingwall side of the pit consisted of stripping from the 1560' ground contour easterly into the hangingwall contact, removing any rock or earth that was encountered. This was done from 1000 north to 2300 north with the exception of a 100 foot section which was left for an access road.

The following tabulation summarizes the stripping operations:

<u>Month</u>	<u>Cu. Yds Surface</u>	<u>Cu. Yds Rock</u>	<u>Total Cu. Yds.</u>	<u>Yards Per Man Day</u>	<u>Man Days</u>	<u>Cost Per Yd.</u>
January	40622	-	40622	171.40	237	0.279
February	53482	1540	60022	109.73	547	0.462
March	1598	3580	5178	21.35	245	7.403
April	19920	5700	25620	137.00	187	0.495
May	21140	-	21140	111.26	190	0.687
June	-	120	120	60.00	20	-
July	-	-	-	-	-	-
August	17220	3400	20620	151.62	136	0.399
September	31200	7000	38200	116.46	328	0.015
October	29720	9060	38780	173.90	223	0.485
November	53640	5080	58720	146.80	400	0.447
December	87740	-	87740	187.48	468	0.283
Total 1956	361282	35480	396762	133.10	2981	0.474
Total 1955	165635	-	165635	154.37	1073	0.395
Total to Date	526917	35480	562397	138.73	4054	0.451

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6. OPEN PIT (CONTINUED)

b. Stripping Expenditures:

<u>E&A No.</u>	<u>Amount</u> <u>Authorized</u>	<u>Amount</u> <u>Expended</u>	<u>Amount</u> <u>Unexpended</u>
CC & MI-767	\$ 202,000.00	\$ 188,038.59	\$ 13,961.41
<u>Detail:</u>	<u>Cu. Yds.</u>	<u>Rate</u>	<u>Amount</u>
Earth	361,282	\$ 0.390	\$ 140,899.98
Rock	35,480	1.328	47,138.61
Total	396,762	\$ 0.474	\$ 188,038.59

c. Open Pit Mining:

The crude ore mined during the year was obtained from the 1600' bench between coordinates 1300' north and 1800' north.

A road was first developed from the footwall westerly to the correct elevation, and then the pit enlarged to the north and south. Faces were then mined both northeast and southeast on either side of the access road.

The early part of the year a road was built to the 1600' bench. This was done with a 3½" wagon drill and the ore removed was stockpiled south of the primary crusher.

The major portion of the drilling started in March with the jet piercing machine developing the larger portion of the tonnage and the wagon drill working in conjunction with it, removing large toes and inaccessible knobs. Some experimental drilling was also done with the Joy 60-BH rotary drill.

Fourteen major field blasts were fired during the year with the primary powder being EP152. The EP158 (pellets) and EP197B (Ammonia Nitrate) was used in accordance with the existing water conditions.

The Marion 4161 - 5 cu. yd. shovel was used for loading the ore into three 34-Ton Euclid end dump trucks for transportation to the primary crusher.

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6. OPEN PIT (CONT'D.)

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

Summary of Pit Production:

Crude from Pit to Crushing Plant		395,185 Tons
Crude from Stockpile to Crushing Plant		<u> -</u> Tons
Total Crude from Pit to Crushing Plant		395,185 Tons
Waste rock, pit to dump - yards		- Tons
Total footage drilled - Jet Piercing Machine		15,390 Ft.
Total footage drilled - wagon drills		22,052 Ft.
Average grade of crude ore	39.97% Iron	- 42.00% Silica
Cost per tons of crude ore	\$ 0.645	

WORK SCHEDULE:

Wagon Drilling	2 Shifts per day - 5 days per week
Jet Drilling	2 Shifts per day - 5 days per week
Crude Ore Hauling	1 Shift per day - 5 days per week

Summary of Powder Used:

Primary Blasting, Jet Pierced Holes & Joy Holes:

<u>Type</u>	<u>Unit Cost</u>	<u>Lbs. Used</u>	<u>Total Cost</u>
EP152	\$ 18.08	127,130	\$ 22,985.10
EP158	18.75	57,050	10,696.88
EP194	12.00	1,400	168.00
EP197B	8.83	28,050	2,476.20
AN188	3.66	30,600	1,119.96
M.S. Connectors	45.50 C	370	168.35
Plastic Primacord	36.50 M	30,000	1,095.00
Regular Primacord	32.00 M	17,500	560.00
XC45 Boosters	50.00 C	1,050	525.00
			<u>\$ 39,794.49</u>

Cost per ton of material broken \$.082

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6. OPEN PIT (CONT'D.)c. Open Pit Mining (Cont'd.)Summary of Jet Drill Holes Blasted:

<u>Date</u>	<u>No. of Holes</u>	<u>Average Depth</u>	<u>Average Spacing</u>	<u>Powder Factor *</u>	<u>Gross Tons</u>	
					<u>Ore</u>	<u>Rock</u>
3-2	11	26.9	18.0 x 20.0	3.05	13938	-
3-20	16	28.0	20.0 x 20.0	3.13	17127	-
4-24	35	24.7	17.0 x 20.0	2.09	27792	-
5-4	23	49.0	19.0 x 21.0	1.50	31173	-
5-14	55	32.4	17.0 x 19.0	2.04	50923	-
6-15	32	28.0	16.5 x 19.0	2.18	23985	-
6-27	38	39.4	15.6 x 19.7	2.17	41987	-
8-13	54	29.2	16.5 x 19.5	2.02	46967	-
8-22	30	26.1	17.0 x 18.5	2.00	22898	-
9-13	48	40.5	17.0 x 18.0	2.00	62330	-
10-15	31	26.6	15.8 x 19.8	1.78	25000	-
10-22	34	32.4	17.2 x 18.2	1.92	35000	-
11-5	40	36.6	18.8 x 18.3	1.78	48000	-
11-12	11	46.1	19.2 x 19.5	2.00	19000	-
Total	448				456120	

Joy Holes:

3-2	11	26.9	16.9 x 21.0	3.05	12000
3-20	8	49.5	11.5 x 25.0	3.13	18000

Grand Total: Avg. 1.99 486120 Tons

* Note: Wagon drilling tonnage broken approximately 20,880 tons.
Powder Factor expressed as tons of crude or per pound of powder.

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6. OPEN PIT (CONT'D.)

c. Open Pit Mining (Cont'd.)

Summary of Footages Drilled

<u>Month</u>	<u>Jet Piercing</u>	<u>Wagon Drilling</u>	<u>Others</u>
January		2735	930 Joy
February	200	3201	801 Joy
March	957	3709	-
April	2237	1857	-
May	3511	1099	-
June	1146	-	-
July	-	-	-
August	2021	692	-
September	2437	2426	-
October	1676	3697	-
November	940	1166	-
December	265	1470	-
	<hr/>	<hr/>	<hr/>
Total	15390	22052	1731

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6. OPEN PIT (CONT'D.)

c. Open Pit Mining (Cont'd.)

Summary of Jet Piercer Operating Costs

Month	Oxygen	Fuel Oil	Reamer Shells	Kelly & Kelly Est.	Burner Assembly	Piping	Misc. Sup.	Maint. Sup.	Royalty	Maint. Labor	Total Optg. Labor	Total
January												
February											172.68	172.68
March	2007.84	330.93				20.29	262.63	243.62		19.44	918.42	3803.17
April	3534.14	685.54	200.00	300.00		46.79	610.61	1105.17		164.16	1376.54	8022.95
May	5213.82	1298.03	200.00	300.00		5.25	2278.86	1444.83		245.22	2169.96	13155.97
June	9117.95	842.06	200.00	300.00			801.25	391.45		771.02	757.01	13180.74
July	3370.68	293.39					169.21		3131.37			6964.65
August		719.30	200.00	300.00			251.04	1129.45	1019.23	973.30	1655.81	6248.13
September	6656.33	1027.40	200.00	300.00		43.72	323.96	1153.82	1351.13	1000.48	1488.54	13545.38
October	6609.08	705.02	200.00	300.00		24.20	264.28	1099.40	959.33	1386.09	1215.27	12762.67
November	6970.49	762.09	200.00	255.25			804.80	995.64	705.20	672.72	980.90	12347.09
December	3229.24	248.32	200.00	200.00			719.66	694.35	135.92	207.25	184.96	5819.70
Total	46709.57	6912.08	1600.00	2255.25		140.25	6486.30	8257.73	7302.18	5439.68	10920.09	96023.13

Total Drilled Footage Jet Drilled Holes 15,390
 Cost Per Foot of Drilled Footage 6.239
 Total Tons Blasted Ore and Waste 486,120
 Total Cost Per Ton Blasted Ore & Waste 0.198

Above costs relative to months in which charged out.

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7. PLANT

a. General:

Work by the various contractors involved in the plant construction was completed generally in February. Company personnel then followed through, completing and modifying various transfer points, wear areas and potential trouble spots from the primary crusher through to the tail race. Break-in of the plant was started in March with the first sustained crushing on March 1st. Feed was delivered to the first concentrator unit on the 12th and to the second unit on the 23rd. The first concentrate was filtered on March 13th.

The crushing plant operated on a single shift per day basis through the year. The concentrator was on a single shift basis from start-up time until April 12th at which time the second shift was added. On April 20th, operations went on a three-shift per day basis.

The start-up of the plant was relatively smooth because of a basically sound design, as well as the fact that experienced personnel was available for many of the critical jobs.

b. Production by Months:

<u>Month</u>	<u>Tonnage</u>	<u>% Fe</u>	<u>% P.</u>	<u>% SiO₂</u>	<u>% Sul.</u>	<u>% H₂O</u>
March						
April	20,917	63.77	.037	7.30	.007	5.30
May	36,691	62.99	.033	8.44	.005	5.30
June	28,300	63.27	.039	8.03	.005	5.14
July	371	63.27	.039	6.03	.005	5.14
August	32,794	63.03	.041	8.47	.010	5.12
September	36,065	63.44	.043	7.44	.005	4.97
October	41,733	63.00	.038	8.51	.007	5.52
November	20,295	63.90	.043	7.41	.007	6.19
December	-	-	-	-	-	-
Totals	217,166	63.27	.038	8.03	.066	5.32

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7. PLANT (CONT'D.)c. Metallurgical Balance:

<u>Product</u>	<u>% Wt.</u>	<u>% Wt. Crude</u>	<u>% Fe</u>	<u>% Fe Unit Recovery</u>	<u>% Fe Unit Recovery (Flot. Circuit)</u>
<u>Concentrator</u>					
Concentrate		55.58	63.38*	88.13	
Tailing		44.42	9.76	11.87	
Head		100.00	39.97	100.00	
<u>Unit One</u>					
Concentrate	58.97	56.96	63.20	90.00	92.42
Flotation Tailing	41.03	39.63	7.45	7.38	7.58
Flotation Feed	100.00	96.59	40.33	97.38	100.00
Sec. Cyclone O'Flow		3.41	30.74	2.62	
Head		100.00	40.00	100.00	
<u>Unit Two</u>					
Concentrate	57.70	55.86	63.85	89.33	91.67
Flotation Tailing	42.30	40.95	7.92	8.12	8.33
Flotation Feed	100.00	96.81	40.19	97.45	100.00
Sec. Cyclone O'Flow		3.19	31.83	2.55	
Head		100.00	39.93	100.00	

* The slight difference in iron analysis between the yearly production shown under 7 (b) and in metallurgical balance is due to difference in method of weighting analyses used by shipping department and mill.

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7. PLANT (CONT'D.)d. Hourly Operating Rates:

	<u>Tons</u>	<u>Gross Hours of Operation</u>	<u>Net Hours of Operation</u>	<u>LTPH (gross)</u>	<u>LTPH (net)</u>
<u>Feed to Primary Crusher</u> 1956	423081	1332.50	974.00	317.50	434.15
<u>Ore for Roads, Stockpile, Etc.</u> 1956	20613				
<u>Ore in Process</u>	None				
<u>Fine Ore Bin to Concentrator</u> 1956	402468	3312.72	3086.38	121.49	130.40
<u>Fine Ore Bin to Unit One</u> 1956	207232	3296.72	3001.56	62.86	69.04
<u>Fine Ore Bin to Unit Two</u> 1956	195236	3105.80	2830.33	62.86	69.72
<u>Concentrates</u> 1956	220689	3312.72	3086.38	66.62	71.50
<u>Operating Time - Concentrator</u> 1956		93.17%			
<u>Operating Time - Unit One</u> 1956		91.05%			
<u>Operating Time - Unit Two</u> 1956		91.13%			

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7. PLANT (CONT'D.)e. Monthly Hourly Operating Rates

	<u>Feed to Primary Crusher</u>	<u>Fine Ore Bin to Concentrator</u>	<u>Fine Ore Bin to Unit One</u>	<u>Fine Ore Bin to Unit Two</u>	<u>Concentrates</u>
<u>Long Tons Per Gross Hour</u>					
March	157.60	61.98	45.00	43.96	29.98
April	222.46	121.32	61.55	59.78	63.00
May	372.19	125.40	60.79	64.68	69.13
June	271.64	101.04	51.24	49.85	56.83
August	384.82	131.59	66.39	65.20	73.05
September	378.67	133.41	67.20	66.30	77.39
October	387.10	138.94	69.57	69.52	75.17
November	360.69	106.71	67.03	66.92	55.65
Year	317.50	121.49	62.86	62.86	66.62

Long Tons Per Net Hour

March	389.51	90.38	72.47	69.96	43.72
April	362.60	133.93	69.67	70.11	69.55
May	434.80	133.82	68.07	72.11	73.77
June	416.44	127.15	65.34	64.06	71.52
August	465.16	132.92	68.57	66.64	73.79
September	434.47	134.86	68.46	67.45	78.23
October	457.48	140.22	71.56	71.70	75.87
November	493.57	109.17	69.24	69.52	56.93
Year	434.15	130.40	69.04	69.72	71.50

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7. PLANT (CONT'D.)f. Concentrator Time Distribution

<u>Unit One</u>	<u>Hours</u>	<u>Percent of Delays</u>	<u>Percent of Total Working Hours</u>
<u>Operational</u>			
Starting & Stopping for weekend	64.47	21.84	1.95
Rod mill - loading up	9.35	3.17	0.28
Rod mill - charging	5.54	1.88	0.17
Ball mill - loading up	0.17	0.06	0.01
Hydroscillator - rakes loaded	1.81	0.61	0.05
Power Failures	4.88	1.65	0.15
Broken tailing dike	120.00	40.66	3.64
Water failure	2.50	0.85	0.08
Out of feed	4.33	1.47	0.13
Cleaning out fine ore bin for regrinding	6.08	2.05	0.18
	219.13	74.24	6.64
<u>Equipment</u>			
Break-in equipment	28.83	9.77	0.87
Rod mill	11.77	3.99	0.36
Hydroscillator	5.67	1.92	0.17
Thickener	16.89	5.72	0.51
Conveyor belts	2.67	0.90	0.08
Pumps	0.91	0.31	0.03
Chutes, feed boxes, etc.	2.54	0.86	0.08
Fresh water valve	5.75	1.95	0.18
Conveyoflo scale	0.66	0.22	0.02
Electrical - misc.	0.34	0.12	0.01
	76.03	25.76	2.31
<u>Total</u>	295.16	100.00	8.95

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7. PLANT (CONT'D.)f. Concentrator Time Distribution

<u>Unit Two</u>	<u>Hours</u>	<u>Percent of Delays</u>	<u>Percent of Total Working Hours</u>
<u>Operational</u>			
Starting & Stopping for weekend	61.17	22.21	1.97
Rod mill - loading up	11.20	4.07	0.36
Rod mill - charging	5.84	2.12	0.19
Ball mill - loading up	0.17	0.06	0.01
Hydroscillator - rakes loaded	3.42	1.24	0.12
Power failures	4.08	1.48	0.13
Broken tailing dike	120.00	43.56	3.86
Water failure	3.74	1.36	0.12
Cleaning out fine ore bin for regrinding	3.50	1.27	0.12
	213.78	77.61	6.88
<u>Equipment</u>			
Break-in equipment	3.91	1.42	0.13
Rod mill	17.73	6.44	0.57
Ball mill	10.42	3.78	0.34
Hydroscillator	4.26	1.55	0.14
Thickener	1.00	0.36	0.03
Conveyor belts	3.67	1.33	0.12
Pumps	7.33	2.66	0.24
Chutes, feed boxes, etc.	5.03	1.82	0.16
Fresh water valve	5.42	1.97	0.17
Electrical - misc.	2.92	1.06	0.09
	61.69	22.39	1.99
Total	275.47	100.00	8.87

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7. PLANT (CONT'D.)g. Monthly Rod, Ball & Reagent Consumption:

<u>Month</u> <u>Rods</u>	<u>Unit One</u>		<u>Unit Two</u>	
	<u>#</u>	<u>#/ton</u>	<u>#</u>	<u>#/ton</u>
March	6830	1.343	6830	3.107
April	21060	1.031	32159	1.620
May	49236	1.525	48097	1.403
June	37379	1.466	29362	1.183
August	43186	1.449	33583	1.147
September	63123	2.016	51513	1.670
October	50713	1.313	59118	1.535
November	36512	1.542	27624	1.813
Year	308039	1.486	288286	1.477

Balls

March	2860	0.562	-	-
April	24129	1.181	21448	1.081
May	34853	1.080	34853	1.016
June	37534	1.472	34853	1.405
August	37534	1.259	34853	1.191
September	42896	1.370	42896	1.390
October	45577	1.180	45577	1.184
November	26810	1.132	21448	1.407
Year	252193	1.217	235928	1.208

Fatty Acids

March	5679	1.117	2735	1.244
April	19492	0.954	21996	1.107
May	26455	0.820	33618	0.980
June	28122	1.103	31345	1.263
August	32180	1.080	38235	1.306
September	39134	1.250	45151	1.463
October	44861	1.161	56450	1.465
November	33277	1.405	17257	1.130
Year	229200	1.106	246787	1.264

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7. PLANT (CONT'D.)

h. Plant Testing (1)

Testing in the concentrating and crushing sections was not as extensive as in the initial phase at Humboldt. Many of the major problems were solved there, and the experience applied almost directly to Republic.

Structures were obtained throughout the crushing section to help determine proper crusher settings and screen sizes.

In August, 3½" rods were added to #1 rod mill (in place of 3") in an effort to improve feed rates. This size continued to be charged in #1 through November. The #2 rod mill was charged with 4" rods in October and November.

Data were gathered on the effect of varying the ECO adjustment on the hydroscillator. First the effect upon the overflow was studied and then the overall effect upon concentrate fineness and iron unit recovery.

Different apex valve openings were used in the 24" cyclones during the first months to find how much underflow could be settled satisfactorily by the densifier. The 6" cyclones' apex valves were allowed to wear open, allowing considerable slime to report to the flotation feed. No adverse effects were noted.

Tests were conducted on both flotation units to determine the merits of one-stage cleaning versus two-stage cleaning. The latter was the more efficient, although satisfactory results could be obtained with the one-stage. Later in the year, data were collected on the effects of weir and froth heights upon grade and separation in the different stages.

The Fagergren cells operated with little change from their initial settings. The recleaners were slowed down in August to increase the concentrate grade.

The Denver cells were slowed down in April and May to avoid overloading the motors and to improve their performance. The boards on the rougher cell lips were removed, making the cells much lower level. These changes brought about considerable improvement in recovery.

Short test runs were made adding caustic to various stages of the circuit, adding part of the total fatty acid to the ball mill, and substituting pine oil for MIBC.

A system of evaluating % iron in flotation tails by microscope was put into use. This supplements the use of the small Wilfley tables.

Nylon and polyethylene cloths were tested in comparison to saran for use on the drum filters.

R.L.C.

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7. PLANT (CONT'D.)

h. Plant Testing (Cont'd.)

In addition to the above, regular day-to-day control was in effect over all parts of the plant, data being collected on rates, specific gravities, steel and reagent consumptions, etc.

Plant Testing (2)

While on regrinding the power to reduce Republic concentrate to the desired fineness was calculated. This was projected to give data for additional mills to be installed at the pelletizing plant.

Considerable work was done on thickening and filtering to reduce losses during regrinding.

8. MAINTENANCE, REPAIR AND CHANGES:

a. Pit

Major repairs to the mining equipment consisted of the rewiring of the right swing motor on #101 Marion shovel. Three new hoisting ropes were installed on the #101 shovel.

The #85 Lima shovel required the replacement of the swing shaft, the center pintle, lower propel shaft and a new block for the diesel engine.

A new Kelly was installed on the Linde JPM-3 after the old kelly had been turned end for end.

The tractors required the routine replacement of track pads and link assemblies.

There were six engines and converters overhauled in the Euclid truck fleet.

New vanes and bearings were installed in the 600 gyroflow compressor.

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8. MAINTENANCE, REPAIR AND CHANGES:

b. Plant

The installation of new major equipment by plant personnel and the principal maintenance projects completed in the plant during the year are outlined by months in the following tabulation:

<u>Month</u>	
January - March	Install Rotoclone dust collector in secondary crusher building. Install two water pumps in river pump house. Install tailing line with plant connections. Increase throw and speed of Simplicity screens. Modify pulp distributors. Correct electrical troubles with primary and secondary crushers which caused crushers to stall under load. Straighten out tangle of No. 2 rod mill change. Apply linatex lining to grinding mill chutes and cyclone piping. Manufacturers representatives and service men called in to check their respective equipment before and during initial start-up.
April	Repair and modify automatic water valve in 20" water main. Install dust hooding. Repair and replace fine ore bin feeder belts and modify feeders.
May	Modify top deck of No. 1 screen and change dead bed ahead of screen. Install additional ball bin and reagent tank. Replace micarta bearing sheave on No. 2 ball mill.
June	Increase capacity of dust handling pump. Change mantle and concave in tertiary crusher.
July - August	Reduce speed of Fagergren recleaner flotation cells. Increase piping size from thickener underflow to pumps from 4" to 6". Change mantle and concave in secondary crusher. Weld cracked seams in fine ore bin.
September	Complete air control system for dropping cars at concentrate pocket. Experiment with powder cutting torch for removing worn manganese from crushers.

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8. MAINTENANCE, REPAIR AND CHANGES (CONT'D.)

b. Plant (Cont'd.)

September	Replace rotor tubes in Fagergren flotation cells. Complete installation of No. 3 pump in river pump house.
October	Replace eccentric bearing on No. 1 screen. Replace micarta sleeve bearing on No. 2 ball mill. Change mantle and concave in tertiary crusher. Complete installation and testing of reuse water pumps.
November - December	Install Olson heater in primary crusher building. Convert circuit for regrinding of stockpiled concentrate. Fabricate chutes for pelletizing plant.

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9. E & A's:

a. Construction and Stripping E & A's:

	<u>1956</u> <u>Expenditures</u>	<u>Total</u> <u>Expenditures</u>
CC-491: Opening & Equipping Republic Mine		
A. General Expense	63334.62	286626.62
B. General Surface	36626.68	201073.68
C. Shop, Office & Dry Building	12890.36	502037.36
D. Concentrator Plant		
a. Crushing Plant	88438.35	1606630.35
b. Concentrator Plant	180082.30	2356269.30
c. Stocking & Shipping	13065.99	127874.99
d. Reagent & Storage	5804.11	8030.11
E. Power Distribution	16030.12	134978.12
F. Pelletizing	-0-	19532.48
G. Mining Equipment	125619.47	717173.99
H. Water Supply	32180.53	170511.53
I. Tailings Disposal	18508.16	100028.16
J. House Moving, '55 Plat	29673.61	289112.61
Total E&A - CC & MI-491	622254.30	6519879.30
CC & MI-767: Stripping - Republic Mine - Year 1956	188038.59	188038.59
MI-1 - Moving Houses	90380.20	90380.20
MI-2 - Building Up Tailings Dam Dikes	56537.48	56537.48
MI-3 - Dipper for Marion Shovel	-0-	-0-
MI-4 - Trailer Tank for Pit	16573.01	16573.01
MI-6 - Preliminary Design	2827.41	2827.41
MI-7 - Oscillator Assembly	-0-	-0-
MI-8 - First Addition to Republic Townsite	17816.39	17816.39
MI-9 - Marion Electric Shovel	1182.23	1182.23
MI-11 - Stripping Republic Mine, Year 1957	-0-	-0-
MI-14 - Dragline Equipment	-0-	-0-
MI-15 - (One) 34-Ton Euclid	-0-	-0-
MI-16 - (Six) 34-Ton Euclids - Used	126000.00	126000.00
MI-13 - MOC Testing	16838.59	16838.59
Total	1138448.20	7036073.20

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10. COST PRODUCTIONa. Operating and Stockpile Regrind Costs:

	<u>1956</u> <u>Operating</u>	<u>1956</u> <u>Stockpile</u> <u>Regrind</u>
Pit Expense	1.173	.333
Crushing & Screening	.497	.195
Milling Expense	1.445	.777
Tailings Disposal	.091	.011
Stocking Expense	.073	.000
General Mine Expense	.500	.662
Telephones & Safety	.009	.008
Holiday	.021	.042
Vacation	.022	.034
Cost of Production	<u>3.831</u>	<u>2.062</u>
Shipping Expense	.026	.058
Total	<u>3.857</u>	<u>2.120</u>

b. Detail of 1956 Operating Costs:

	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Total</u> <u>Year</u>
Pit Expense	1.330	1.202	1.129	22.360	.819	.921	1.051	1.583	-	1.173
Cr. & Screen.	.480	.516	.460	3.140	.491	.468	.514	.506	-	.497
Milling Exp.	1.313	1.406	1.436	11.700	1.193	1.645	1.365	1.692	-	1.445
Tail. Disp.	.006	.037	.645	1.760	.000	.001	.002	.000	-	.091
Stock. Exp.	.055	.072	.087	.194	.079	.062	.092	.049	-	.073
Gen. Mine Exp.	.626	.506	.508	9.743	.420	.455	.479	.471	-	.500
Tel. & Safety	.007	.005	.005	.609	.004	.010	.007	.016	-	.009
Holiday	.000	.036	.000	.000	.001	.044	.000	.085	-	.021
Vacation	.000	.000	.027	.084	.028	.023	.020	.027	-	.022
Shipping Exp.	.000	.006	.017	.033	.003	.023	.063	.064	-	.026
Total Cost	<u>3.817</u>	<u>3.786</u>	<u>4.314</u>	<u>24.794</u>	<u>3.038</u>	<u>3.652</u>	<u>3.593</u>	<u>4.493</u>	<u>-</u>	<u>3.857</u>

c. Detail of 1956 Stockpile Regrind:

	<u>November</u>	<u>December</u>	<u>Total Year</u>
Pit Expense	.350	.325	.333
Crushing & Screening	.127	.224	.195
Milling Exp.	.568	.865	.777
Tailings Disposal	.000	.016	.011
Stocking Expense	.000	.000	.000
General Mine Exp.	.622	.679	.662
Tel. & Safety	.000	.011	.008
Holiday	.000	.059	.042
Vacation	.031	.036	.034
Shipping Exp.	.053	.060	.058
Total Cost	<u>1.751</u>	<u>2.275</u>	<u>2.120</u>

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11. TAXES:

<u>DESCRIPTION</u>	1956	
<u>REPUBLIC TOWNSHIP</u>	<u>VALUATION</u>	<u>TAXES</u>
REPUBLIC MINE, including stockpile, supplies & equipment as placed by State Mine Appraiser:		
Real Estate	935,000	23,375.00
Personal Property	205,000	5,125.00
		28,500.00
Collection Fee		285.00
Total Republic Mine	1,140,000	28,785.00
Part of NE $\frac{1}{4}$, Sec. 7, 46-29	200	5.00
Part of NE $\frac{1}{4}$, Sec. 7, 46-29	200	5.00
Gov't. Lot 6, Sec. 8, 46-29	300	7.50
SE $\frac{1}{4}$ of NE $\frac{1}{4}$, Sec. 18, 46-29 40.00A	200	5.00
Part of SE $\frac{1}{4}$ of NW $\frac{1}{4}$, Sec. 19, 46-29 10.00A	500	12.50
NE $\frac{1}{4}$ of SW $\frac{1}{4}$, Sec. 19, 46-29	800	20.00
SE $\frac{1}{4}$ of SW $\frac{1}{4}$, Sec. 19, 46-29 40.00A	600	15.00
Gov't. Lot 3 & Part Gov't. Lot 4, Sec. 19, 46-29 43.25A	625	15.63
SE $\frac{1}{4}$ of NW $\frac{1}{4}$, Sec. 20, 46-29 40.00A	175	4.38
REPUBLIC IRON CO'S 2ND ADDITION TO VILLAGE OF IRON CITY:		
Lot 88	500	12.50
Lot 89	725	18.13
Lot 100	700	17.50
Lot 102	700	17.50
Part of Lot 106	100	2.50
Parcel in NE $\frac{1}{4}$, Sec. 7, 46-29	200	5.00
PERSONAL PROPERTY:		
Parcel 475, Park City	300	7.50
Parcel 485, Park City	300	7.50
Parcel 450, Park City	550	13.75
		191.89
Collection Fee		1.92
	7,675	193.81
TOTAL REPUBLIC TOWNSHIP	1,147,675	28,978.81
Tax Rate		25.00
<u>HUMBOLDT TOWNSHIP</u>		
Parcel in SW $\frac{1}{4}$ of SW $\frac{1}{4}$, Sec. 9, 46-29 20.00A	250	5.00
W $\frac{1}{2}$ of NW $\frac{1}{4}$, Sec. 16, 46-29	1,000	20.00
SE $\frac{1}{4}$ of NW $\frac{1}{4}$, Sec. 16, 46-29	500	10.00
N $\frac{1}{2}$ of SW $\frac{1}{4}$, Sec. 16, 46-29	1,000	20.00
		55.00
Collection Fee		.55
TOTAL HUMBOLDT TOWNSHIP	2,750	55.55
Tax Rate		20.00

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12. ACCIDENTS AND PERSONAL INJURY:

<u>Name</u>	<u>Date of Injury</u>	<u>Nature of Injury</u>	<u>Days Lost</u>	<u>Compensation Paid</u>
Douglas Koski	5-25-56	Fractured finger	14	37.33
Walfred Beltonen	8-24-56	Laceration of finger	10	54.00
Kenneth Mattila	8-31-56	Cut in knee	10	38.50
Clyde Bath	4-23-56	Punchered toe	5	(Non-compensable)
		Total	<u>39</u>	
		Compensable Injuries	-	3
		Non-compensable 1 - 7 days	-	1
		Compensable days lost	-	34
		Days lost non-compensable	-	5

13. EXPLORATION:

No exploration work was done in 1956.

14. PROPOSED NEW CONSTRUCTION:

E&A MI-6 which covers preliminary design for plant expansion from the present 600,000 tons per year nominal capacity to 1,200,000 tons per year was approved during the year and the design and planning are currently under way. It is expected that before the end of the year, a major construction program will be initiated which will eventually include the addition of plant facilities for grinding, conversion of hematite to the magnetic form and concentration of ores to produce an additional 600,000 tons per year of MOC concentrates.

Other projects proposed for the year include the following:

- a. Construction of first addition to Republic townsite E&A MI-8.
- b. Moving of approximately 39 houses from the mining area to the new townsite.
- c. Extension of a power line to service the north end of the pit.

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15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT

a. Equipment received:

X-Cell Sander
Buffalo Floor Drill
Blount Bit Grinder
Pettibone-Mulliken Swing Loader
Michigan Loader
Brownhoist Mobilcrane and Dropball
Kohler Light Plant
3 - Welders
2 - Lincoln Welders
F.M. 16" Pomona Pump
Complete 66" Wemco Fagergren Flotation
Machine Mechanism
10" x 6" Rolls Crusher
4" x 6" Jaw Crusher
6 - Used 34-Ton Euclid Trucks
4" F.M. Centrifugal Pump, 7½ H.P.
Rumelin Dust Collector
Gardner-Denver Air Trac
Magna Auto Arc Welder
Rotary Positive Root-Connersville Blower
2 - Sturtevant Industrial Fans w/motor and drive
2 - 13A Denver-Wilfley Laboratory Concentrating
Tables
3 - #368W-A Non-tilting Platform Trucks
1 - 34W Warehouse Truck w/iron wheels
1 - Olson Oil Heater
IR Condensate Return Unit
JO-4 Hypressure Jenny
Ingersoll-Rand 1½" Pump
Snow-Wing
Dings 42" Belt Detector
FM Platform Scale
2 - Model E - Clarkson Reagent Feeders
2 - 11" Delta Drill Press
#577 Black & Decker Die Grinder
International 1956 Platform Truck
2 - Arcair Torches
F-201 Frosto Vaporizer
#S36 Blackhawk Rigid Pipe & Conduit Bender

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15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT (CONT'D.)

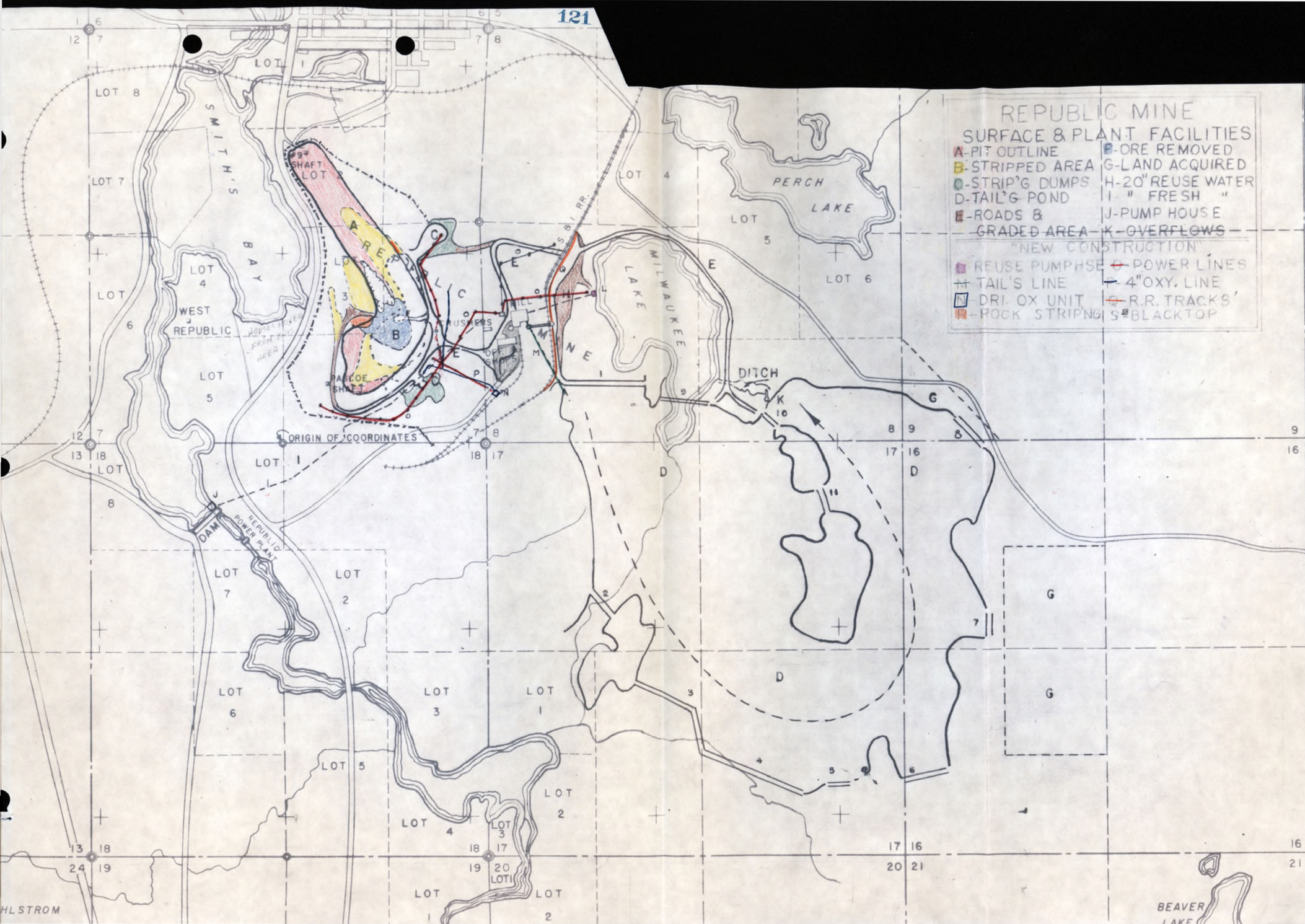
b. Proposed New Equipment:

- 1 - Pick-up Truck
- 1 - Service Truck
- 1 - Rotary type Drill
- 1 - Spare Main Shaft & Mantle for Tertiary
- 1 - Clam Shell Bucket for Mobil Crane
- 1 - CD Frame Hydroseal Pump
- 1 - Gilson Testing Screen
- 4 - Conditioners
- 1 - Spare Rake Mechanism for Hydroscillators
- 1 - DH-123 Drill (without carriage)
- 1 - Hydraulic Lift Tail Gate
- 1 - Dipper for Marion Shovel (MI-3)
- 1 - Oscillator Assembly for Hydroscillator (MI-7)
- 1 - Marion 4161 Electric Shovel (MI-9)
- 1 - Dragline Equipment for 54-B Shovel (MI-14)
- 1 - 34-Ton Euclid End Dump Truck (MI-15)

The equipment included in this list does not include items that are to be included in the major expansion E&A which is to be submitted later in the year.

REPUBLIC MINE SURFACE & PLANT FACILITIES

A- PIT OUTLINE	B- ORE REMOVED
B- STRIPPED AREA	G- LAND ACQUIRED
C- STRIP'G DUMPS	H- 20" REUSE WATER
D- TAIL'G POND	I- 1" FRESH "
E- ROADS &	J- PUMP HOUSE
--- GRADED AREA --- K- OVERFLOWS ---	
"NEW CONSTRUCTION"	
REUSE PUMPHOUSE	POWER LINES
TAIL'S LINE	4" OXY. LINE
DRI. OX UNIT	R.R. TRACKS
ROCK STRIPPING	BLACKTOP



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1. INTRODUCTION:

Operations at the Tilden were started with a blast hole drilling program starting March 5th. Primary drilling was accomplished through the use of three Bucyrus-Erie Model 29T churn drills using 9 inch bits.

Plant repairs were made just prior to the start of crushing operations on April 9th. April 9, 1956 represents the earliest starting date for the crushing operations since the 1930's.

Production of silica ore came from the West and East pits. The major portion of the silica ore came from the West Pit lower bench.

A small tonnage of low phos ore was produced from the Summit Pit.

Ore production was completed on June 8th. The 2 shift production crews were transferred to the Ohio Mine.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Ore Statement:

	<u>Tilden Silica</u>	<u>Tilden Low Phos</u>	<u>Total</u>
On Hand January 1, 1956	17,571	18,874	36,445
Output for Year	<u>162,329</u>	<u>24,020</u>	<u>186,349</u>
Total Shipments	<u>179,900</u> <u>140,401</u>	<u>42,894</u> <u>25,027</u>	<u>222,794</u> <u>165,428</u>
Balance on Hand December 31, 1956	<u>39,499</u>	<u>17,867</u>	<u>57,366</u>

b. Shipments: (Gross Tons)

	<u>Pocket</u>	<u>Stockpile</u>	<u>Total</u>
Tilden Silica	60,645	79,756	140,401
Tilden Low Phos.	<u>20,654</u>	<u>4,373</u>	<u>25,027</u>
Total	81,299	84,129	165,428

Note: Included in above shipments are 500 tons used for Cleveland-Cliffs Iron Company, inter-unit.

c. Comparison of Shipments - 9 Year Period: (1948-1956)

<u>Year</u>	<u>Tons Silica</u>	<u>Tons Low Phos</u>	<u>Total Year</u>
1948	78,641	43,750	122,391
1949	69,446	9,373	78,819
1950	91,510	23,926	115,436
1951	78,627	9,959	88,586
1952	64,590	15,859	80,449
1953	83,896	19,497	103,393
1954	77,781	-	77,781*
1955	101,437	-	101,437
1956	140,401	25,027	165,428

*Includes 20,838 tons of overrun on Tilden Silica.

d. Production Data:

	<u>Days Operated</u>	<u>Shifts Operated</u>	<u>Average Tonnage Per 8 Hour Shift</u>	<u>Total Tons</u>
Total Year	50	98	1,902	186,349

e. Production by Pits:

<u>Production</u>	<u>West Pit Lower Bench</u>	<u>West Pit Upper Bench</u>	<u>East Pit Lower Bench</u>	<u>Summit Pit</u>	<u>Total</u>
Season to Date	127,212	4,460	34,037	20,640	186,349

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3. ANALYSIS:a. Shipping Department Analysis:

Grade	From	To	Tons	Iron	Phos	Sil	Sul	Moist.
Til. Sil.		Stockpile	101,684	40.43	.038	40.44	.005	-
Til. Sil.	Pkt.	Presque Isle	60,387	41.25	.041	39.93	.005	3.81
Til. Sil.	Stkp.	Presque Isle	77,992	39.17	.032	42.74	.005	3.41
Til. Sil.	Pkt.	Edison Industries	124	41.92	.045	37.28	.005	2.54
Til. Sil.	Stkp.	Edison Industries	818	39.30	.045	42.86	.005	2.99
Til. Sil.	Stkp.	Inland Steel Co.	42	33.50	.041	50.84	.005	2.20
Til. Sil.	Pkt.	Perfect Seal Mfg.	134	36.20	.022	46.62	.005	2.70
Til. Sil.	Stkp.	Perfect Seal Mfg.	904	40.49	.060	40.90	.007	2.72
Silica Output			162,329	40.73	.040	40.59	.005	-
Low Phos		Stockpile	3,366	35.13	.017	48.52	.005	-
Low Phos	Pkt.	Presque Isle	20,654	35.21	.015	48.18	.005	1.75
Low Phos	Stkp.	Presque Isle	3,873	37.47	.021	45.18	.005	2.60
Low Phos	Stkp.	Research Lab	500	36.75	.014	45.54	.005	2.70
Low Phos Output			24,020	35.20	.015	48.20	.005	-

b. Composite Analysis of Shipments:

	Tons	Iron	Phos	Sil.	Mn.	Al.	Lime	Mg.	Sul.	Loss By Ig.	Moist
<u>Tilden Silica:</u>											
Dried	140,401	40.15	.034	41.65	.07	.67	.11	.15	.005	.20	3.58
<u>Low Phos</u>											
Dried	25,027	35.62	.016	47.64	.07	.74	.06	.10	.005	.17	1.88

c. Analysis of Ore Remaining in Stockpile: (Estimated)

Grade	Tons	Iron	Phos	Sil.	Sul.
Tilden Silica	39,499	40.35	.038	41.03	.006
Tilden Low Phos	17,867	36.09	.017	46.87	.010

4. LABOR AND WAGES:a. Comments:

The 1956 production was completed prior to the new wage agreement between the Cleveland-Cliffs Iron Company and the United Steelworkers of America (CIO) dated August 6, 1956.

b. Statement of Product:

	<u>Year 1956</u>
Production	186,349
Number of Days Operated	50
Number of Shifts Operated	98
Average Daily Product (Tons)	3,727
Average Product Per Shift (Tons)	1,902
Average Number of Men Employed	37
Product Per Man Per Day	82.32

Average Number of Men (Operating Only)

<u>Mine Payroll</u>		<u>Payroll</u>	<u>Total</u>
<u>Hourly</u>	<u>Salaried</u>		
35	1	1	37

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4. LABOR AND WAGES: (Cont'd)

c. Grievances:

The following grievance, made by Alex Leppala, was carried through step four and dropped by the Union:

"Failure to comply with Section VIII, Subsection 5. I took my vacation starting May 3 and I was paid for 40 hours at the rate of \$1.94. I am working at the Tilden as a temporary employee. I feel that I should have been paid at the rate of my last 2 pay periods at the Ohio Mine, or the average hours per work week during the ore production season of the preceding year which were worked by the mine at which the employee is employed whichever is the larger with a maximum of 48 hours.

5. OPEN PIT OPERATIONS:

a. Stripping:

Stripping was scheduled for the year 1956. However, due to the shortage of haulage equipment the program was delayed to 1957.

b. Open Pit Mining:

The 1956 production began on April 9th. Snow and freezing temperatures for the first two weeks kept production at a minimum for that period.

The Tilden silica grade was made by stockpile mixing of East and West pit ores. Approximately two thirds of the production came from the West Pit lower bench. This high percentage was necessary due to the lack of a second shovel to make partial pocket shipments from the East Pit area.

CHURN DRILLING

<u>Location</u>	<u>Shifts</u>	<u>Footage Drilled</u>	<u>Avg. Depth</u>	<u>Feet Per Shift</u>	<u>No. Holes</u>	<u>Bits Used</u>	<u>Feet Per Bit</u>
West Pit (L.B.)	141	2,084	65	14.8	33	172	12.1
West Pit (U.B.)	14	150	70	10.1	2	24	6.0
East Pit (L.B.)	39	520	68	13.2	10	58	8.0

TRUCK HAULAGE

<u>Location</u>	<u>Material</u>	<u>Loads</u>	<u>Shifts</u>	<u>Loads Per Shift</u>	<u>Type Truck</u>
Pit to Plant	Til. Sil.	2,861	34	81.8	22 Ton
Pit to Plant	Til. Sil.	3,011	50	60.2	22 Ton
Pit to Plant	Low Phos.	883	14	63.0	22 Ton
Pit to Plant	Til. Sil.	<u>1,222</u>	<u>14</u>	<u>87.3</u>	<u>22 Ton</u>
Total		7,977	112	71.2	22 Ton
Plant to Stockpile	Til. Sil.	837	11	76.1	22 Ton
Plant to Stockpile	Low Phos.	153	2	76.5	22 Ton
Plant to Stockpile	Til. Sil.	<u>1,236</u>	<u>14</u>	<u>88.3</u>	<u>22 Ton</u>
Total		2,226	27	82.4	22 Ton

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5. OPEN PIT OPERATIONS: (Cont'd)b. Open Pit Mining: (Cont'd)PRIMARY BLASTING

<u>Location</u>	<u>Date</u>	<u>No. of Holes</u>	<u>Tons Ore Broken</u>	<u>Tons Rock Broken</u>	<u>Tons Material Broken Per Lbs. of Powder</u>
West Pit (L.B.)	4-13-56	14	44,000	-	2.13
West Pit (L.B.)	5-1 -56	19	48,125	-	2.04
Summit Pit	5-4 -56	25	33,000	-	2.54
East Pit (L.B.)	5-10-56	<u>16</u>	<u>52,600</u>	-	<u>2.48</u>
Total		74	177,725	-	2.29

Primary blasting was calculated at one pound of powder for each yard of material in place. Two tons of ore per pound of powder produced effective fragmentation.

Total Powder Used:

24,350#	E.P. 152	@ \$17.90c	\$4,358.65
26,650#	188	@ 7.90c	2,105.35
35,500#	194	@ 11.50c	4,082.50
88	M.S. Connectors	@ 45.50c	40.04
207	Boosters	@ 50.00c	103.50
3,500'	Plain Primacord	@ 32.00M	112.00
7,400'	Plastic Primacord	@ 36.50M	<u>270.10</u>

Total Cost

\$11,072.14

Powder cost per ton material broken - \$0.062

6. ESTIMATE OF ORE RESERVES:a. Summary of Estimate of Ore Reserves:

	<u>Proven</u>	<u>Prospective</u>	<u>Total Tons</u>
Ore Reserves as of Jan. 1, 1956	4,317,749	2,735,500	7,053,249
Less 1956 Production	<u>186,349</u>	-	<u>186,349</u>
Ore Reserves as of Dec. 31, 1956	4,131,400	2,735,500	6,866,900

b. Expected Average Analysis of Ore Reserves:

	<u>Tons</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Sul.</u>	<u>Moist</u>
Tilden Proven	4,131,400	39.74	.028	43.51	.090	.009	2.50
Tilden Prospective	<u>2,735,500</u>	36.90	.026	42.90	.090	.009	2.50
Total	6,866,900						

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

c. Proven Ore: (Developed)

1. West Pit - Above Floor at 1430'

Tons

Assumption: 13 Cubic Feet Equals One Ton

Proven as of January 1, 1956	1,095,387
Mined during 1956	<u>131,672</u>
Total Remaining December 31, 1956	963,715

2. East Pit - Above Floor at 1440'

Assumption: 14 Cubic Feet Equals One Ton

Proven as of January 1, 1956	2,888,611
Mined during 1956	<u>34,037</u>
Total Remaining December 31, 1956	2,854,574

3. Summit Pit - Above Floor at 1620'

Assumption: 14 Cubic Feet Equals One Ton

Proven as of January 1, 1956	333,751
Mined during 1956	<u>20,640</u>
Total Remaining December 31, 1956	313,111

4. Total Proven Ore as of December 31, 1956:

West Pit	963,715
East Pit	2,854,574
Summit Pit	<u>313,111</u>
Total All Pits	4,131,400

d. Total Prospective Ore:

1. West Pit:

Balance remaining to be stripped in east half of Upper Bench	500,000
--	---------

2. East and Summit Pits:

Total above 1500' lying north and east of the East Pit	<u>2,235,500</u>
--	------------------

Total Prospective Ore as of December 31, 1956	2,735,500
---	-----------

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6. ESTIMATE OF ORE RESERVES: (Cont'd)e. Guaranteed Grade 1956:

<u>Grade</u>	<u>Iron</u>	<u>Phos</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag</u>	<u>Sul</u>	<u>Loss</u>	<u>Moist</u>
<u>Tilden Silica</u>										
Dried	39.00	.040	42.30	.07	.69	.25	.20	.010	.35	
Natural	38.30	.040	41.54	.07	.68	.25	.20	.010	.34	1.80
<u>Tilden Low Phos</u>										
Dried	36.00	.015	46.90	.07	.66	.20	.20	.010	.30	
Natural	35.50	.015	46.24	.07	.65	.20	.20	.010	.30	1.40

7. TAXES:

<u>Description</u>	<u>1956</u>		<u>1955</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
<u>Tilden Mine:</u>				
N $\frac{1}{2}$ of Sec. 26, 47-27, 320A	\$75,000	\$1,961.26	\$130,000	\$2,854.80
Personal Property, Equipment and Supplies	<u>140,000</u>	<u>3,661.00</u>	<u>85,000</u>	<u>1,867.60</u>
Total Tilden Mine		5,622.26		4,722.40
Collection Fee		<u>56.22</u>		<u>47.22</u>
Total Tilden Mine	\$215,000	\$5,678.48	\$215,000	\$4,769.62

8. PERSONAL INJURY:

The Tilden employees finished the year with a perfect safety record. There were no compensable or lost time accidents.

9. PROPOSED NEW CONSTRUCTION:

(NONE)

10. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT:a. Equipment Received:

(NONE)

b. Proposed New Equipment:

- 1 - Electric Shovel (Model 54-B, Bucyrus-Erie)
- 1 - Pick-up Truck
- 1 - D-8 Caterpillar Tractor
Conveyor to Pocket Revision
- 1 - Air Trac Drill and Compressor.
Dust Collection Changes

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11. GENERAL SURFACE:

a. Buildings and Repairs:

(NONE)

b. Roads, Transmission Lines, Etc:

(NONE)

c. Stocking Area:

Additional work on the increased stocking area for the Tilden silica grade was delayed to 1957.

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COST OF OPERATIONS:Cost of Production 1956:

	<u>Tons</u>	
Production	186,349	
<u>PIT OPERATING:</u>	<u>Amount</u>	<u>Rate</u>
Primary Drilling	\$20,712.76	\$0.111
Primary Blasting	10,591.63	0.057
Secondary Breaking - Drilling	3,065.22	0.016
Secondary Breaking - Blasting	1,272.05	0.007
Deferred Drilling	8,719.33	0.047
Power Shovels	13,375.37	0.072
Power Shovels - Rental Only	82.60	0.000
Haulage Trucks	12,544.80	0.067
Tractors	3,744.75	0.020
Tractors - Rental Only	1,717.59	0.009
Pit Roads and Ramps	482.05	0.003
Supervision	2,355.41	0.013
General Pit Expense	2,993.61	0.016
Repairs and Maintenance of Equipment	<u>7,996.76</u>	<u>0.043</u>
Total Pit Expense	\$86,218.75	\$0.463
<u>CRUSHING</u>		
Crushing	<u>\$16,529.07</u>	<u>\$0.089</u>
Total Crushing	\$16,529.07	\$0.089
Pumps and Housing	\$ 306.84	\$0.002
Stocking Expense	4,007.88	0.021
General Mine Expense	16,799.28	0.090
Winter and Idle Expense	41,232.10	0.221
Power Credit	<u>189.80</u>	<u>0.001</u>
Cost of Production	164,904.12	0.885
Taxes	5,678.48	0.030
Depletion and Depreciation	25,774.48	0.138
Shipping Expense	<u>7,852.66</u>	<u>0.043</u>
Total Cost at Mine	\$204,209.74	\$1.096

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BLASTING TILDEN WEST PIT LOWER BENCH

The above picture was taken of a primary blast made in the Tilden West Pit lower bench on April 13, 1956.

Fourteen holes averaging sixty feet in depth were loaded with 20,600 pounds of Hercules explosives.

This blast was of particular interest as the major portion of the explosive material used was E.P. 188 (ammonium nitrate). The E.P. 188 was later improved and designated as E.P. 197B.

BUNKER HILL MINE
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1. GENERAL:

Operations at the Bunker Hill Mine continued at an accelerated pace during 1956. In addition to the operations necessary for normal production, a program of increased development was carried on in anticipation of the Bunker Hill-Maas Mine merger. On November 15th, mining operations were temporarily suspended to permit the installation of a new skip hoist, which will provide the hoisting capacity necessary for the Bunker Hill-Maas consolidation. At the close of the year, all major changes necessary for the consolidation were very near completion.

The industry-wide steel strike began on the midnight shift of June 30th, and continued through August 6th. Necessary maintenance during the strike was performed by the Mine Supervisory Force and a few select hourly-rate personnel. Normal operations were resumed on the day shift of August 7th.

Production from the Bunker Hill Mine in 1956 totaled 438,678 tons. This is a decrease of 4.38% under the 460,958 tons produced in 1955. The decrease in production is a direct result of the decrease in the number of days the Mine operated during the year. As a result of the steel strike and the suspension of mining operations on November 15th, the number of days the Mine operated decreased from 252 days in 1955, to 199 days in 1956. Production was obtained from the 7th, 10th, and 12th Levels, with the 12th Level producing the major portion.

Shipments during the year decreased 325,987 tons from 708,341 tons in 1955 to 382,354 tons in 1956. The decrease in shipments was largely the result of the steel strike of June 30th.

The Mine operated on a five-day, two-shift basis during the year. To enable mining operations to proceed smoothly, a small skeleton crew was employed on the midnight shift to tram ore and supplies.

The average dry iron analysis was slightly lower than in 1955. The average dry iron analysis decreased from 58.11 in 1955 to 57.80 in 1956. The shipping analysis showed a natural iron content of 50.08, with a 12.87 moisture content, as compared with a natural iron of 50.80 and a 12.27 moisture in 1955. As a result of the increased moisture content, all ore was stockpiled with no pocket shipments being made during the year.

There was a notable increase in the ore reserves of the Athens and Bunker Hill properties, as information obtained from diamond drilling indicated a westward extension of ore structures. In the Mitchell Lease, the production obtained from mining out the lease exceeded the previous ore estimate by 13,690 tons.

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1. GENERAL: (Cont'd.)

Effective August 6, 1956, there was a general wage increase of \$0.075 per hour, plus \$.003 increment increase between job classes.

The year 1956 saw extensive surface activities at the Bunker Hill Mine. A new northeast stocking trestle was erected, and at the close of the year, construction was well underway on a new garage building and a shop addition. The Nordberg air compressor was dismantled and replaced by two Ingersoll-Rand compressors, and a new motor generator set and flywheel were installed. On November 15th, work commenced on the installation of a new skip hoist, and on the necessary headframe modifications. The new hoist was mechanically ready for operation at the close of the year, although it will be necessary to modify the electrical control system somewhat to obtain the desired hoist performance.

Underground mining operations were confined to block caving in the north and south ore bodies. Yieldable arch steel supports were used to an increased extent in block caving areas with very satisfactory results. In block transfer drifts where heavy ground conditions necessitate large amounts of repair work, it has been found that production can be improved considerably by replacing transfer scraping systems with drag-chain conveyors.

Exploration for the year was concentrated in the following areas:

1. The ore section intersected by the north end of the 10th Level conveyor drift.
2. The westward extension of the south ore body and the upper 10th Level ore body.
3. The initial exploration of the Boundary Ore Body.

All diamond drilling was accomplished from the 10th Level.

Pumping continued on an automatic basis with very satisfactory results.

There were 12 active E & As during the year and a total of \$1,816,830 was expended under these Capital Expenditure Authorizations.

The total valuation for the Bunker Hill-Athens properties increased \$260,000 over the 1955 valuation as a result of an increase in ore reserves at the Bunker Hill property. This increase in valuation was essentially offset by a decrease in valuation at the Athens.

There was a notable decrease in the number of lost-time accidents during the year. The excellent accident frequency and severity rates of 30.29 and .632 are a credit to the Mine supervisory personnel and should place the Bunker Hill Mine well among the leaders in the competition for the 1956 safety award.

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1. GENERAL: (Cont'd.)

There was a slight decrease in the cost per kilowatt in 1956 and the total amount expended decreased from \$139,000 in 1955 to \$131,397 in 1956.

2. PRODUCTION:

a. Production by Grades and Months:

<u>Month</u>	<u>Athens</u>	<u>Mitchell</u>	<u>Bunker Hill</u>	<u>Total</u>	<u>Rock</u>
January	16,405	9,781	9,572	35,758	11,205
February	9,852	9,104	23,529	42,485	10,585
March	10,691	6,247	27,210	44,148	11,625
April	7,233	1,277	32,325	40,835	10,905
May	10,317	6,489	30,176	46,982	10,975
June	16,348	9,895	20,653	46,896	12,395
July	-----	-----	-----	-----	-----
August	17,273	7,018	16,122	40,413	12,020
September	16,308	1,622	25,906	43,836	10,562
October	25,656	2,554	26,781	54,991	12,350
November	11,163	-----	12,293	23,456	3,705
December	-----	-----	-----	-----	-----
Total	<u>141,246</u>	<u>53,987</u>	<u>224,567</u>	<u>419,800</u>	<u>106,327</u>
Stockpile Overrun	<u>14,130</u>	-----	<u>4,748</u>	<u>18,878</u>	-----
Total 1956	<u>155,376</u>	<u>53,987</u>	<u>229,315</u>	<u>438,678</u>	<u>106,327</u>
Total 1955	<u>340,371</u>	<u>71,363</u>	<u>49,224</u>	<u>460,958</u>	<u>124,226</u>
Increase			<u>180,091</u>		
Decrease	184,995	17,376		22,280	17,899

b. Shipments:

<u>Grades:</u>	<u>Pocket</u>	<u>Stockpile</u>	<u>1956</u> <u>Total</u>	<u>1955</u> <u>Total</u>
Athens		148,969	148,969	492,913
Mitchell Lease		53,284	53,284	114,097
Bunker Hill		<u>180,101</u>	<u>180,101</u>	<u>101,331</u>
Total		<u>382,354</u>	<u>382,354</u>	<u>708,341</u>
Total Last Year	<u>17,108</u>	<u>691,233</u>	<u>708,341</u>	-----
Increase in Shipments				
Decrease in Shipments	17,108	308,879	325,987	

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2. PRODUCTION: (Cont'd.)c. Ore Statement:

	<u>Athens</u>	<u>Mitchell</u>	<u>Bunker</u>	<u>Total</u>	<u>Total</u>
		<u>Lease</u>	<u>Hill</u>	<u>1956</u>	<u>1955</u>
On Hand January 1, 1956	55,791	12,398	26,791	94,980	342,363
Product for Year	141,246	53,987	224,567	419,800	431,749
Stockpile Overrun	14,130		4,748	18,878	29,209
<u>Total</u>	211,167	66,385	256,106	533,658	803,321
Shipments	148,969	53,284	180,101	382,354	708,341
Balance On Hand	62,198	13,101	76,005	151,304	94,980
Increase in Output			180,091		20,958
Decrease in Output				22,280	
Increase in Ore on Hand	184,995	17,376		56,324	
Decrease in Ore on Hand	6,407	703	49,214		
					247,383

Operating Schedule:

<u>Year</u>	<u>Days Per Week Mine Operated</u>
1956	5 days entire year
1955	4 days thru April 17th -- 5 days balance of year
1954	5 days January to April 4th -- 4 days April 5th thru December
1953	5 days entire year
1952	6 days thru July -- 5½ days thru November 15th -- 5 days thru December

d. Division of Product by Levels:

	<u>1956</u>		<u>1955</u>	
	<u>Tons</u>	<u>Percent</u>	<u>Tons</u>	<u>Percent</u>
6th Level			123,091	26.7
7th Level	71,966	17.1	50,701	11.0
10th Level	107,662	25.6	7,756	1.7
12th Level	240,172	57.3	279,410	60.6
<u>Total</u>	419,800	100.0	460,958	100.0

e. Production Delays:

There were no major delays encountered during the year.

3. ANALYSIS:a. Average Mine Analysis on Output:

<u>Grade:</u>	<u>1956</u>					<u>1955</u>				
	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>
Athens-Bunker Hill & Mitchell Lease	438,678	57.80	.112	8.79	.006	460,958	58.11	.112	8.74	.006

b. Average Analysis of Shipments:

<u>Grade:</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Athens-Bunker Hill & Mitchell Lease	57.48	.112	9.14	.66	3.43	.46	1.21	.005	1.69	
<u>Natural</u>	50.08	.098	7.96	.57	2.99	.40	1.05	.004	1.47	12.87

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3. ANALYSIS: (Cont'd.)

c. Average Analysis of Ore in Stock:

<u>Grade:</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Athens-Bunker Hill & Mitchell Lease	151,304	58.02	.111	8.80	.66	3.43	.46	1.21	.006	1.69	
<u>Natural</u>		50.57	.097	7.67	.58	2.99	.40	1.05	.006	1.47	12.85

d. There were no straight cargo shipments.

4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

Developed Ore:

Athens:

Of the total reserve based on the figures submitted to the Michigan State Tax Commission, all reserves above 12th Level are considered as developed ore. The remaining ore, which is between 12th and 14th Levels, is considered undeveloped.

Bunker Hill:

All of the ore reserves above 10th Level, with the exception of any ore north of the 3000-S coordinate, and all reserves east of the 2400-W coordinate on 12th Level are considered developed. The remaining ore is considered undeveloped.

The ore reserves in the following table are based on the figures submitted to the Michigan State Tax Commission.

	<u>Athens</u>	<u>Mitchell Lease</u>	<u>Bunker Hill</u>	<u>Total</u>
Ore Reserves - Dec. 31, 1955	512,600	40,297	2,928,049	3,480,946
Ore Production - 1956	155,376	53,987	299,315	438,678
Ore Reserves - Dec. 31, 1956	519,388		4,226,542	4,745,930
Tonnage Proved in 1955	162,164	13,690	1,597,808	1,703,662
Above 6th Level	2,043	639		2,682
6th Level to 7th Level	1,024	8,611		9,635
Above 10th Level			1,528,382	1,528,382
10th Level to 12th Level	523,371		1,896,796	2,420,167
12th Level to 14th Level	128,882		1,361,093	1,489,975
Total Gross July 31, 1956	655,320	9,250	4,786,271	5,450,841
Less 10% for Mining & Rock	65,532	925	478,627	545,084
Net Total As Of July 31, 1956	589,788	8,325	4,307,644	4,905,757
Less Production July 31, 1956 to December 31, 1956	70,400	11,194	81,102	162,696
Net Total As Of Dec. 31, 1956	519,388	-----	4,266,542	4,745,930

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4. ESTIMATE AND ANALYSIS OF ORE RESERVES: (Cont'd.)

Expected Average Natural Analysis of Ore Reserves:

The following analyses are based on the figures submitted to the Michigan State Tax Commission:

<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
50.50	0.100	8.00	0.39	2.75	0.36	0.80	0.011	1.40	13.40

The increase in the Athens reserves is due to a change in the interpretation of the position of the Main Athens Dike on 12th Level as a result of mine development in the 2102 block area.

The slight increase in the reserve of the Mitchell Lease is realized because during the mining out of this lease, the production has exceeded the previous ore estimate.

The westward extension of the ore structures as a result of diamond drilling and the initial exploration of the Boundary Ore Body are responsible for the increases in the Bunker Hill Reserve Estimate.

The continued exploration of the Boundary Ore Body since the State Tax Commission Estimate has revealed a significant addition to the Bunker Hill reserves.

5. LABOR & WAGES:

Labor Relations:

Labor relations during the year were excellent, with no formal grievances being submitted. The improvement has been very pronounced, as can be seen in the decrease in the number of grievances submitted over the past three years--13 in 1954, 5 in 1955, and none in 1956.

Employment:

The average number of statistical employees in 1956 was 386, as compared to 388 in 1955.

There were 43 separations during 1956--9 quit, 5 retired, 2 died, 26 transferred, and 1 drafted. There were 1 new hire, 13 rehired, and 31 transfers during 1956.

Number of Men Beginning of Year	362
Added During Year	45
Separations	<u>43</u>
Total End of Year	364

The Mine was idle from July 1st through August 6th, due to a strike of the A.F.L. CIO Union.

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5. LABOR & WAGES: (Cont'd.)

The following tables give data pertinent to paid vacations and holidays.

Vacations - 1956

	<u>Number of Men</u>	<u>Number of Hours</u>	<u>Amount</u>	<u>Rate Per Hour</u>
One Week	20	800	\$ 1,879.24	\$2.349
Two Weeks	145	11600	32,562.28	2.807
Three Weeks	186	22320	59,068.72	2.646
Total	351	34720	\$93,510.24	\$2.693

Paid Holidays - 1956

	<u>Number of Men</u>	<u>Number of Hours</u>	<u>Amount</u>	<u>Rate Per Hour</u>
New Years Day	285	2280	\$ 5,592.28	\$2.453
Memorial Day	315	2520	6,092.79	2.418
Fourth of July	23	184	439.28	2.387
Labor Day	317	2536	6,419.73	2.531
Thanksgiving	154	1232	2,988.55	2.426
Christmas Day	246	1968	4,753.58	2.415
Total	223	10720	\$26,286.21	\$2.452

Statement of Wages:

<u>Average Wages Per Day</u>	<u>1956</u>	<u>1955</u>	<u>Increase</u>	<u>Decrease</u>
Surface	\$ 21.26	\$ 19.80	\$1.46	
Underground	23.26	22.56	.70	
Total	\$ 22.70	\$ 21.60	\$1.10	

Average Wages Per Month

Surface	\$455.32	\$415.80	\$39.52
Underground	498.16	473.76	24.40
Total	\$486.16	\$453.60	\$32.56

Average Days Worked Per Month

1956 - 16.50
1955 - 21.00

Tons Per Man Per Day

Surface	27.13	24.01	3.12	
Underground	10.74	12.74		2.00
Total	7.69	8.32		.63

Labor Cost Per Ton

Surface	.784	.825		.041
Underground	2.167	1.771	.396	
Total	2.951	2.596	.355	

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6. SURFACE:

Athens Shaft:

The Athens Shaft was inspected periodically throughout the year and continued to show slight movement in the upper part of the shaft. The Athens Shaft is presently being used for exhaust ventilation and a second outlet.

Construction:

Masonry work on the northeast addition of the engine house was completed early in the year by Kielenen and Son, Contractors, and construction of a new shop addition and garage building by the Mine Surface Department commenced. A complete remodeling of the dry house was made to provide facilities for Maas Mine personnel, who were transferred to the Bunker Hill Mine on May 1st.

Equipment:

An area northeast of the Bunker Hill Shaft was prepared for stocking, and a new northeast stocking trestle was erected by the Worden-Allen Company. Box beams obtained from the Maas Mine trestle were utilized in the construction of the new trestle.

The Nordberg air compressor was dismantled and replaced by two Ingersoll-Rand compressors, which will provide the increased air capacity necessitated by the Bunker Hill-Maas consolidation. The Mine Surface Department also completed the installation of a new motor-generator set and fly-wheel.

On November 15th, mining operations were temporarily suspended at the Bunker Hill Mine to permit the installation of a new skip-hoisting system utilizing 12-ton skips. The former skip hoist was dismantled and replaced with a new 12-foot diameter double drum hoist. Necessary modifications to the Bunker Hill headframe were performed by the Company steel workers, and steel work was practically all completed during December, although some difficulty was experienced as a result of poor weather conditions. At the close of the year, the new hoist was mechanically ready for operation; however, the electrical control system of the hoist required revamping prior to obtaining the desired hoist performance.

7. UNDERGROUND:

Mining and Development:

Mining operations above the 7th Level were completed during the year. The production was obtained from a block cave in the Mitchell Lease, and two scam drifts which mined the remaining ore reserves east of the Athens-Mitchell boundary line. At the termination of operations in the Mitchell Lease, production had exceeded the previous ore estimate by 13,690 tons.

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7. UNDERGROUND: (Cont'd.)

In the Athens property above 12th Level, mining operations consisted of block caving in the north ore body above the 2200 and 2300 cross-cuts. Two block caves above the 2300 cross-cut were completed early in the year. One block cave, which is located west of the 2300 cross-cut along the north footwall, continued in production throughout the year. Production from this block was improved considerably by replacing the conventional transfer scraping system with a drag-chain conveyor. The 2200 cross-cut was completed in April, and the major production from this area was realized from a grizzly block developed on the west side of the cross-cut. Presently under development are two block caves which will mine the extreme eastern portion of the north ore body, from the -1100 sub-level.

The mining above 10th Level in the Bunker Hill property was confined to two areas in the Upper 10th Level Ore Body. Mining operations continued in two block caves in the eastern limit of the ore body, while in the north central portion of the ore body, a block cave developed on the -985 sub-level reached full production during April. At the close of the year, two block caves were under development along the western portion of the 1900 drift. The 10th Level main line conveyor drift was completed, and two drag-chain conveyor transfer drifts were driven from the 1900 drift to the main conveyor drift. This installation will convey ore from the mining area to ore passes in the north footwall, where it will be transferred to the 14th Level conveyor system.

In the Bunker Hill property above 12th Level, the majority of the production was obtained from block caving in the north ore body above the 2400 cross-cut. Three block caves were active in this area during the year. On the western side of the 2400 cross-cut, development was near completion in two block caves, which will mine the eastern portion of the south ore body. The south main line drift showed an advance of 685 feet, while the north main line drift was advanced 320 feet to the 2820-W coordinate. Advances of 192 feet and 276 feet were made in the 2500 and 2600 cross-cuts.

In preparation for the Bunker Hill-Maas consolidation, the hoisting capacity of the Bunker Hill Shaft was increased by the installation of a new skip hoist and 12-ton skips. The measuring pockets on the 10th and 12th Levels were modified to accommodate the increased capacity of the new skips, and new pockets of the vibrating type were installed on the 6th and 14th Levels.

The installation of the 14th Level conveyor haulage system was completed during the year, and trial operation of the belt began in December.

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7. UNDERGROUND: (Cont'd.)

The following is a resume of the main level drifting done in 1956:

<u>Level</u>	<u>Ore Drift</u>	<u>Rock Drift</u>	<u>Total</u>
2nd Level		522	522
10th Level	502	489	991
12th Level	52	1807	1859
14th Level	—	<u>945</u>	<u>945</u>
Total	554	3763	4317

Exploration:

Athens:

Mapping, incidental with development, and the drilling of two short test holes were the extent of exploration in the Athens property during the year.

Routine mapping in the development of the 2102 and 2203 mining blocks has revealed two changes in the expected structure of the North Ore Body.

1. Development of both the 2102 and 2203 block areas has indicated a 20-30 foot zone of ferruginous argillite and argillaceous iron-formation occurring along the north side of the Athens Dike in the North Ore Body. This area had been previously thought to be minable ore up to the Dike.
2. Mapping of the 12th Level north main drift at about the 1200-W coordinate indicated that the Athens Dike was folded to the north in this area. Recent development in the 2102 block area does not verify this folding. Therefore, it appears that between the 1200-W and 1365-W coordinates, a sharp fold, or more probably a fault, offsets the dike to the north.

Bunker Hill:

A continued, full-time diamond drill program resulted in a significant increase of ore reserves during the year. This drilling program was concentrated in three areas:

1. The ore cut by the north end of the 10th Level conveyor drift.
2. The initial exploration of the Boundary Ore Body.
3. The westward extension of the South Ore Body and Upper 10th Level Ore Body.

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7. UNDERGROUND: (Cont'd.)
Exploration: (Cont'd.)
Bunker Hill: (Cont'd.)

The following table shows the amount of ore cut and the total footage drilled during 1956:

<u>1956 - Hole Numbers</u>	<u>First Class Ore</u>	<u>Footage Drilled</u>
58	Power Cable Hole	220'***
59	" " "	202'***
60	72'	212'
61	9'	181'
62	0	170'
63	92'	425'
64	6'	169'
65	336'	451'
66*	148'	264'
67	0	325'
68*	160'	398'
69	202'	455'
70	19'	144'
Maas 91**	95'	195'
Maas 94**	65'	225'
	<u>1204'</u>	<u>3614'</u>
		Footage Drilled for Ore Exploration
		<u>424'</u> Hole #58 and #59
		<u>4038'</u> Total Footage Drilled

* Holes Which Extended Into Pioneer & Arctic--Footage is Bunker Hill Portion.

** Maas Holes Drilled From Bunker Hill--Footage is Bunker Hill Portion.

*** Not Included in Footage Drilled For Ore Exploration.

The following is a summary by north-south sections of the drilling program. The entire program was accomplished from 10th Level.

2400-W Section:

Drilling was initiated along this coordinate to explore the section of ore which was intersected by U.H. #29 and the north end of the 10th Level conveyor drift. Underground holes #60, #61, and #62 drilled for this purpose outlined a small ore section.

From this same drill station, Maas U.H. #91 and #94 were drilled to explore into the Pioneer & Arctic property in search of an ore structure that may be formed at the intersection of the Negaunee Fault and the north limb of the engine house anticline. The expected structure was not intersected; however, both holes cut significant runs of ore at the Bunker Hill-Pioneer & Arctic property line. Underground holes #66, #67, & #68 were

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7. UNDERGROUND: (Cont'd.)
Exploration: (Cont'd.)
Bunker Hill: (Cont'd.)

drilled to outline this ore. As a result of this drilling, a very significant ore structure, referred to as the Boundary Ore Body, was outlined along this coordinate.

3000-W Section:

Exploration along this coordinate was directed toward outlining the westward extension of the Upper 10th Level and South Ore Bodies.

U.H. #63 tested the ore and located the position of the sill-like footwall of the upper 10th Level ore structure.

U.H. #64 showed that the ore along the Athens Dike does not build up to the 10th Level elevation along this coordinate.

U.H. #65 determined the position of the Bunker Hill Fault, the Athens Dike, and tested the ore concentration of the South Ore Body occurring between these two structures.

3200-W Section:

Because of the complex nature of the Upper 10th Level Ore Body and the uncertainty of the continuation of the South Ore Body, both ore structures were again drilled along this coordinate.

U.H. #69 intersected both ore structures and determined the positions of the sill-like intrusive, the Bunker Hill Fault, and the Athens Dike.

Because a decrease in thickness of the upper 10th Level ore section was indicated by U.H. #69, U.H. #70 was drilled and proved a marked reduction in the thickness of the ore body along this section.

The results of the 1956 exploration program indicate the following:

1. The ore structure cut by the north end of the 10th Level conveyor drift on about the 2400-W coordinate is quite limited in extent. This ore appears to be lying in a V-shaped structure formed by the intersection of a north-dipping intrusive and the south-dipping footwall argillite, limited to the east by a NE-SW fault on about the 2100-W coordinate.
2. The (Negaunee) Fault occurs on about the 2400-S coordinate and as expected, it takes part in the formation of an ore structure in conjunction with a down-faulted area of the north footwall and an east-west north-dipping intrusive. This ore body is referred to as the Boundary Ore Body, because it occurs along the Bunker Hill-Pioneer & Arctic property line. A very significant ore section was outlined on the 2400-W section.

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7. UNDERGROUND: (Cont'd.)
Exploration: (Cont'd.)
Bunker Hill: (Cont'd.)

3. The sill-like intrusive which underlies the Upper 10th Level Ore Body is not flat-lying as previously thought, but has a large fold with the axis plunging to the northwest at 32°. This fold appears to be the controlling feature of the ore lying above the sill, as a marked reduction in thickness is noticed at the flanks.
4. The South Ore Body, which occurs between the Bunker Hill Fault and the Athens Dike, continues west to the 3200-W coordinate. This structure was expected to pinch out as the NW-SE Bunker Hill Fault intersected the E-W Athens Dike. However, the Fault appears to have changed to an E-W direction and approaches vertical paralleling the Athens Dike about 80 feet south of it.

Statement of Timber Used:

	<u>Amount - 1956</u>	<u>Amount - 1955</u>
Cribbing	\$ 4,727.87	\$ 4,549.95
Stulls	9,983.53	11,884.26
Lagging	17,166.26	10,967.16
Poles	5,802.68	6,150.50
Steel Beams	28,329.55	53,606.15
Steel Sets (Circular-Arch-Yielding)	42,326.41	39,345.01
Total	\$108,336.30	\$126,503.03

Total Cost of Timber, Lagging, Poles, etc.:

<u>Year</u>	<u>Amount</u>	<u>Per Ton.</u>
1956	\$108,336.30	.2470
1955	126,503.03	.2744
1954	97,254.14	.2210
1953	117,991.28	.1903
1952	69,794.67	.1404
1951	69,080.92	.1097
1950	64,244.24	.1050
1949	68,774.23	.1250
1948	79,243.23	.1564
1947	78,082.59	.1537

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7. UNDERGROUND (Cont'd.)

Explosives:

Statement of Explosives Used During 1956

	<u>1956</u>		<u>1955</u>	
	<u>Quantity</u>	<u>Amount</u>	<u>Quantity</u>	<u>Amount</u>
Total Powder Used	113,957#	\$22,295.92	131,037	\$24,693.12
Total Caps, Fuse, etc. Used		21,078.36		19,850.38
Total		\$43,374.28		\$44,543.50
 <u>PRODUCT</u>		 438,678		 460,958
Pounds Powder Per Ton of Ore		.2597		.2843
Tons of Ore Per Pound of Powder		3.849		3.5178
Cost Per Ton For Powder		.0508		.0536
Cost Per Ton For Fuse, Caps, etc.		.0480		.0430
Cost Per Ton For All Explosives		.0988		.0966

Pumping:

The following table shows the average number of gallons pumped per minute for the last five years:

<u>Month</u>	<u>1956</u>	<u>1955</u>	<u>1954</u>	<u>1953</u>	<u>1952</u>
January	911	1124	1115	1341	1788
February	811	1057	1083	1361	1650
March	923	1023	1060	1351	1567
April	901	1002	1150	1395	1509
May	937	1014	1150	1457	1623
June	914	1053	1234	1541	1505
July	981	1053	1191	1583	1488
August	1020	1011	1238	1740	1487
September	944	999	1091	1598	1282
October	1030	961	1164	1551	1307
November	1020	963	1142	1498	1399
December	1017	880	1129	1526	1306
Average	956	1012	1146	1495	1493

The following statement shows the average number of gallons pumped for the past ten years:

<u>Year</u>	<u>Gallons Per Minute</u>
1956	956
1955	1012
1954	1146
1953	1495
1952	1493
1951	1539
1950	1593
1949	1214
1948	1077
1947	1085

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

There were 13 active E & As at the Bunker Hill during 1956: E & A CC-619--Underground Development, E & A CC-754--Underground Development, E & A CC-685--Alterations to Shop Building, E & A CC-753--Relocate Trestle, etc., E & A CC-717--Install Shaft Sets, E & A CC-782--Chain Conveyors, E & A CC-794--New Garage, E & A CC-830--Pickup Truck, E & A CC-662--Connect Bunker Hill Shaft to Maas Workings, E & A AM-36--Relocate Healy Avenue, E & A CC-875--Transformers & Cable, E & A CC-795--Caterpillar D8 Tractor, E & A CC-684--Heating Plant.

<u>Reference</u>	<u>Prior Year Expenditures</u>	<u>1956 Expenditures</u>	<u>Total Expenditures</u>
E & A CC-619	\$1,541,100	\$216,615	\$1,757,715
E & A CC-754	-----	711,897	711,897
E & A CC-753	4,437	110,669	115,106
E & A CC-717	-----	-----	-----
E & A CC-782	-----	44,770	44,770
E & A CC-794	-----	43,174	43,174
E & A CC-830	-----	2,949	2,949
E & A CC-662	896,032	613,292	1,509,324
E & A AM-36	-----	3,027	3,027
E & A CC-685	8,762	20,073	28,835
E & A CC-684	87,112	11,552	98,664
E & A CC-875	-----	13,812	13,812
E & A CC-795	-----	25,000	25,000

Comparative Mining Costs:

	<u>1956</u>	<u>1955</u>	<u>Increase</u>	<u>Decrease</u>
Product	438,678	460,958		22,280
Underground Costs	3.553	2.940	.613	
Surface Costs	.520	.545		.025
General Mine Expense	.752	.694	.058	
Cost of Production	4.825	4.179	.646	
Depreciation	.245	.142	.103	
Taxes	.031	.051		.020
Loading & Shipping	.087	.141		.054
Administration, Cleveland Office,				
Hoisting Fee & Pensions-S.U.B.	.099	.079	.020	
Total Cost at Mine	5.287	4.592	.695	
Budget: Estimated Cost at Mine	4.902	5.142		.240
Number of Shifts & Hours		30-1/8 Hr.		30
	199-2/8 Hr.	222-2/8 Hr.		23
Number of Days Operated	199	252		53
Average Daily Product	2204	1944	260	

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8. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Cont'd.)

Proportion of Labor & Supplies:

<u>Cost of Production</u>	<u>1956</u>	<u>Percent</u>	<u>1955</u>	<u>Percent</u>	<u>Increase</u>	<u>Decrease</u>
Labor	3.310	68.60	2.897	69.32	.413	
Supplies	1.515	31.40	1.282	30.68	.233	
Total	4.825	100.00	4.179	100.00	.646	

Days and Shifts:

<u>Year</u>	<u>Days Mine Operated</u>	<u>Shifts & Hours</u>	<u>Men Employed</u>	<u>Total Shifts Worked</u>
1956	199	199-2/8 Hr.	386	398
1955	252	30-1/8 Hr. 222-2/8 Hr.	388	474
Increase				
Decrease	53	30-1/8 Hr. 23-2/8 Hr.	2	76

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8. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING: (Cont'd.)

Detailed Cost Comparison: (Cont'd.)

Cost of Production:

<u>Underground Costs:</u>	<u>1956</u>		<u>1955</u>	
	Amount	Per Ton	Amount	Per Ton
Development	\$ 306,749.82	\$.699	\$ 305,904.73	\$.664
Mining	509,585.13	1.161	414,732.47	.900
Tramming	283,408.97	.647	228,830.33	.496
Ventilation	27,459.73	.063	28,606.28	.062
Pumping	37,034.14	.084	36,050.17	.078
Compressors and Air Lines	43,213.54	.099	36,330.23	.079
Underground Superintendence	88,963.56	.203	89,774.69	.194
Maint: Pockets and Chutes	3,092.97	.007	2,685.34	.006
" Mining Equipment	69,750.39	.158	51,178.05	.111
" Levels and X-Cuts	43,842.54	.100	35,954.99	.078
" Shaft	21,348.61	.049	13,202.97	.028
Telephones & Safety Devices	21,786.30	.049	22,988.77	.050
Holiday Pay	15,731.83	.036	27,169.21	.059
Vacation Pay	86,713.32	.198	62,094.80	.135
Total Underground Cost	\$1,558,680.85	\$3.553	\$1,355,503.03	\$2.940
<u>Surface Costs:</u>				
Hoisting	\$ 60,957.93	\$.139	\$ 71,098.44	\$.154
Crushing and Screening - Surf.	9,140.13	.021	8,139.09	.017
Stocking	51,921.52	.119	62,917.19	.136
Timber Yard	25,570.09	.058	23,153.30	.050
Dry House	20,280.53	.046	22,336.53	.048
Policing	11,315.37	.026	17,984.70	.039
General Surface	11,626.96	.027	17,996.88	.040
Maint: Headframe Bldg. & Equip.	1,041.90	.002	840.83	.002
" Other Mine Buildings	8,969.49	.020	1,953.08	.005
Telephones & Safety Devices	1,201.99	.003	835.75	.002
Holiday Pay	3,143.27	.007	6,424.18	.014
Vacation Pay	22,725.00	.052	17,400.00	.038
Idle and Abandoned Properties	76.10	---		
Total Surface Cost	\$ 227,970.28	\$.520	\$ 251,079.97	\$.545
<u>General Mine Expenses:</u>				
Electrical Engineering	\$ 5,782.53	\$.013	\$	\$
Geological Department	6,838.26	.016	3,129.06	.007
Mining Engineering Department	20,620.90	.047	21,649.61	.047
Mech. Dept.	11,403.86	.026	17,820.35	.040
Safety Department	6,080.93	.014	5,760.50	.013
Research Laboratory	4,385.02	.010	7,819.46	.016
Analysis and Grading	26,425.83	.060	27,350.86	.059
Design Department	683.97	.001		
Special Expense	3,928.28	.009	4,685.03	.010
" " - Hygiene Clinic	5,616.59	.013	4,824.01	.011
" " - Employment Off.	973.83	.002	1,026.25	.002
Ishpeming Office	69,935.93	.159	69,845.08	.152
Mine Office - Supt. & Clerks	43,416.21	.099	49,860.26	.108
Central Warehouse Overhead	16,741.02	.038	17,046.55	.037
Insurance	49,000.48	.111	43,050.47	.092
Personal Injury	11,330.98	.026	10,234.06	.023
R.R. Relocation Engr.	2,173.15	.005		
Taxes - Unemployment Insurance	9,592.26	.022		
Taxes - Old Age Benefit	32,004.88	.073	35,483.32	.077
Surface Rental			100.00	---
Employees Ins. & Comp. Dept.	6,526.13	.015		
Power Dept. Credit	4,088.26	.009		
Supply Inventory Adj.	698.26	.002		
Total General Mine Expenses	\$ 330,071.04	\$.752	\$ 319,684.87	\$.694
Cost of Production	\$2,116,722.17	\$4.825	\$1,926,267.87	\$4.179

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8. IDLE EXPENSE:

Detailed Idle Cost:

	Idle-Account of Strike	Idle-Install New Hoist	Total Idle Cost
<u>Underground Costs:</u>			
Development	\$ 81.41	\$ 1,719.26	\$ 1,800.67
Mining	4,081.27	10,788.37	14,869.64
Tramming	577.25	8,485.74	9,062.99
Auxiliary Hoisting			
Ventilation	984.67	1,655.75	2,640.42
Pumping	1,787.72	1,407.73	3,195.45
Compressors and Air Lines	1,428.65	3,492.95	4,921.60
Underground Superintendence	12,754.17	17,366.23	30,120.40
Maint: Pockets and Chutes		108.72	108.72
" Mining Equipment		7,444.27	7,444.27
" Levels and X-Cuts	338.42	22,891.61	23,230.03
" Shaft	2.61	412.49	415.10
Telephones & Safety Devices	93.35	1,358.88	1,452.23
Holiday Pay	213.08	3,747.73	3,960.81
<u>Total Underground Cost</u>	<u>\$ 22,342.60</u>	<u>\$ 80,879.73</u>	<u>\$103,222.33</u>
<u>Surface Costs:</u>			
Hoisting	\$ 985.05	\$ 3,419.56	\$ 4,404.61
Stocking		1,849.03	1,849.03
Timber Yard	206.11	1,838.46	2,044.57
Dry House	58.50	1,077.55	1,136.05
Policing	1,065.50	1,305.30	2,370.80
General Surface	192.94	827.93	1,020.87
Maint: Other Mine Buildings	390.60	410.46	801.06
Telephones & Safety Devices	3.97	7.54	11.51
Holiday Pay	333.36	1,215.80	1,549.16
<u>Total Surface Cost</u>	<u>\$ 3,236.03</u>	<u>\$11,951.63</u>	<u>\$ 15,187.66</u>
<u>General Mine Expenses:</u>			
Electrical Engineering	\$ 940.04	\$ 469.82	\$ 1,409.86
Mining Engineering Department	2,396.28	1,442.19	3,838.47
Geological Department	806.74	356.97	1,163.71
Mech. Eng. Department	1,295.22	748.57	2,043.79
Safety Department	600.00	267.50	867.50
Research Laboratory	142.90		142.90
Analysis & Grading - Laboratory	770.94		770.94
" " " - Shipping	444.00	238.00	682.00
Telephones & Safety Devices		64.40	64.40
Special Expense - Pensions	9.00		9.00
" " - Retirements	479.00		479.00
" " - Hygiene Clinic	243.36		243.36
" " - Employment Off.	114.00	46.50	160.50
Ishpeming Office	8,112.00	3,317.00	11,429.00
Mine Office - Supt. & Clerks	4,246.48	6,615.44	10,861.92
Central Warehouse Overhead	1,425.66	3,323.16	4,748.82
Insurance - Property	382.97		382.97
" - Group, Health & Life	929.26	883.20	1,812.46
" - Group Annuity	1,072.88	2,397.70	3,470.58
" - Catastrophe	216.00	321.00	537.00
Personal Injury - Comp. & Doctors	223.20	929.85	1,153.05
Taxes - Unemployment Insurance	51.01	272.70	323.71
" - Old Age Benefit	270.05	1,096.50	1,366.55
Employees Ins. & Comp.	768.00	306.00	1,074.00
<u>Total General Mine Expenses</u>	<u>\$25,938.99</u>	<u>\$23,096.50</u>	<u>\$49,035.49</u>
<u>Cost of Production</u>	<u>\$51,517.62</u>	<u>\$115,927.86</u>	<u>\$167,445.48</u>

BUNKER HILL MINE
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9. TAXES:

DESCRIPTION	1956		1955	
	VALUATION	TAXES	VALUATION	TAXES
<u>ATHENS MINE</u>				
Including Stockpiles, Supplies & Equipment as placed by State Tax Commission				
Real Estate	\$ 590,000	\$ 24,485.00	\$1,300,000	\$55,081.00
Personal Property	111,000	4,606.50	595,000	25,210.15
Collection Fee		290.92		802.91
TOTAL ATHENS MINE	\$ 701,000	\$ 29,382.42	\$1,895,000	\$81,094.06
Total Rented Buildings	1,040	43.59	1,040	44.50
TOTAL ATHENS IRON MINING COMPANY	\$ 702,040	\$ 29,426.01	\$1,896,040	\$81,138.56
<u>BUNKER HILL MINE</u>				
Realty as described and assessed by Michigan State Tax Commission				
Personal Property - State Tax Commission	\$2,215,000	\$ 91,922.50	\$ 700,000	\$29,659.00
Personal Property - State Tax Commission	839,000	34,818.50	900,000	38,133.00
Personal Property - Furnace Houses	5,050	209.58	5,050	213.96
Total	\$3,059,050	\$126,950.58	\$1,605,050	\$68,005.96
Collection Fee		1,269.51		680.06
TOTAL BUNKER HILL MINE	\$3,059,050	\$128,220.09	\$1,605,050	\$68,686.02

10. ACCIDENTS AND PERSONAL INJURY:

The following table lists the compensable injuries for 1956:

Fatal	0
Time Lost - Over 4 Months	0
Time Lost - 1 to 4 Months	7
Time Lost - Less than 1 Month	9
Total	16

<u>Date of Accident</u>	<u>Name</u>	<u>Injury</u>	<u>Days Lost</u>
1/13/56	Leonard Pellow	Fracture of great left toe.	41
3/ 6/56	David Davis	Amputation tops of two fingers right hand.	44
3/21/56	Wilfred Tremblay	Laceration left knee.	14
3/11/56	Joseph Benaglio	Bruised back.	15
3/21/56	Charles Ahola	Bruised muscle right leg.	17
4/18/56	Osmond Kemp	Fracture right leg.	75
4/21/56	Theodore Lundstrom	Strained back.	7
5/ 5/56	Alfred Denofrio	Fracture left index finger	25

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

<u>Date of Accident</u>	<u>Name</u>	<u>Injury</u>	<u>Days Lost</u>
4/27/56	Raymond Garceau	Burns - right hand.	16
5/16/56	Daniel Mongiat	Bruised cheek bone.	38
6/ 9/56	Leslie Wills	Crushed little finger right hand.	35
6/14/56	Enrico Spelgatti	Fractured ribs - right side.	38
6/20/56	Harold Granlund	Electrical burns - both hands.	7
6/27/56	John Juidici	Torn ligaments - right leg.	13
11/19/56	Lawrence Paquette	Contusions left ankle - right leg and back.	34
12/10/56	Raymond J. Traux	Loss two upper front teeth and cut upper lip.	<u>7</u>
	Total Days Lost		426

11. POWER:

The Cleveland-Cliffs Iron Company Electric Power Department generates the power and the Upper Peninsula Power Company distributes it over their transmission lines. The average cost per kilowatt hour in 1956 was \$.00894, as compared to \$.00932 in 1955.

The rate per kilowatt hour is determined by dividing the total operating cost of The Cleveland-Cliffs Iron Company Electric Power Department by the total kilowatt hours sold and charging each consumer proportionately. To this is added a wheeling charge by the Upper Peninsula Power Company for distributing the power to the Mine.

The following table lists the costs of power for 1956:

Hoisting	\$ 15,790.66
Compressor	36,353.64
Electric Haulage	9,916.27
Pumping	44,236.65
Ventilation	18,283.44
Dry House	760.25
#31 Power Shovel	497.67
Shops	1,285.74
Stocking	3,465.55
Heating Plant	<u>807.31</u>
TOTAL	\$131,397.18

CAMBRIA--JACKSON MINE
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1. GENERAL:

Production and costs for the year 1956 were excellent. The mining costs remained almost unchanged from the previous year, even though there was a sizeable increase in wages. A production average of 960 tons per day was attained in spite of the adverse factors of diminishing mining areas and double tramming most of the ore mined during the year. Production for the year totaled 218,000 tons.

The total cost at mine of \$5.149 was \$.095 higher than in 1955.

The tons per man per day increased over the previous year from 6.27 to 6.45, which is the highest since 1950 when the production totaled 445,071 tons.

The analysis of output was very good for the year. The sulphur content decreased .068% from the previous year, due to the increased amount of production in the low-sulphur East Deposit.

Average Mine Analysis on Output: (Incl. Stockpile)

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Sulphur</u>
Jackson	58.52	.089	9.45	.052

The shipping season opened May 9th and closed on November 21st. Shipments from the stockpile and pocket totaled 221,031 tons of Jackson Grade ore. The stockpile was completely loaded out in November and the analysis was identical with the average mine analysis on output.

Average Analysis of Shipments: (Total Average)

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Sulphur</u>
Jackson	58.52	.090	9.41	.058

The net ore reserves reported to the Tax Commission on December 31, 1956 were 108,318 tons. This shows a decrease of 263,803 tons over the previous year.

No grievances were filed in 1956.

Exploration drilling continued throughout the year in the 8th Level East Deposit. All of the holes drilled were to outline the ore body below the level. Results of the drilling indicate that this deposit is related to the high-sulphur ore body on the Mather Mine, B Shaft, 5th Level.

The two 1-3/8" hoisting ropes were replaced this year. Both ropes were installed during 1954 and each hoisted approximately 275,000 tons.

During December of this year the 30" conveyor belt between the 7th and 8th Levels was replaced. Since the installation of the belt in January 1951, a total of 1,283,388 tons of ore and rock have been handled without any major delays.

CAMBRIA-JACKSON MINE
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2. PRODUCTION
SHIPMENTS &
INVENTORIES:

a. Production by Grade and Months:

	<u>Jackson</u>	<u>Rock</u>
January	19,593	408
February	20,050	396
March	20,297	848
April	19,300	424
May	18,461	600
June	18,866	620
July	00,000	000
August	14,841	844
September	19,148	488
October	22,923	652
November	15,814	372
December	16,698	544
Total	205,991	6,196
Overrun	12,009	
Total	218,000	

b. Shipments:

	<u>Pocket Tons</u>	<u>Stockpile Tons</u>	<u>Total Tons</u>	<u>Total 1955</u>	<u>Increase or Decrease</u>
Jackson	85,420	135,611	221,031	339,084	118,053

c. Ore Statement:

	<u>1956</u>	<u>1955</u>
On Hand January 1, 1956	25,792	130,876
Output for Year	205,991	228,192
Overrun	12,009	5,808
Total	243,792	364,876
Shipments	221,031	339,084
Balance on Hand	22,761	25,792
Decrease in Output	22,201	9,508
Decrease in Ore on Hand	3,031	105,084

CAMBRIA-JACKSON MINE
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2. PRODUCTION
SHIPMENTS &
INVENTORIES:

c. (Cont'd)

Working Schedule:

- 1956 - Five 2-8 hr. shifts per week from January 1, 1956 to December 31, 1956.
- 1955 - Four 2-8 hr. shifts per week from January 1, 1955 to April 18, 1955. Five 2-8 hr. shifts per week from April 18, 1955 to December 31, 1955.
- 1954 - Five 2-8 hr. shifts per week from January 1, 1954 to April 5, 1954. Four 2-8 hr. shifts per week from April 5, 1954 to December 31, 1954.
- 1953 - Five 2-8 hr. shifts per week from January 1, 1953 to December 31, 1953.
- 1952 - Six 2-8 hr. shifts per week from January 1, 1952 to May 1, 1952. Five and one-half 2-8 hr. shifts per week from May 1, 1952 to November 15, 1952. Five 2-8 hr. shifts per week from November 17, 1952 to December 31, 1952.

d. Division of Product by Levels and by Months:

	<u>7th Level</u>	<u>8th Level</u>	<u>Total</u>
January	640	18,953	19,593
February	1,200	18,850	20,050
March	1,120	19,177	20,297
April	340	18,960	19,300
May	-	18,461	18,461
June	-	18,866	18,866
July	-	-	-
August	-	14,841	14,841
September	-	19,148	19,148
October	-	22,923	22,923
November	-	15,814	15,814
December	-	16,698	16,698
Total	<u>3,300</u>	<u>202,691</u>	<u>205,991</u>
Overrun			<u>12,009</u>
Total			218,000

CAMBRIA-JACKSON MINE
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2. PRODUCTION
SHIPMENTS &
INVENTORIES: (Cont'd)

e. Production Delays:

During the year there were three major production delays which caused the loss of 83 production shifts. The first delay was caused by an underground mine fire at the Mather Mine "B" Shaft. A total of six production shifts were lost due to this fire, which started on the day shift of June 2nd and ended on the day shift of June 5th. The second and longest delay of the year started on the midnight shift of June 30th, when the United Steelworkers of America, C. I. O. went on strike. This strike lost 75 production shifts and ended on the day shift of August 7th. The last delay occurred on September 19th when an excess number of broken wires appeared on the east hoisting rope. The rope was changed immediately with the loss of only two production shifts.

CAMBRIA-JACKSON MINE
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3. ANALYSIS:

a. Average Mine Analysis on Output:

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Sulphur</u>
Jackson	58.52	.089	9.45	.052

b. Average Analysis of Shipments:

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Sulphur</u>	<u>Moisture</u>	<u>Iron Nat'l.</u>
Jackson	58.52	.090	9.41	.058	11.01	52.08

c. Average Analysis of Ore in Stock:

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>	<u>Moist.</u>
Jackson	22,761	58.20	.078	10.12	.29	2.45	.58	.26	.032	2.36	10.98

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

a. Comparative Mining Costs:

	<u>1956</u>	<u>1955</u>
Product	218,000	234,000
Underground Costs	\$ 3.555	\$ 3.438
Surface Costs	.519	.450
General Mine Expenses	<u>.575</u>	<u>.570</u>
Cost of Production	\$ 4.649	\$ 4.458
Depletion:		
Original Cost	.076	.075
Depreciation:		
Plant and Equipment	.052	.080
Movable Equipment	.004	.005
Amortization:		
Development	.000	.011
Taxes	.126	.152
Loading and Shipping	.091	.119
Rental of Shaft Facilities	<u>.151</u>	<u>.154</u>
Total Cost at Mine	\$ 5.149	\$ 5.054
Budget - Estimated Cost per Ton	\$ 5.171	\$ 5.197
Number of Shifts and Hours	227 2-8	234 2-8
Total 8 Hr. Operating Shifts	454	468
Number of Operating Days	227	234
Average Daily Product	960	1,000

Proportion of Labor and Supplies

	<u>Amount</u>	<u>Per Ton</u>	<u>Per Cent</u>
Labor	\$ 814,135.16	\$ 3.735	73%
Supplies	308,275.66	1.414	27
Total Cost at Mine	<u>\$ 1,122,410.82</u>	<u>\$ 5.149</u>	<u>100%</u>

CAMBRIA-JACKSON MINE
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4. COST OF OPENING, EQUIPPING,
DEVELOPING AND OPERATING: (Cont'd)

	1956		1955	
	Amount	Per Ton	Amount	Per Ton
b. Detailed Cost Comparison(Operating):				
Development	\$ 84,348.58	.387	\$ 182,173.12	.779
Mining	270,539.44	1.241	213,146.13	.911
Tramming	176,393.27	.809	150,366.86	.642
Auxiliary Hoisting	37,123.94	.170	20,170.76	.086
Ventilation	10,282.42	.047	7,489.34	.032
Pumping	21,449.74	.098	30,583.81	.131
Compressor and Air Lines	25,820.84	.118	31,165.25	.133
Underground Superintendence	58,347.71	.268	64,657.02	.276
Maint: Pockets and Chutes	1,881.58	.009	3,221.56	.014
Mining Equipment	12,345.11	.057	18,161.45	.078
Levels and Cross-cuts	15,596.07	.072	22,403.84	.096
Shaft	6,518.07	.030	5,889.55	.025
Vacation Pay	34,459.84	.158	33,356.70	.143
Holiday Allowance	10,261.24	.047	12,675.68	.054
Telephones and Safety Devices	9,526.30	.044	8,958.09	.038
Total Underground Costs	\$ 774,894.15	3.555	\$ 804,419.16	3.438
Hoisting	\$ 34,437.10	.158	\$ 29,141.02	.125
Stocking	21,281.65	.098	18,119.22	.077
Timber Yard	14,375.88	.066	12,065.31	.052
Dry House	10,389.12	.048	9,003.23	.038
Policing	13,909.83	.064	14,009.44	.060
General Surface	6,629.96	.030	9,612.71	.041
Maint: Headframe Building and Equipment	548.15	.002	305.11	.001
Other Mine Buildings	1,192.27	.005	950.58	.004
Vacation Pay	7,671.44	.035	8,629.00	.037
Holiday Allowance	2,562.60	.012	3,238.08	.014
Telephones and Safety Devices	232.74	.001	298.03	.001
Total Surface Costs	\$ 113,230.74	.519	\$ 105,371.73	.450
Geological Department	\$ 889.25	.004	\$ 2,475.80	.011
Mining Engineering Department	3,375.30	.016	5,289.81	.022
Mechanical & Electrical Engineering Depts.	1,721.01	.008	2,995.43	.013
Safety Department	2,651.72	.012	2,928.26	.013
Research Laboratory	1,926.06	.009	3,920.18	.017
Analysis and Grading	17,971.44	.082	15,352.82	.065
Special Expenses - Pensions, Etc.	3,715.56	.017	4,843.60	.020
Ishpeming Office	28,000.87	.128	29,456.45	.126
Mine Office	18,759.21	.086	24,439.67	.104
Central Warehouse Overhead	1,780.29	.008	2,763.23	.012
Insurance	11,833.21	.055	12,878.21	.055
Personal Injury	7,290.37	.033	5,374.46	.023
Taxes - Unemployment Insurance	3,627.10	.017	1,852.86	.008
Taxes - Old Age Benefit	12,233.04	.056	12,871.01	.055
Employees Insurance & Comp.	10,695.64	.049	5,514.66	.024
Fire Loss	000.00	.000	448.21	.002
Power Credit	1,191.04	.005	0,000.00	.000
Total General Mine Expenses	\$ 125,279.03	.575	\$ 133,404.66	.570
COST OF PRODUCTION	\$ 1,013,403.92	4.649	\$ 1,043,195.55	4.458

CAMBERIA--JACKSON MINE
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4. COST OF OPENING, EQUIPPING,
DEVELOPING AND OPERATING: (Cont'd)

b. Detailed Idle Costs:
(Idle - Due to Steelworkers' Strike 1956)

UNDERGROUND COSTS

Ventilation	\$ 132.58
Pumping	1,400.21
Compressors and Air Lines	432.66
Underground Superintendence	4,988.35
Maint: Mining Equipment	265.14
Holiday Allowance	77.92
Telephones & Safety Devices	<u>89.47</u>
Total Underground Cost	\$ 7,386.33

SURFACE COSTS

Hoisting	\$ 1,125.20
Dry House	83.31
Policing	1,391.76
General Surface	65.04
Holiday Allowance	<u>203.36</u>
Total Surface Cost	\$ 2,868.67

GENERAL MINE EXPENSES

Geological Department	\$ 19.92
Mining Engineering Department	296.69
Mechanical Engineering Dept.	51.86
Safety Department	228.00
Research Laboratory	90.93
Analysis & Grading - Laboratory	468.04
" " " - Shipping	168.00
Special Expense - Pensions	4.00
" " - Retirements	182.00
" " - Hygiene Clinic	102.19
" " - Employment Off.	48.00
Ishpeming Office	3,084.00
Mine Office - Supt. & Clerks	1,850.49
Central Warehouse Overhead	123.77
Insurance - Property	150.14
" - Group, Health & Life	290.06
" - Group Annuity	563.08
" - Catastrophe	114.00
Personal Injury - Comp. & Doctors	88.20
Taxes - Unemployment Insurance	20.35
" - Old Age Benefit	107.72
Electrical Engineering Dept.	284.20
Employees Ins. & Comp.	<u>303.48</u>
Total General Mine Expenses	\$ 8,639.12
Cost of Production	\$ 18,894.12

CAMBRIA-JACKSON MINE
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5. ESTIMATE AND
ANALYSIS OF
ORE RESERVES:

The net ore reserves reported to the Tax Commission on December 31, 1956 were 108,318 tons. Production for the year totaled 218,000 tons, however the net ore reserves decreased 263,803 tons. The additional loss in reserves was caused by a horse of jasper in the East Deposit which was not known at the time of the previous estimate. All of the ore reserves at the Cambria-Jackson Mine are located in the Jackson Strip.

	<u>Jackson Strip Sulphurous</u>	<u>Mather Mine "B" Shaft Sulphurous</u>	<u>Total</u>
Between 6th and 7th Levels	9,750	-	9,750
Between 7th and 8th Levels	<u>209,963</u>	<u>37,550</u>	<u>247,513</u>
Total Gross as of July 31, 1956	219,713	37,550	257,263
Less Prod. July 31 to Dec. 31, 1956	<u>89,424</u>	-	<u>89,424</u>
Total Gross as of Dec. 31, 1956	130,289	37,550	167,839
Less 10% for Mining Loss and Rock	<u>21,971</u>	<u>3,755</u>	<u>25,726</u>
Net Total as of Dec. 31, 1956	108,318	33,795	142,113

Expected Average Natural Analysis of Ore Reserves as of December 31, 1956:

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>	<u>Moist.</u>
Jackson	142,113	52.00	.079	7.79	.18	2.41	.57	.30	.131	2.50	12.40

CAMBRIA-JACKSON MINE
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6. LABOR AND WAGES:

a. Comments:

There were no grievances presented in either 1955 or 1956. This is an excellent demonstration of the very good labor relations at this property.

During the first quarter of the year 8 contract miners were transferred to the Mather Mine "B" Shaft, because of the shortage of miners at this latter property. These transfers accounted for the major decrease in the number of men on the payroll at the end of the year.

b. Employment Record:

At the end of the year 144 men were employed at the mine, which represents a net decrease of 10 employees for the year.

Number of Men 1/1/56		154
Losses - Quit	2	
- Retired	2	
- Transferred	15	- 19
	<u>19</u>	<u>135</u>
Gains - Rehired	1	
- Transferred	3	
- Returned service men	5	+ 9
	<u>9</u>	
Total on Payroll 12/31/56		144

c. Vacations and Holidays:

The men benefited by five paid holidays which were as follows: New Year's, Memorial Day, Labor Day, Thanksgiving and Christmas. This was in accordance with the provisions of the labor contract.

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6. LABOR AND WAGES: (Cont'd)

d. Comparative Statement of Wages and Product:

	<u>1956</u>	<u>1955</u>	<u>Increase or Decrease</u>
<u>Average Wages per Day:</u>			
Surface	\$ 21.13	\$ 19.60	\$ 1.53
Underground	23.10	21.25	1.85
Total	\$ 22.64	\$ 20.87	\$ 1.77
<u>Average Wages Contract Miners:</u>	\$ 24.10	\$ 24.30	\$.20
<u>Average Wages per Month:</u>			
Surface	\$ 436.05	\$ 382.25	\$ 53.80
Underground	476.70	414.04	115.72
Total	\$ 467.21	\$ 406.81	\$ 60.40
<u>Tons per Man per Day:</u>			
Surface	27.76	27.58	.18
Underground	8.40	8.12	.28
Total	6.45	6.27	.18
<u>Labor Cost per Ton:</u>			
Surface	\$.761	\$.711	\$.050
Underground	2.752	2.617	.135
Total	\$ 3.513	\$ 3.328	\$.185

CAMBRIA-JACKSON MINE
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7. SURFACE:

During the year the two 1-3/8" hoisting ropes were replaced. On September 19, 1956 the east hoist rope was changed when an excessive number of broken wires suddenly appeared in the rope. This 2,100' hoist rope was installed on May 1, 1954 and hoisted 271,587 tons of ore and rock. The west hoist rope was replaced on November 3, 1956 after the diameter of the rope became below gauge. A total of 272,847 tons of ore and rock were hoisted from June 12, 1954 to November 3, 1956. This tonnage is the anticipated amount for a hoist rope at this property.

The north stocking trestle was completely repaired during the year.

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8. UNDERGROUND:

a. General:

Of the yearly tonnage produced at the Cambria-Jackson Mine 3,300 tons, or 1.51%, was mined from the 7th Level and 214,700 tons, or 98.49%, from the 8th Level.

Due to the decreasing number of mining areas, the number of mining contracts was reduced from 10 to 8 during the year.

Mining above the 7th Level was completed during the spring of 1956 when a crew of miners sub-caved a small pillar of ore in the East Deposit.

All of the ore mined from the 8th Level is trammed to the 8th Level storage trench and transferred to the 7th Level by a 30" conveyor belt. The ore is then trammed from a storage bin to the 7th Level skip pocket at the shaft.

The 30" conveyor belt between the 7th and 8th Levels was replaced on December 15, 1956, after the carcass had deteriorated to the point that further vulcanizing became impossible. The 1,200' conveyor belt, which was installed in January 1951, handled 1,283,388 tons of ore and rock.

East Deposit:

Development and mining, which totaled 203,651 tons, continued in this ore body which is located adjacent to an inferred fault zone. This deposit starts above the 7th Level and plunges to the southeast towards the Mather Mine "B" Shaft. The sulphur analysis varies throughout the area, with the upper portion of the deposit being predominantly standard ore and the lower portion high sulphur ore. During 1957 practically all of the Cambria-Jackson production will come from this area.

Central Deposit:

At the end of the year one crew began to develop the bottom limits of this sulphurous deposit at the 8th Level elevation. Production from this deposit, which will be scraped directly into the 8th Level storage trench, should total 30,000 tons during 1957.

West Deposit:

Sub-caving at top-timber height above the 8th Level was completed by two crews of miners. A total of 14,349 tons of sulphurous ore was mined from this area during the year.

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8. UNDERGROUND: (Cont'd)

b. Exploration:

The diamond drilling exploration program carried out in 1956 totaled 6 holes and 1,074 feet, compared with 12 holes and 2,332 feet drilled in 1955.

The exploration drilling was confined to the 8th Level East Deposit, all holes being drilled downward to explore for and outline the ore below the 8th Level.

This orebody is bounded on the north by a dike and extends downdip into the Mather Mine "B" Shaft 5th Level mining area. The orebody is irregular in shape, the upper portion being standard grade ore and the lower portion being high sulphur ore.

Hole No.	Level	From	Footage	Ore	Total Depth	Location	Purpose
232	8	0	128	0	128	840 X-Cut	Explore
233*	6	0	602	0	602	Main Level	Subsidence
234	8	0	139	95	139	-180 Sub	Explore
235	8	0	200	16	200	-180 Sub	Explore
236	8	0	206	61	206	-180 Sub	Explore
237	8	0	244	159	244	-180 Sub	Outline
238	8	0	157	85	157	-180 Sub	Outline
Totals	6		1,074	416			

* Not included in totals.

Hole #233 is a subsidence hole drilled due south from the east end of the 6th Level to intercept the Mather "B" cave area as it progressed upward and to delineate its northern boundary.