

**THE CLEVELAND-CLIFFS IRON COMPANY**

**Ore Mining Department**

**ANNUAL REPORT OF GENERAL MANAGER**

**For Year Ending December 31, 1954**

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THE CLEVELAND-CLIFFS IRON COMPANY  
ORE MINING DEPARTMENT

Manager's Annual Report Year 1954

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CLIFFS SHAFT MINE  
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I. GENERAL

The production in 1954 was 444,307 tons and the budget estimate was 452,931 tons. The operating schedule was 3-8 hour shifts per day with hoisting on 2-8 hour shifts per day for 5 days per week through March 31, 1954. Effective April 1st, the operating schedule was reduced to 4 days a week. The mine was idle two weeks in July for vacation purposes and there were no other shutdowns during the year.

The Cost of Production was \$6,526 and the total cost was \$7,285 compared with \$5,933 and \$6,525 respectively in 1953. The increase in wages and supply costs, together with some loss in production due to less mining contracts and continued emphasis on improving the quality of the lump grade, accounts for the higher costs.

There was an average of 71 contracts in the mine compared with 77 in the previous year. The reduction in contracts was partly due to the transfer of some miners to the shaft-sinking crew. Depletion of stoping areas was also responsible for a reduction in the number of contracts.

Shipments totalled 428,217 tons leaving a balance of all grades totalling 131,254 tons on hand at the end of the year. This compares with a total of 115,164 tons on hand at the end of the previous year. The current year's overrun from stockpile was 5,356 tons and pocket overrun was 3,181 tons. The bulk of the shipments was made from the stockpile and excepting the Crushed grade, the mine product was stockpiled throughout most of the year. This assured better blending of the lump ore shipments and allowed for better clean-up of the old piles.

The mixing agreement with the Oliver Mining Division was put into effect July 1, 1954. This agreement allows Fee and Lease ore to be mixed after being hoisted and placed on stockpile under present condition but when the "C" Shaft comes into operation, the crude ores will be mixed in storage raises underground.

The product has continued to be screened to -2" fines and +2" lump, yielding an average during the year of 70.3% lump and 29.7% fines. A 30" x 42" Jaw crusher was installed in the old crusher building and put into operation in June. Second class ore that is too lean to be graded with the Lump ore is now processed through primary and secondary crushing as a third grade.

Construction has continued throughout the year on the "C" Shaft project under E. & A. CC-560. Shaft sinking was started in May and 1,062 feet of shaft was advanced to reach the crusher station elevation below the 15th level at the close of the year. C. R. Meyer & Sons Company completed construction of the concrete tower headframe and the structural steel upper section was erected under contract with Wisconsin Bridge & Iron Company. The major part of the manway and service tunnel from "C" Shaft to the Dryhouse was also constructed. The south wing of the Engine House is being renovated to provide room for installation of three M.G. sets for the new hoists and their control panels.



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2. PRODUCTIONa. Production by Grade and Months

Month	Optg. Days	CLIFFS SHAFT		BANCROFT		SECTION 10		Total	Rock
		Lump	Crushed	Lump	Crushed	Lump	Crushed		
Jan.	20	19,688	8,021	4,473	1,778	4,307	1,739	40,006	5,844
Feb.	20	20,645	8,424	3,780	1,519	6,226	2,530	43,124	3,730
March	23	22,649	9,238	4,157	1,724	7,859	3,171	48,798	3,934
April	18	21,385	8,305	2,407	940	4,782	1,853	39,672	3,426
May	16	20,705	6,625	3,504	1,286	3,353	1,236	36,709	3,188
June	18	20,620	7,659	2,078	709	7,973	2,715	41,754	4,546
July	8	10,205	5,391	838	404	1,703	949	19,490	1,828
August	18	19,050	11,474	2,160	866	3,802	1,526	38,878	4,642
Sept.	17	17,155	8,602	1,887	732	3,457	1,344	33,177	9,010
Oct.	16	14,279	8,043	973	387	3,086	1,201	27,969	3,276
Nov.	17	13,239	11,013	3,618	1,360	2,626	989	32,845	2,656
Dec.	18	17,081	9,792	2,961	1,243	3,970	1,482	36,529	3,620
Total		216,701	102,587 <sup>o</sup>	32,836	12,948 <sup>o</sup>	53,144	20,735 <sup>o</sup>	438,951	49,700
Current Year's Stkpile Overrun				2,280	-37	3,169	-56	5,356	
Total	209	216,701	102,587	35,116	12,911	56,313	20,679	444,307	49,700

(<sup>o</sup>) Includes 20,720 tons of Intermediate Grade ore processed through secondary crushing

b. Shipments

	Pocket Tons	Stockpile Tons	Total Tons 1954	Last Year Tons
Cliffs Shaft Lump	45,054	181,086	226,140	255,260
Cliffs Shaft Crushed	43,123	51,647	94,770	113,881
Bancroft Lump	6,777	21,617	28,394	42,495
Bancroft Crushed	4,389	7,847	12,236	18,781
Section 10 Lump	15,019	31,008	46,027	60,821
Section 10 Crushed	8,680	11,970	20,650	26,477
Total	123,042	305,175	428,217	517,715

c. Ore Statement

	CLIFFS SHAFT		BANCROFT		SECTION 10		Total	Total Last Yr.
	Lump	Crushed	Lump	Crushed	Lump	Crushed		
On Hand Jan. 1, 1954	86,946	14,262	4,181	1,879	5,282	2,614	115,164	81,618
Output for Year	220,390	98,898	35,317	12,710	56,700	20,292	444,307	551,261
Total	307,336	113,160	39,498	14,589	61,982	22,906	559,471	632,879
Shipments	226,140	94,770	28,394	12,236	46,027	20,650	428,217	517,715
Balance on Hand	81,196	18,390	11,104	2,353	15,955	2,256	131,254	115,164
Decrease in Output							105,473	

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2. PRODUCTION (Cont'd)

d. Working Schedule

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

<u>Year</u>	<u>Schedule</u>
1954	- 3-8 hr. shifts per day with hoisting on 2-8 hr. shifts per day, 5 days per week Jan. 3rd through March 31st - 4 days per week April 1st through December 31st.
1953	- 3-8 hr. shifts per day with hoisting on 2-8 hr. shifts per day, 5 days per week.
1952	- 3-8 hr. shifts per day with hoisting on 2-8 hr. shifts per day, 6 days per week May 1st to Nov. 15th - 5 days per week Nov. 15th through Dec. 31st.
1951	- 3-8 hr. shifts per day with hoisting on 2-8 hr. shifts per day, 6 days per week.
1950	- 3-8 hr. shifts per day with hoisting on 2-8 hr. shifts per day, 5 days per week Jan. 1st - Feb. 5th; 6 days per week Feb. 5th - May 22nd; 5 days per week May 22nd - Aug. 21st; 6 days per week Aug. 21st - Dec. 31st.

e. Production Delays

The only major delay occurred on September 15th when the bearing pedestal broke loose on pinion shaft of the "B" Shaft hoist. Loss in production on this account was 2,500 tons.

3. ANALYSIS

a. Average Mine Analysis of 1954 Output

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
°Combined Cliffs Shaft Lump	58.63	.106	9.07
Combined Cliffs Shaft Crushed	55.87	.106	12.11
Cliffs Shaft Lump	59.27	.107	8.24
Cliffs Shaft Crushed	56.21	.107	11.47
Sec. 10 & Bancroft Lump	59.63	.118	8.49
Sec. 10 & Bancroft Crushed	56.65	.125	11.72

(°) Combined Cliffs Shaft ore represents ore produced after July 1st, 1954 when the mixing agreement was executed.

b. Average Analysis of Shipments for 1954:

<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>
Lump Ore	(°)	59.28	.112	8.79	.27	2.16	1.04	.94	.007	1.42	.51
Crushed Ore	(°)	56.53	.116	11.38	.25	2.55	1.16	1.05	.010	1.70	2.23
Intern. Ore	(°)	53.17	.105	15.40	.34	2.57	1.17	1.48	.007	1.81	2.23

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



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3. ANALYSIS (Cont'd)c. Average Analysis of Ore in Stock Dec. 31, 1954

<u>Grade</u>		<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Combined C. S. Lump	Dried	58.60	.104	8.83	.27	2.46	1.14	.94	.007	1.72	-
	Nat'l.	58.30	.104	8.78	.27	2.45	1.13	.94	.007	1.71	.51
" C. S. Crushed	Dried	57.14	.106	11.28	.25	2.55	1.16	1.05	.009	1.70	-
	Nat'l.	55.87	.104	11.03	.24	2.49	1.13	1.03	.009	1.66	2.23
Cliffs Shaft Lump	Dried	58.81	.103	9.65	.31	2.15	.90	.80	.011	1.05	-
	Nat'l.	58.61	.103	9.62	.31	2.14	.90	.80	.011	1.05	.34
Combined C. S. Crushed-Interm.	Dried	54.07	.097	14.41	.34	2.67	1.27	1.48	.005	1.81	-
	Nat'l.	52.93	.095	14.11	.33	2.61	1.24	1.45	.005	1.77	2.10

Intermediate was separated from the crushed in stockpile at the end of shipping season.

4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATINGComparative Mining Costs

Product	<u>1954</u>		<u>1953</u>	
	<u>Amount</u>	<u>Cost/Ton</u>	<u>Amount</u>	<u>Cost/Ton</u>
	444,307		551,261	
Underground Costs	\$1,953,826.29	4.397	\$2,334,277.90	4.234
Surface Costs	320,743.40	.722	340,236.61	.617
General Mine Expense	625,114.41	1.407	596,216.51	1.082
Cost of Production	2,899,684.10	6.526	3,270,731.02	5.933
Depreciation	45,085.65	.101	36,769.00	.067
Taxes	233,164.45	.525	233,164.45	.423
Loading & Shipping	59,060.83	.133	56,313.06	.102
Total Cost At Mine	\$3,236,995.03	7.285	\$3,596,977.53	6.525
Budget: Estimated Cost Per Ton		6.601		6.284
Number of Shifts and Hours		2-8 hr.		2-8 hr.
Number of Days Operated		209		249
Average Daily Product		2,151 tons		2,214 tons



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4. COST OF OPENING, EQUIPPING, DEVELOPING & OPERATING

Detailed Cost Comparison

	<u>Total 1954</u>		<u>Total 1953</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs</u>				
Development	\$ 213,095.75	.478		
Mining	842,337.53	1.895		
Tramming	380,087.46	.854		
Ventilation	4,210.33	.010		
Pumping	37,970.97	.085		
Compressors & Air Lines	66,524.07	.150		
Underground Superintendence	149,424.93	.340		
Maint: Pockets & Chutes	63,187.47	.143		
" Mining Equipment	187,868.89	.422		
" Shaft	9,118.89	.020		
Total Underground Costs	1,953,826.29	4.397	\$2,334,277.90	4.234
<u>Surface Costs</u>				
Hoisting	71,428.70	.160		
Crushing & Screening-Surf.	93,261.65	.210		
Stocking	51,896.46	.117		
Timber Yard	4.27	-		
Dry House	22,685.75	.051		
Policing	14,738.98	.033		
General Surface	32,394.38	.073		
Maint: Headframe Bldg. & Equip.	12,252.58	.028		
" Other Mine Buildings	22,080.63	.050		
Total Surface Costs	320,743.40	.722	340,236.61	.617
<u>General Mine Expenses</u>				
Geological Department	19,965.51	.047		
Mining Engineering Department	26,022.88	.060		
Mech. & Elect. Eng. Department	30,228.10	.069		
Safety Department	8,235.48	.018		
Research Laboratory	1,688.04	.004		
Analysis & Grading-Laboratory	49,364.20	.111		
" & " -Shipping	7,546.92	.017		
Telephones & Safety Devices	30,240.65	.068		
Welfare - General	4,235.84	.009		
" - District	634.18	.001		
Special Expense - Pensions	121.87	-		
" " - Retirements	6,634.34	.015		
" " - Legal	3,646.54	.007		
" " - Hygiene Clinis	9,257.18	.021		
" " - Employment Off.	1,999.95	.004		
Ishpeming Office	78,427.28	.177		
Mine Office - Supt. & Clerks	52,529.26	.115		
Central Warehouse Overhead	21,064.43	.050		
Insurance-Property	2,799.24	.006		
" -Group, Health & Life	27,240.29	.061		
" -Group Annuity	14,493.14	.033		
" -Catastrophe	4,856.67	.011		
Personal Injury-Comp.&Doctors	15,218.31	.034		
" " -Comp. Dept.	3,203.50	.007		
Vacation Pay-Current Year	90,248.89	.203		
" " -Prior Year Adj.	1,400.01	.003		
Holiday Allowance	49,211.07	.110		



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

Detailed Cost Comparison (Cont'd)

	<u>Total 1954</u>		<u>Total 1953</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>General Mine Expenses</u> (Cont'd)				
Taxes - Unemployment Insurance	\$ 18,871.37	.042		
" - Old Age Benefit	34,270.64	.077		
Design Department	14,294.61	.033		
Greenhouse Expense	111.44	-		
Retroactive Pay Adjustment	147.40	-		
Total Gen. Mine Expenses	625,114.41	1.407	596,216.51	1.082
<b>COST OF PRODUCTION</b>	<b>\$2,899,684.10</b>	<b>6.526</b>	<b>\$3,270,731.02</b>	<b>5.933</b>

Due to change in Cost Sheet forms, only total figure is used for 1953.

The increase in Cost of Production, compared with 1953, is due principally to the lower production because of the reduced operating schedule after April 1st. The reduction in number of mining contracts resulting from depletion of ore areas and the continued emphasis on improving the quality of the lump grade also affected production and mining costs adversely.

The following are some major items of expense charged to operating:

Underground Costs - A substantial amount of new equipment was charged to this account to replace obsolete drills and provide sufficient loading equipment for the development program.

Surface Costs - This expense increased for the following reasons: 1) About 1300' of wood water main into the mine had to be replaced with new 6" cast-iron pipe, 2) A temporary heating plant was erected to supply heat to the new headframe, batching plant and equipment repair building, 3) A prefabricated metal building was provided for repairing mine equipment and 4) A new crusher mantel was purchased and major repairs made to the pan conveyor.

General Mine Expense - The total expense in this account was higher due chiefly to higher Ishpeming Office expense, Holiday Pay allowance and charging overhead expense on "C" Shaft Project to operating.

Expenditure & Authorization Summary

E. & A. CC-560 - New Shaft Project

E. & A. CC-560M was combined with CC-560 early in 1954; the total expenditure authorized is \$2,374,380.00 for sinking and equipping the new shaft. Expenditures up to and including December, 1954 were \$1,551,668.27. Work done under this E. & A. is detailed under Sections 7 & 8 of this report.

E. & A. CC-608 - Jaw Crusher for Intermediate Grade

Approval of an expenditure of \$32,000 was granted in November of 1953 for processing second-grade material through secondary crushing. A total amount of \$32,414.92 was charged to this account which was complete in June.

E. & A. CC-637 - Pettibone-Mulliken Loader

An expenditure of \$9,050 was authorized in September for the purchase of a Fork Lift loader to expedite supply handling. A total cost of \$8,851.96 was incurred under this E. & A.



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5. ESTIMATE & ANALYSIS OF ORE RESERVES

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

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

The annual increase in the estimated reserves is due largely to the method employed in making up the tax estimates. Experience has shown that extension of proven ore reserves for any considerable distance away from a working area has been an unreasonable assumption at this property due to the complex mine geology. As a result, much of the proven ore reserves and additions are based on an accumulated group of more or less standard ore extensions. This practice accounts for the same magnitude of proven ore reserves each year fluctuating somewhat according to depletion and ore development. The most significant ore reserve additions realized this year were those drilled from 8th level Northeast which are thought to extend to the mining limits.

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

	<u>Cliffs Shaft</u>	<u>Bancroft</u>	<u>Sec. 10</u>	<u>Total Lease</u>	<u>Total Tons</u>
Estimated Reserves-Dec. 31, 1953	1,018,058	152,854	389,823	542,677	1,560,735
Less 1954 Production	<u>319,288</u>	<u>48,027</u>	<u>76,992</u>	<u>125,019</u>	<u>444,307</u>
Balance as of 1953 Estimate	698,770	104,827	312,831	417,658	1,116,428
Est. Reserves-Dec. 31, 1954	<u>938,842</u>	<u>133,573</u>	<u>397,537</u>	<u>531,110</u>	<u>1,469,952</u>
New Developed Ore	240,072	28,746	84,706	113,452	353,524

Expected Average Analysis of Ore Reserves

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Magn.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Natural	57.50	.107	10.00	.35	2.10	.80	.80	.014	1.20	.85

The geological and engineering study of hard ore reserves, which was made in 1952, was reviewed in 1953 and 1954. Based on the 1954 revision and that portion of the second class ore which will be mined, the proven and probable ore reserve is estimated at 5,800,000 tons as of December 31, 1954. The reserves include first and second class ore in a ratio of approximately 75%-25% respectively. The second class ore is being mined as an intermediate grade and will eventually give a 52%-48% lump-crushed split.



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6. LABOR AND WAGES

Labor relations have been quite satisfactory during the year. There were four grievances submitted during the year and one from the previous year that are tabulated as follows:

<u>Name</u>	<u>Nature of Grievance</u>	<u>Step of Grievance Procedure</u>
Rudolph Hytinen-John Rolstone	Incentive rate revision	Arbitration (won)
Mine Timbermen	Work schedule	3 (dropped)
Carl Kurin	Holiday pay	3 (settled)
Leo Maki-Toivo Laitinen	Incentive pay	2 (settled)
Harold Kellow	Non-promotional posting	3 (dropped)
Eino Maki	Disciplinary lay-off	4 (pending)

Employment

No. of Men Beginning of Year		497
Separations	30	
Added During Year	<u>22</u>	
Decrease in Men	8	<u>8</u>
Total End of Year		489
Avg. No. of Men as per Labor Statement (Statistical)		460
Avg. Absenteeism (Statistical)		23

The following table shows a classification of separations in 1954:

	<u>No. of Men</u>
Military Service	3
Quit	6
Retired	11
Transfers	1
Discharged	5
Deceased	<u>4</u>
Total	30

During 1954, 164 employees were eligible for three week vacations, 179 for two weeks and 117 for one week with the remainder not eligible for vacation privileges.

Statement of Wages

a. Average Wages Per Day

	<u>1954</u>	<u>1953</u>
Total Surface & Underground	19.64	18.91

Figures above for 1953 include retroactive and holiday pay.

b. Average Wages Per Month

	<u>1954</u>	<u>1953</u>
Total Surface & Underground	343.70	410.58

The mine operated an average of  $17\frac{1}{2}$  days per month in 1954 while averaging  $20\frac{3}{4}$  days per month in 1953.

c. Tons Per Man Per Day

	<u>1954</u>	<u>1953</u>
Total Surface & Underground	4.47	4.68

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6. LABOR & WAGES (Cont'd)

Statement of Wages (Cont'd)

d. Labor Cost Per Ton

	<u>1954</u>	<u>1953</u>
Total Surface & Underground	4.39	4.01

7. SURFACE

A. New Shaft

The new shaft development was continued under E. & A. CC-560. C. R. Meyers & Sons Company was awarded a contract in November, 1953 to construct the reinforced concrete headframe to a height of 60' above collar elevation. Following the completion of this portion in February, the balance of the concrete section was also awarded to Meyers and construction completed in August.

A contract for the fabrication and erection of the structural steel upper section of the headframe was let to Wisconsin Bridge & Iron Company in August. This construction was finished in November; meanwhile the same firm was awarded a contract for the balance of the structural steel and the siding.

A temporary engine house was erected and the sinking hoist installation completed late in June. Other construction comprised a concrete batching plant, service tunnel excavation and construction and footings and piers for the screening and loading pocket structure. A rotary dump for the shaft rock was installed in October when shaft stripping reached 15th level and the bottom of the shaft pilot raise.

Conversion of the south wing of the Engine House into a motor-generator room began in August. Work on M.G. set foundations, floor supports and floors continued intermittantly through December. A temporary heating boiler was installed late in the year to provide heat for the headframe, batching plant and M.G. set room.

B. Existing Plant

Under E. & A. CC-608, a 30" x 42" jaw crusher was installed within the framework of the existing crusher building. Work on the pocket and crusher was completed late in May. Ore that is too lean for grading with first class material is being processed through second-stage crushing.

The mixing agreement with Oliver Iron Mining Division became effective July 1st and Euclid truck stocking of the pocket ore was begun. Nearly all shipments for the balance of the year were from stockpile.

In October, several breaks in the cast-iron frame of the old gyratory crusher were so extensive that repair by metal-locking plus additional bracing around the frame had to be done.

A prefabricated metal building was erected for servicing and repairing mine equipment.



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8. UNDERGROUND

During 1954, a fairly heavy development program was maintained. New Shaft development, in addition to operational development, tied up the available equipment. Continued stress on analyses, depletion of a number of stoping areas, ore tied up by haulage and the reduced number of possible ore exploration areas all contributed to a reduction in the number of stoping contracts. These factors also have resulted in a larger proportion of the production coming from pillars.

A. New Shaft

A large portion of the development underground during the year was in conjunction with the new shaft project. Early in the year, shaft pilot raises and main-level extensions were completed. Ore-pass development, consisting of control subdrifts on 5th, 8th, 10th and 15th levels and raises extending from these drifts, were driven during the year.

The new shaft pilot raise was stripped to 15th level and sinking was carried to an elevation of  $+273'$  by the end of the year. Crusher station excavation was begun in December. The following tabulation summarizes the underground development progress by the end of 1954:

New Shaft Project Development Summary

<u>Level and Operation</u>	<u>Status</u>	<u>Cont. No.</u>	<u>Rock Footage to Date</u>
1st "B" - Drifting - Main	Complete	41	465'
5th "A" - " "	Complete	41	454'
8th "A" - " "	Complete	13,10,41	556'
10th "A" - " "	Complete	41	73'
15th "A" - " "	Complete	13	108'
			1656'
<u>Shaft Raise Development</u>			
2nd "A" to Ledge - Raising @ 90°	Complete	10	250'
5th "A" to 3rd - " @ 90°	Complete	47	61'
8th "A" to 5th - " @ 50°)			3')
	Complete	10	123')
10th "A" to 8th - " @ 90°	Complete	10	86'
15th "A" to 10th - " @ 50°)			19')
	Complete	47	230')
			772'
<u>Ore Pass Development</u>			
5th "A" - Drifting - Sub	Complete	104	31'
8th "A" - " - Sub	Complete	41	63'
10th "A" - " - Sub	Complete	13,52	75'
15th "A" - " - Sub	Complete	41,52	80'
			249'
5th "A" to 1st - Raising @ 50°	Complete	47	218'
8th "A" to 5th - " @ 50°	Incomplete	47	327'
10th "A" to 8th - " @ 50°	Incomplete	52	205'
15th "A" to 10th - " @ 50°	Incomplete	52	221'
			971'



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8. UNDERGROUND (Cont'd)

B. Mining Area

Many of the haulage drifts are in ore and, as a result, mining of inlying areas is continuously being tied up by tramming operations. There is a choice of (1) driving by-pass haulage drifts and mining out the area or (2) moving the contracts that become tied up by main-level haulage to outlying areas. Generally, the latter practice is being followed.

During the past year depletion and grade difficulties have made it necessary to concentrate a greater number of the stoping contracts on pillar recovery. At the beginning of the year, 16% of the stoping contracts were mining pillars and at the end of the year the proportion had increased to 23% of the contracts.

Sinking operations in the New Shaft took a number of miners away from production in June. A drill hole incentive plan for the miners and a scraping incentive plan for the scraper operators were expanded to cover stoping operations where conditions were favorable. Generally, the drill hole incentive contracts have replaced the double-shift stoping contracts. Since 1/3 to 1/2 of the stope labor is used in scraping, it was felt a specialization of the work would have certain advantages:

- (1) At least maintain and possibly increase production per stope over the double-shift stope rate by minimizing delays due to ventilation, adding flexibility and providing an incentive more in proportion to work output.
- (2) Scraping operations could be done more efficiently with a plan covering all scraping and at a lower job class.

In practice, these assumptions seem to be borne out. By the end of 1954, fourteen stoping contracts were on a drill hole footage incentive basis.

These changes have had an effect on the distribution of stoping contracts. Increased pillar recovery has brought more contracts within the "A" Shaft area while the drill hole incentive plan has tended to thin out the number of contracts where used in the "A" Shaft East and Section 10 Lease areas.

Distribution of Stopping Contracts

	<u>No.-Stopping Cont.</u>			<u>No.-Double-Shift Contracts</u>			<u>Total Cont. Shifts or Equiv.<sup>o</sup></u>		
	<u>12/52</u>	<u>12/53</u>	<u>12/54</u>	<u>12/52</u>	<u>12/53</u>	<u>12/54</u>	<u>12/52</u>	<u>12/53</u>	<u>12/54</u>
"A" Shaft	22	16	18	3	2	2	25	18	20
"B" Shaft	23	23	17	3	1	4	28	24	21
Banc. & "A" Shaft Northeast	12	11	11	1	1	2	13	12	13
Sec. 10 & Moro	10	11	10	7	7	6	17	18	16
"A" Shaft East	<u>6</u>	<u>7</u>	<u>5</u>	<u>0</u>	<u>2</u>	<u>1</u>	<u>6</u>	<u>9</u>	<u>6</u>
Total	73	68	61	14	13	15	87	81	76

(<sup>o</sup>) For each drill hole incentive contract there is a scraping contract.

The above comparison shows the decrease in stoping contracts due largely to depletion. Available stoping areas are decreasing as haulage tie-ups become more prominent and as exploration drilling reaches the point of diminishing returns. Mining or development is underway in practically every known ore body which is available for mining.



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8. UNDERGROUND (Cont'd)

B. Mining Area (Cont'd)

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

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

Development in "B" Shaft included main-level drifting on 1st, 5th and 15th levels. Eight raises were extended from 3rd, 5th and 8th levels. The 3rd and three of the 5th level raises were in the structure above 4th level proven by drilling on Lake Bancroft early in 1953. Raises to 3rd and 1st level provided shortened scraping distances and made available the 1st level by-passed area. The 8th level raise opened an area proven recently by diamond drilling on 7th level.

Depletion of eight stopes resulted in a net loss of five contracts compared with the previous year. Four contracts were put on a drill hole incentive to stimulate production. Only four of the 17 stoping contracts are mining below 3rd level and 8 of the total are the direct result of the short-range diamond drill program begun in 1949. Three contracts have only pillars as ore reserves.

The bulk of the first class ore reserves continue to lie above 1st level and in the "Lake Bancroft" structure. Development in the latter structure during the year reduced the extent of the ore reserves due to the thinning of the ore to the west on 2nd level.

2. "A" Shaft - (400 E - 2800 E, between the Bancroft & Section 10 Lease)

"A" Shaft development, other than new shaft, was minor for the year. Branch and secondary raises were provided for two contracts.

The number of stoping contracts increased by two as compared with 1953, largely due to the increased necessity of pillar recovery. Five contracts have no reserves other than pillars while nine contracts were mining pillars at the end of the year.

Reserves in "A" Shaft are dispersed and, in part, tied up by tramming operations. Exploration drilling has proven several extensions to known areas in the past year.

3. Bancroft & "A" Shaft Northeast

Considerable drifting has been done on 8th level northeast to develop a 2nd class ore area extending from 8th level to the mining limit. Drifting and raising from 15th was also done to allow mining below 10th level northeast in two areas. Raises were also extended from 8th level Bancroft and 12th level northeast to provide for contract relocation.

Depletion of two stopes resulted in no net loss of contracts as compared with the previous year. However, the number of contracts that can be maintained in this area is limited, in part, by ore haulage drifts, particularly on 10th level.

Reserves of first class ore are largely concentrated between 9th and 11th levels. In the northeast area, drilling and subsequent development has proven a large lean conglomerate ore structure running continuously from 12th level to the mining limit.

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8. UNDERGROUND (Cont'd)

B. Mining Area (Cont'd)

4. Section 10 Lease and the Moro Mine

Development in Section 10 was fairly extensive during the year. Two raises were extended from 8th to 7th, two from 10th to 8th and one branch raise from 8th to 6th to facilitate mining. Development of two shrinkage stopes included driving a considerable amount of subdrift and raise between 8th and 5th levels. Drifts were extended on 10th level to the east under two contracts, to the south adjacent to the Moro and to the west paralleling 8th level development.

The mining continues to be concentrated on 5th and 8th levels. All stoping contracts on 8th level Section 10 were put on a drill hole incentive about mid-year as miners from double-shift contracts were taken for the new shaft. As a result, the mining complement was reduced 42% while production per day averaged 20% less the last 6½ months of the year.

Since the reserves in this part of the mine amount to about 40% of the total, a gradual increase in production from this area is planned. Ventilation presents a problem in concentrating mining in the area. Most of the reserves above 5th level are now mined out and the major portion of the reserves lie in a continuous ore area extending from 5th to 10th level.

5. "A" Shaft East - (East of 2800 E and extending from the north boundary of Section 10 to 1200 S)

The only development in the "A" Shaft east area this year was a raise for mining in a 7th level #3 mine stope.

The number of contracts mining in this area was reduced by two due to depletion. Mining development in two areas began last year have been up to expectations while a 3rd area entered this year had to be stopped due to a combination of back conditions and ore thickness.

The known ore reserves changed little from last year outside of depletion. Faulting, however, apparently limits the structure being mined near the New York Mine on the north. Emphasis on mining the east and northeast areas will continue to be stressed as we attempt to deplete the outlying areas before retreating towards shaft.

C. Delimiting Ore

During the year, the short-range underground diamond drilling program was reduced from two to one rig. A total of 3,788' of drilling was done in 21 holes. The planning of the program was largely guided by the new shaft ore estimate and its subsequent revisions. Underground diamond drilling was done in all working areas of the mine.

The table below summarizes the material encountered:

<u>Hole Numbers</u>	<u>Material</u>	<u>Feet</u>	<u>Percent</u>
Series #895	Ore	281	7.4
to #917	Lean & 2nd Class Ore	402	10.6
	Iron Formation	813	21.5
	Intrusive	1,475	38.9
	Argillite & Quartzite	817	21.6
	Total	3,788	100.0



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8. UNDERGROUND (Cont'd)

C. Delimiting Ore (Cont'd)

Drilling in "A" Shaft, Section 10 and Bancroft Leases, "A" Shaft East and Northeast and "B" Shaft may be considered nearly complete. The old Moro Mine workings and "B" Shaft Far West workings remain to be drilled. Significant tonnage additions of second class ore were proven in the Bancroft Lease and "A" Shaft northeast areas.

The introduction of an underground diamond drill incentive resulted in a considerable labor savings per foot of hole drilled. The cost per foot also decreased as compared with 1953 due to longer holes being drilled with its proportionate reduction in moving time between set-ups.

D. New Equipment

A large portion of the equipment purchased in 1954 was in conjunction with (1) maintenance of existing plant, (2) the new plant, (3) our heavy development program and (4) gradual replacement of JB-4 type drill machines. The following major items of equipment were purchased in 1954:

<u>Item</u>	<u>Amount</u>
Crusher Mantle	\$ 1,640.00
Pan Conveyer	749.26
Hoist Ropes	2,005.73
Equipment Repair Bldg.	4,506.00
Water Line - Surface	2,984.00
Miners Lamps	6,241.69
Temporary Heating Plant	5,100.00
Shop Grinder	200.00
50-ton Press	461.56
3 Welders	1,562.00
New Pump Valves	1,027.80
Locomotive Battery	2,064.00
4" & 6" Air Lines	5,000.00
Air Saw	382.30
3 - JR38 Drill Machines	1,760.05
9 - Atlas 754 Drill Machines	5,206.49
4 - J50 Drill Machines	1,940.00
1 - CP50 Drill Machine	1,142.00
2 - Power Feeds	1,060.00
1 - BU Hoist	520.00
1 - 3 drum Joy Hoist	5,600.00
1 - #21 Eimco Loader	4,925.53
98 Scraper Blocks	<u>4,748.37</u>
Total	\$60,826.78

E. Explosives

Powder consumption per ton of ore increased substantially compared with 1953 due to the much greater carry-over of broken ore in the stopes at the end of 1954. The average price of powder increased from \$16.87 per cwt. to \$17.26 per cwt. The net result was an increased explosives cost per ton which is summarized in the following tables:

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8. UNDERGROUND (Cont'd)E. Explosives (Cont'd)

TABLE 1  
Cost of Explosives-Operating

	<u>Quantity</u>	<u>Avg. Price</u>	<u>1954</u>	<u>1953</u>
Powder - Lbs. - All kinds	490,550	17.26	\$84,665.51	\$96,130.08
Misc. Supplies (Caps, Fuse, Testers, etc.)			<u>33,543.03</u>	<u>35,059.89</u>
Total			\$118,208.54	\$131,189.97

TABLE 2  
Unit Cost & Consumption of Explosives

	<u>1954</u>	<u>1953</u>
Pounds Powder Per Ton of Ore	1.104	1.033
Tons Ore Per lb. of Powder	.906	.967
Cost Per Ton for Powder	.191	.174
Cost Per Ton for Blasting Supplies	.075	.064
Cost Per Ton for All Explosives	.266	.238

TABLE 3

	<u>1954</u>	<u>1953</u>
Cost Per Ton Developing	.057	-
Cost Per Ton Mining	.209	-
Total	.266	.238

F. Carset Bits

Since tungsten carbide bits were introduced into Cliffs Shaft, a footage record per bit has been kept for the purpose of determining the performance of various type bits and a comparison of costs. The following table shows the pertinent data:

<u>Description</u>	<u>Quantity</u>	<u>Price</u>	<u>Amount</u> <u>1954</u>	<u>Amount</u> <u>1953</u>
Ing. Rand, Series 113 - 1-3/8"	904	9.45	\$ 8,549.85	\$ 2,539.80
" " 113 - 1-1/2"	37	11.00	407.00	-
" " 115 - 1-5/8"	1,396	12.53	17,488.92	32,070.50
" " 115 - 1-3/4"	61	13.37	815.46	1,077.82
Rockbits " 113 - 1-3/8"	74	9.45	699.30	463.05
" " 115 - 1-5/8"	249	11.40	2,838.60	4,200.70
" " HM - 2-1/4"	1	19.10	19.10	-
" " HM - 2"	1	14.28	14.28	-
Copco " 113 - 1-1/2"	100	11.95	1,195.00	-
Timken " HM - 1-1/2"	48	11.00	528.00	979.80
Total	2,871	11.34	\$32,555.51	\$41,333.67
Production - Tons			444,307	551,261
Cost Per Ton For Ore			.073	.075
Feet Drilled - Rock & Ore			573,908	661,365
Average Feet Drilled per Bit			203	189
Cost Per Foot of Hole			.057	.063



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8. UNDERGROUND (Cont'd)F. Carset Bits (Cont'd)

Bit prices generally were higher this year compared to 1953. However, the average cost per bit was reduced due to the increased use of the 1-3/8" size bit as compared to the 1-5/8" size. A heavy development program has tended to maintain a high cost per ton.

G. Pumping

There have been no changes in the pumping equipment on the 15th level although work is in process on adopting a form of automatic pumping for the mine.

9. TAXES

Comparative data for 1954 and 1953 is shown below:

	<u>1 9 5 4</u>		<u>1 9 5 3</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Realty	3,275,000	127,561.25	3,270,000	127,366.50
Personal	1,111,100	43,277.35	816,100	31,787.10
Lot 2, Sec. 3,47-27-Bancroft	600,000	23,370.00	800,000	31,160.00
Lot 174, Nelson's Addition	100	3.90	100	3.90
S. 35.91 <sup>1</sup> of Lot 179	50	1.95	50	1.95
S $\frac{1}{2}$ of NW $\frac{1}{4}$ of Sec. 10, 47-27	<u>1,000,000</u>	<u>38,950.00</u>	<u>1,100,000</u>	<u>42,845.00</u>
Total Cliffs Shaft Mine	5,986,250	233,164.45	5,986,250	233,164.45
Taxes per ton produced		.525		.423
Taxes per ton shipped		.545		.450

10. ACCIDENTS & PERSONAL INJURY

Twelve compensable and five non-compensable injuries occurred in 1954 for a total time lost of 654 $\frac{1}{2}$  days. This record of 17 accidents compared with the 20 incurred during 1953 and ranked Cliffs Shaft fourth on Safety during 1954 among the Company's underground mines.

Comparison of Frequency and Severity in 1953 and 1954 is as follows:

<u>Year</u>	<u>Frequency</u>	<u>Severity</u>
1953	21.12	.600
1954	20.04	.771

Frequency Rate - Number of accidents for every 1,000,000 man hours

Severity Rate - Number of days lost per 1,000 man hours

A summary of the compensable accidents is listed below:

#1310 - Henry Hartikka - Motor Brakeman - February 20, 1954 - door on 15th level shack closed on hand - cut on right index finger - lost time, 37 days.

#1311 - Oscar Stolen - Scraper Operator - March 17, 1954 - while trying to get out of drift when raise came down, he slipped and fell. A chunk hit him on right shoulder - bruised right shoulder - time lost, 7 days.

#1312 - William Collins - Surface Laborer - March 29, 1954 - his left foot was caught between the trunion and cylinder fronthead on Bulldozer, while hauling steel - fracture of first phalanx - lost time, 135 days.



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10. ACCIDENTS & PERSONAL INJURY (Cont'd)

#1313 - Robert E. Anderson - Contract Miner - March 23, 1954 - he had been tramping ore from a drift heading to a transfer raise while his partner was cleaning out the drift with a mechanical loader. Anderson was injured while alone during a return trip with an empty car. The pin holding the right front wheel had broken allowing the wheel to slide off. The car tipped and Anderson was thrown from his position on the motor and in between the car and locomotive. His right leg was pinned between the car coupling and the motor frame. Injuries were punctured wound, lower leg, right, just below knee, contusions, surface and muscular, lower right leg - lost time, 75 days.

#1315 - Herman Paju - Contract Miner - May 12, 1954 - while carrying a powder box from 10th level to 11th, a 1" x 24' pipe fell through a hole on the side of the stage and struck him on the back of the head - contusions and bruises, occipital region, abrasion left side of face and right leg below knee - lost time, 17 days.

#1316 - Walter Jensen - Surface Laborer - May 18, 1954 - while unloading stumps from truck, stump rolled causing employee to twist arm - fractured radius - lost time, 47 days.

#1317 - Arvid Anderson - Trammer Boss - August 18, 1954 - while putting safety chain across the edge of pocket on 10th level, "B" Shaft, he slipped and fell into pocket - fracture, simple, tibia and fibula, left lower 1/3 - lost time, 90 days.

#1318 - Alfred Harvela - Contract Miner - August 11, 1954 - while drilling, a piece of ore broke loose and fell on his left foot - lacerations and contusions of left foot - lost time, 10 days.

#1319 - Russell Argall, Jr. - Shaft Miner - October 7, 1954 - while working in bottom of "C" Shaft, something struck him on left foot. What hit him or where it came from has never been determined. Injuries - fracture of left malleolus - lost time, 42 days.

#1321 - Leslie Kelly - Blacksmith, Surface - September 23, 1954 - Injured man was in process of flaring a piece of pipe 2" x 7". As he took the piece of pipe out of the forge and turned towards the anvil his left knee collapsed and he fell to the floor - sprained left knee with bursitis - lost time, 90 days.

#1322 - Norbert Grant - Contract Miner - July 14, 1954 - while walking into his working place off 10th level along travel way in stope bottom, he slipped and fell backward and landed on his battery case - pain in lower part of back and possible slipped disk - lost time, 100 days.

#1323 - Gardner Bess - Shaft Miner - December 27, 1954 - injured man and partner were taking up the tray and clam after the mucking cycle. The cage was near the shaft bottom where only the temporary guides were installed. Bess had his right arm around the tray and protruding slightly out from the cage in the position of the permanent runners. His arm was caught under the runner before the cage could be stopped - severe contusion of right arm - lost time 20 days.

11. POWER

The power cost for 1954 compares favorably with the cost in 1953:

	<u>1954</u>	<u>1953</u>
K. W. H.	7,153,135	8,622,471
Average Cost Per K.W.H.	.0093796	.016986
K.W.H. Per Ton	16.1	14.5
Cost Per Ton	.168	.248

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11. POWER (Cont'd)

The increase in K.W.H. consumption per ton is due to the absorption of nearly all energy charges except new shaft hoisting into operating accounts. A sizeable reduction in cost to the mine has resulted from corporate charges.

Since the Cliffs Power & Light Company was dissolved on January 1, 1954, the Company's electric power department has been supplying the mine's power. Energy charges are pro-rated each month on the basis of the K.W.H. used and the actual cost of producing power the previous month. A line charge paid to the Upper Peninsula Power Company is added to the rate. At the end of the year an adjustment is made for the one month lag in rate calculation.

During the year there was no delay of a prolonged nature due to power failure which interfered with production.



HUMBOLDT MINE  
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1. GENERAL:

Production started at the Humboldt Mine in February with the first crude ore passing through the crushing plant on the 22nd. By the end of the year 169,366 tons of concentrates had been produced analyzing 62.28% Iron Dry and 9.16% Silica. Field work by O. W. Walvoord, Inc., contractor for construction of the plant, was concluded on February 19th and the few projects not then finished were completed by Cleveland-Cliffs personnel.

Initial crude ore feed for the plant came from a 40,800 ton stockpile that had been produced principally in 1953 by wagon drilled hole blasting. This stockpile supplied the plant with crude ore until April 30th when the first blast of jet drilled holes was made.

A five day per week schedule was carried on to May 1st at which time a seven day per week schedule went into effect. In the concentrator, operations were maintained on a single shift basis until March 9th, after which a three shift per day schedule was started. With this schedule, Thursday day shift was selected for repair day in the concentrator.

Operations were maintained on a continuous basis to November 23rd at which time a two week shut down was scheduled for maintenance and plant changes. The purpose of the changes was primarily to modify the crushing and feeding facilities so that operations under winter conditions could be more easily maintained.

Stripping was carried on nine months of the year. Stripping of the first and second knob areas to the 1585' elevation was completed and the third knob area was approximately half completed.

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	281	1 & 2	8	513
Hauling & Crushing	269	1	8	269
Mill Operating	269	1, 2 & 3	8	780

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1. GENERAL:

Production at the Humboldt Mine was started in February, with the first crude ore passing through the crushers on the 22nd. By the end of the month 22 tons of concentrate had been produced. Field work by the O. W. Walvoord, Inc. was concluded on February 19th and on March 15th the John Hennes Trucking Company completed the final sub contract for O. W. Walvoord. Various projects not finished by the contractors involved were completed by Cleveland Cliffs personnel.

At the first of the year there were 40,800 tons of crude ore in the stockpile, produced principally by wagon drilling. This stockpile plus ore mined by wagon drilling supplied the plant with crude until April 30th when the first blast of jet drilled holes was made. The crude ore stockpile contained 40,920 tons at the close of the year.

A five day per week schedule was carried on to May 1st at which time a seven day per week schedule went into effect. In the concentrator, operations were maintained on a single shift basis until March 9th, after which a three shift per day schedule was started. With this schedule, Thursday day shift was selected for repair day in the concentrator.

Operations were maintained on a continuous basis to November 23rd at which time a two week shut down was scheduled for maintenance and plant changes. The purpose of the changes was primarily to modify the crushing and feeding facilities so that operations under winter conditions could be maintained.

Stripping was carried on nine months of the year. <sup>more easily</sup> Stripping of the first and second knob areas to the 1585' elevation was completed and the third knob area was approximately half completed.

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	281	1 & 2	8	513
Hauling & Crushing	269	1	8	269
Mill Operating	269	1, 2 & 3	8	780

*See revised copy  
attached*



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b. Production by months:

<u>Month</u>	<u>Tons of Crude</u>		<u>Tons of Concentrate</u>
	<u>Crushed</u>	<u>Milled</u>	
Feb. - March	22,860	22,860	6,977
April	23,560*	23,560	10,140
May	47,217	44,671	15,277
June	45,173	45,616	20,388
July	44,809	46,845	19,334
August	47,129	46,921	20,274
September	46,254	46,392	20,679
October	55,401	55,435	25,060
November	36,891	36,994	17,101
December	<u>34,414</u>	<u>34,272</u>	<u>14,126</u>
Total	403,708	403,566	169,356

c. Feed Rates by Months:

<u>Month</u>	<u>Long Tons Per Hour Gross</u>			<u>Long Tons Per Hour Net</u>		
	<u>Crusher Feed</u>	<u>Mill Feed</u>	<u>Concentrate</u>	<u>Crusher Feed</u>	<u>Mill Feed</u>	<u>Conc.</u>
Feb.-March	68.14	49.71	14.49	165.65	62.42	18.19
April	128.04	55.91	19.50	259.61	58.59	20.44
May	157.25	53.48	21.07	257.79	58.40	23.01
June	187.44	66.30	29.63	256.30	69.29	30.97
July	191.49	71.41	29.47	265.93	75.02	30.96
August	188.52	65.79	28.43	295.48	73.63	31.82
September	195.16	68.93	30.73	282.04	74.54	33.23
October	210.77	77.86	35.20	299.46	83.75	37.86
November	197.28	73.11	33.82	290.48	81.73	37.80
December	<u>192.80</u>	<u>75.16</u>	<u>30.98</u>	<u>282.08</u>	<u>81.64</u>	<u>33.65</u>
Year	187.21	65.98	27.69	272.50	71.98	30.21

\*Includes 1980 tons of crude from Weber stockpile.

d. Production Averages:

Average Crude Ore Per Day	1500 Tons
Average Concentrate Per Day	629 Tons
Tons Per Man Per Day - Crude Ore	21.21 Tons
Tons Per Man Per Day - Concentrate	8.90 Tons
Average Weight Recovery	41.50

3. ANALYSIS, SHIPMENTS AND STOCKPILE:

a. Analysis of Pit Crude:

<u>Tons</u>	<u>Iron</u>	<u>Silica</u>
403,708	33.22	49.54

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b. Tonnage and Analysis of Concentrate Produced & Shipped:

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
<u>Shipments:</u>						
Pocket to Presque Isle	87,517	62.45	.081	8.94	.015	6.96
Pocket to Escanaba	3,461	63.47	.059	7.87	.006	6.86
Pocket to Research Lab.	25	62.41	.081	9.03	.012	6.29
Stockpile to P.I.	62,640	62.12	.082	9.20	.008	5.90
Stockpile to Allis C.	95	61.77	.087	9.51	.007	4.84
Conc. in Stockpile January 1, 1955.	15,618	61.73	.074	10.37	.007	6.35
Total Production	169,356	62.28	.081	9.16	.012	6.52

c. Estimated Production and Analysis:

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
Dried		61.60	.089	9.00	.060	-
Natural	166,469	57.17		8.33		7.50

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore - Factors Used:

The 1954 proven crude ore estimate has been changed from the 1953 estimate by changing the conversion factor from 14 to 10.5 cubic feet per ton and subtracting an estimated 20% for pit waste. The probable and prospective estimates have not changed from 1953.

b. Estimated Reserves:

1954 Estimate - 46% Recovery

	<u>Total Crude</u>	<u>Concentrates</u>		<u>Total</u>
		<u>Humboldt Mining Co.</u>	<u>Weber</u>	
1210' Elev. (Proven)	31,162,800	13,391,000	943,900	14,334,900
1110' Elev. (Probable)	7,566,100	3,192,900	287,500	3,480,400
1010' Elev. (Prospect)	7,514,600	2,171,900	284,800	3,456,700

1953 Estimate - 46% Recovery

1210' Elev. (Proven)	29,593,543	12,716,662	896,368	13,613,030
1110' Elev. (Probable)	7,566,100	3,192,900	287,506	3,480,406
1010' Elev. (Prospect)	7,514,600	3,171,900	284,896	3,456,696



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4. ESTIMATE OF ORE RESERVES (Cont.)

b. Estimated Reserves (Cont.)

<u>1954 Estimate</u>	Cu. Yds. <u>Surf.</u>	<u>Stripping</u>	
		Cu. Yds. <u>Rock</u>	Cu. Yds <u>Total Equip. Stripping</u>
1210' Elevation	2,073,840	8,976,300	22,719,330
1110' Elevation	503,800	6,040,700	14,397,410
1010' Elevation	575,200	7,790,500	18,493,350
 <u>1953 Estimate</u>			
1210' Elevation	2,130,100	8,976,300	22,775,590
1110' Elevation	503,800	6,040,700	14,397,410
1010' Elevation	575,200	7,790,500	18,493,350

c. Estimated Analysis, Proven Ore  
(Based on D.D. Holes OA, 1, 2, 3-3A, 9, 10, and 11B.)

<u>Tons</u>	<u>Crude Ore</u>		<u>Weight Recovery</u>	<u>Concentrates</u>		
	<u>Iron</u>	<u>Analysis Dry</u>		<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>
31,162,800	31.10	45.97	14,334,900	61.28	.067	8.18

5. LABOR AND WAGES:

a. General:

The Humboldt crew (hourly rate and mine payroll salaried employees) was increased from 65 to 95 men during the year. Men who had been employed on the various construction jobs were reassigned to operating jobs when the plant started. A notice was posted requesting that all personnel interested in plant jobs sign an application list. Plant personnel were almost completely selected from this list.

Arrangements were negotiated with the Union to have a 90 day trial period on mill jobs. During this time employees were switched around on various jobs before permanent assignments were made.

By the end of the year, all the plant jobs had been described and job classifications established except for the Mill Sampler. As job classifications were determined, pay was adjusted retroactively to April 1st.

Labor relations have been good during the year and no formal grievances have been processed.

There was an increase in wages effective July 1, 1954 that totaled five cents per hour.

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5. LABOR AND WAGES:a. General (Cont.)

The following changes have taken place in salaried personnel during the year:

<u>Name</u>	<u>Title</u>	<u>Status</u>	<u>Date</u>
J. A. Pell	Superintendent	Resigned	March
Leroy Hosking	Ass't. Superintendent	Transferred Out	March
Lionel Larson	Mine Engineer	Transferred Out	March
Robert Mount	Geologist	Transferred Out	April
John Nigra	Surface Foreman	Transferred Out	October
E. W. Lindroos	Ass't. Supt.	Transferred In	March
R. R. Smith	Metallurgist	Transferred In	February
Albert Henry	Mine Engineer	Transferred In	March
Everett Waisanen	Mill Foreman	Transferred In	February
Robert Rodda	Supply Clerk	Transferred In	April
Clarence Thomas	Chemist	Transferred In	February

b. Report of Men Hired, Transferred and Separated:

<u>Month</u>	<u>First of Month</u>	<u>Hires</u>	<u>Trans. from Other Mines</u>	<u>Separated</u>	<u>Trans To Other Mines</u>	<u>End of Month</u>
January	65		5			70
February	70		1			71
March	71			1		70
April	70	12	1	1	4	78
May	78	8		1		85
June	85					85
July	85	4				89
August	89	3		1	1	90
September	90					90
October	90	6	4		1	99*
November	99			1		98*
December	98					98*
<b>Total</b>	<u>65</u>	<u>33</u>	<u>11</u>	<u>5</u>	<u>6</u>	<u>98*</u>

\*Includes three men working at Republic Mine

The above table included only hourly and salaried men on the Humboldt 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>
1953	24	1492½	\$3,033.18	2.032
1954	63	3040	\$6,323.06	2.136



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5. LABOR AND WAGESd. Annual Statement of Labor:

<u>Hourly Employees</u>	<u>Stat. Men</u>	<u>Hours</u>	<u>Amount</u>	<u>Avg. Rate</u>
Straight Time	63 $\frac{1}{4}$	163,455	\$320,615.62	1.961
Overtime	2	4,995 $\frac{1}{4}$	5,019.81	1.005
Shift Diff. - Aft.	14 $\frac{3}{4}$	38,458 $\frac{1}{4}$	2,324.28	.060
Shift Diff. - Nite	4 $\frac{3}{4}$	11,350 $\frac{3}{4}$	1,035.16	.091
Holiday Allowance	1 $\frac{1}{2}$	3,984	7,944.40	1.994
1954 Vac. Pay		2,960	6,323.06	2.136
Sub Total	63 $\frac{1}{4}$	163,455	343,262.33	2.100
Retro. Wage Allow			4,280.20	
Total Hourly Employees	63 $\frac{1}{4}$	163,455	347,542.53	2.126
<u>Salaried Employees</u>				
Mine Payroll	2 $\frac{1}{2}$	6,073	18,284.55	3.011
Total Mine Payroll	65 $\frac{1}{2}$	169,528	365,827.08	2.158
<u>General Payroll</u>				
Salaried Straight Time	5 $\frac{1}{2}$	14,047 $\frac{1}{4}$	33,877.68	2.411
Overtime		180 $\frac{1}{2}$	208.26	1.153
Labor from Other Mines	9 $\frac{1}{4}$	23,847	60,591.37	2.541
Total Labor	80 $\frac{1}{4}$	207,422 $\frac{1}{4}$	460,504.39	2.220

Distributed as Follows

Operating Humboldt Mine	59	152,249 $\frac{3}{4}$	336,093.01	2.207
Stripping	3 $\frac{1}{2}$	9,239 $\frac{1}{2}$	21,698.33	2.348
Uncompleted Construction	11 $\frac{1}{2}$	29,821	68,010.23	2.280
Other Mines	1	2,354	5,635.90	2.394
Other Accounts	$\frac{3}{4}$	1,950 $\frac{1}{2}$	4,783.79	2.452
Deferred Chgs. Ore Prod.	4 $\frac{3}{4}$	11,807 $\frac{1}{2}$	24,283.13	2.056
Total as Above	80 $\frac{1}{4}$	207,422 $\frac{1}{4}$	460,504.39	2.220

e. Labor Cost:

Production of Concentrates - Long Tons	169,356
Number of days operated	269
Number of Shifts operated	780
Average daily production - concentrates	629
Average production per shift	217
Tons concentrate per man per day	8.90
Average wages per man per day	17.76
Average job class	8
Total amount paid for labor (production)	336,093.01
Labor cost per ton of concentrate	1.98

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6. GENERAL SURFACE:

a. Roads and Grading:

The access road to the plant area was raised approximately three feet since it became impassible during the spring run-off. A road was extended westerly from the south end of the pit across County Road 601 and across the railroad track to the NE $\frac{1}{4}$  of the SE $\frac{1}{4}$  of Section 10 which is to be used as a stripping dump.

The area west of the shop was filled in and graded. The concentrate storage area south of the mill was extended to the south and east. A new stocking area was started south of the railroad tracks and west of the Driox unit. Approximately 450' of the northwest end of the tailing dam dike was raised eight feet. This work was all done with pit waste and stripping material.

b. Water Supply

Pipe lines for process water to the mill and the tailing line were completed in January. Work on fire lines was not completed until late in the fall. A pipe line to the pit for hydraulic stripping was completed in May.

Lake Lory supplied fresh make-up water to the plant. The elevation of water in the lake ranged from a high of 1559.0' in June to a low of 1557.75 in September. Periodic checks were made of pH and solids content of water at four points.

The following table shows the water analysis at the end of the year:

	<u>pH</u>	<u>Solids Parts Per Million</u>
1. Stream entering Lake Lory	6.45	33.8
2. Lake Lory Water	6.70	3.0
3. Tailing Dam Overflow	6.55	178.0
4. Reuse water at pumphouse	6.60	337.0

c. Miscellaneous:

The pit power line was extended north along the footwall of the pit then across the pit to the hanging wall and southerly along the hanging wall side. A power line was also extended to the concentrate stocking area for use in loading from stockpile.

One of the temporary wooden buildings was moved to a location due east of the mill near the tailing dam and converted into a powder house. Two of the other temporary buildings were moved to the new fill south of the stocking area for use in storing miscellaneous materials.



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7. OPEN PIT:

a. Stripping:

The 54-B Bucyrus Erie electric shovel was used for stripping on a single shift basis when not needed on pit waste rock removal or in loading from concentrate stockpile. An afternoon stripping shift was added in October and continued into December.

Surface stripping was carried to the 1585' elevation. The first knob area stripping was completed to this elevation. The second knob area was completely stripped and washed clean by hydraulicing. Earth removal on the south half of the third knob area was well underway at the end of the year.

The following tabulation summarizes the stripping operation:

<u>Month</u>	<u>Surface</u>	<u>Rock</u>	<u>Total</u>	<u>Yds. Per Man Day</u>	<u>Man Days</u>	<u>Cost Per Yard</u>
January	4,080	-	4,080	88.69	46	.699
February	3,420	-	3,420	228.00	15	.253
March	-	-	-	-	-	-
April	-	-	-	-	-	-
May	-	-	-	-	-	-
June	10,260	-	10,260	72.25	142	1.762
July	420	6,405	6,825	65.62	104	.526
August	6,610	15,115	21,725	163.35	133	.272
September	950	8,670	9,620	82.22	117	.476
October	20,695	2,465	23,160	144.75	160	.304
November	16,875	2,040	18,915	84.82	223	.537
December	19,120	1,715	20,835	96.90	215	.487
Total 1954	82,430	36,410	118,840	102.98	1154	.507
Total 1953	84,361	-	84,361	64.40	1310	.985
Total to Date	300,491	36,410	336,901	99.72	3378½	.572

b. Stripping Expenditures:

	<u>Amount Authorized</u>	<u>Amount Expended</u>	<u>Amount Unexpended</u>
E&A HM-4	\$168,000.00	\$157,511.71	\$10,488.29
E&A HM-7	34,992.00	37,905.13	2,913.13

c. Open Pit Mining

Crude ore was mined from the 1625' and 1585' benches on the first and second knob areas in the south end of the pit. Up to the end of April, ore milled and stockpiled was produced by wagon drilling except for a small tonnage produced by churn drilling. Following delivery of the jet piercing machine in April, most of the crude tonnage was drilled with this machine. Use of wagon drills continued in developing working faces for the jet piercing machine. The P&H electric shovel was used on crude ore loading into two rental 34 ton Euclid trucks. Two of the large trucks were adequate on the short haul from the first and second knob areas. The 54-B shovel and the 22 ton Euclids were used on waste rock handling, stripping and miscellaneous pit work.

Cost of primary blasting was materially improved by substituting Titan 3 for the more costly EP-152 and EP-158 powders.



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c. Open Pit Mining:

Summary of Pit Production:

Crude from Pit to Crushing Plant	*377,828 Tons
Crude from Stockpile to Crushing Plant	25,880 Tons
Total Crude from Pit to Crushing Plant	*403,708 Tons
Crude in Stockpile December 31, 1953	40,800 Tons
Crude from Pit to Stockpile 1954	26,000 Tons
Crude from Stockpile to Crushing Plant	25,880 Tons
Crude ore in Stockpile December 31, 1954	40,920 Tons
Waste Rock, Pit to Dump - Yards	48,914 Yards
Total Footage drilled Jet Piercing Machine	14,191 ft.
Total Footage drilled Wagon Drills	90,810 ft.
Jackhammer Hours - Secondary Drilling	3,491 Hrs.
Average Grade of Crude Ore	33.22% Iron 49.54% Silica
Cost per ton of Crude Ore	.858

\*Includes 1980 tons from Weber Rock Dump.

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, 7 days per week

Summary of Powder Used:

Primary Blasting, Jet Pierced Holes

Type	Unit Cost	lbs. Used	Total Cost
E.P. 152	17.58 C	133,280	\$23,425.68
E.P. 158	19.95 C	28,600	5,706.50
Titan No. 3	16.00 C	25,175	4,024.83
M.S. Connectors	.405 ea.	550	222.75
Plastic Primacord	.037 ft.	19,500	721.49
Primacord	.032 ft.	119,770	3,851.88
XC-45 Booster	33.25 C	839	278.90
			<u>38,232.03</u>
Cost per ton of Material broken			.095

Primary Blasting, Wagon Drill Holes

Type	Unit Cost	lbs. Used	Total Cost
1 $\frac{1}{4}$ x 8 Gelamite	20.00C	2,442	489.96
1 $\frac{1}{2}$ x 8 "	17.45C	1,350	235.58
1 $\frac{1}{2}$ x 16 "	17.45	3,500	610.76
1 $\frac{1}{2}$ x 24 "	17.45	25,792	4,500.70
Primacord	.032 ft.	98,500	3,179.58
			<u>9,016.58</u>
Cost per ton of Material broken			.099



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7. OPEN PITc. Open Pit MiningSecondary Blasting

Type	Unit Cost	lbs. Used	Total Cost
1 $\frac{1}{4}$ x 8 Gelamite	17.45C	6,579	1,148.03
1 $\frac{1}{2}$ x 8 "	17.45C	350	61.08
1 $\frac{1}{2}$ x 24 "	17.45C	9,363	1,633.86
5 x 5 60% H.P. Gel.	23.50C	117	27.50
Primacord	.032	67,095	2,165.83
Plastic Primacord	.037	1,250	46.25
Elec. Caps	.219	14	3.07
Dry Fuse	.087	926	8.12
			<u>5,093.74</u>

Summary of Footages Drilled

Month	Jet Piercing	Wagon Drilling	Churn Drilling
January	-	18,738	73
February	-	17,548	-
March	-	13,468	-
April	248	6,045	-
May	1,257	4,189	-
June	1,769	3,857	-
July	1,682	1,961	-
August	2,339	3,623	-
September	1,929	4,875	-
October	2,364	4,169	-
November	1,612	4,329	35
December	991	8,008	32
Total	<u>14,191</u>	<u>90,810</u>	<u>140</u>

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7. OPEN PIT:c. Open Pit Mining:Summary of Jet Drill Holes Blasted:

<u>Date</u>	<u>No. of Holes</u>	<u>Avg. Depth</u>	<u>Average Spacing</u>	<u>Powder Factor *</u>	<u>Gross Tons</u>	
					<u>Ore</u>	<u>Rock</u>
4-30	7	40.4	18 x 20	2.21	10,000	
5-11	9	33.0	18 x 18	2.76	13,140	
5-20	7	43.4	18 x 18	2.65	12,110	
5-27	3	34.0	18 x 18	1.95	3,070	
5-27	5	23.7	15 x 15	1.21	2,000	
5-27	15	19.2	12 x 12	1.13	4,400	
6-4	6	39.8	18 x 18	1.89	6,950	
6-11	16	12.5 & 38.1	15 x 15	2.80	11,275	
6-18	21	24.6	17 x 15	1.83	12,000	
6-29	16	38.7	22 x 17	2.10	20,650	
7-8	16	24.8	18 x 18	2.79		12,900
7-16	5	42.9	22 x 18	2.46	7,630	
7-16	12	21.5	18 x 18	3.13	1,010	9,140
7-20	4	34.6	30 x 18	3.77	7,870	
7-23	5	44.8	20 x 18	2.08	6,940	
7-27	7	37.5	18 x 18	1.80	5,330	990
7-30	5	44.2	20 x 18	2.20	6,880	
8-4	6	40.8	22 x 18	2.38	5,470	2,930
8-6	6	43.8	18 x 18	1.92	6,720	550
8-11	7	40.6	18 x 18	1.97	5,600	2,000
8-16	7	35.7	18 x 18	1.86	6,330	1,230
8-20	10	38.2	18 x 18	1.81	7,600	2,460
8-26	7	34.3	19 x 18	2.02	6,770	
9-3	16	39.7	19 x 18	2.37	18,320	3,540
9-14	9	38.7	19 x 18	1.94	7,690	2,530
9-20	7	43.0	19 x 18	2.08	8,980	
9-24	8	40.5	19 x 18	2.18	6,860	2,570
9-29	7	43.9	19 x 18	2.13	9,180	
10-4	8	43.5	20 x 18	2.39	8,220	2,740
10-8	11	42.9	20 x 18	2.29	11,520	2,740
10-13	5	34.3	20 x 18	2.06	5,310	
10-14	5	43.8	20 x 18	2.21	6,850	
10-21	15	34.5	20 x 18	1.87	13,700	
10-28	10	43.0	20 x 18	2.12	12,060	1,370
11-3	5	43.8	20 x 18	1.95	6,850	
11-3	19	23.7	18 x 17	2.00	10,250	
11-9	9	41.2	21 x 18	1.94	11,960	1,440
11-17	4	37.3	24 x 18	2.32	5,160	
11-19	8	39.5	22 x 20	2.13	13,200	
12-10	15	33.0	18 x 18	1.82	10,600	1,200
12-18	9	37.3	20 x 19	1.83	9,140	
12-20	4	43.3	20 x 19	1.98	5,910	
<u>Total</u>	<u>376</u>				<u>351,505</u>	<u>50,330</u>

\*Tons of material broken per pound of powder used.



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7. OPEN PIT

c-Open Pit Mining

Summary of Jet Piercer Operating Costs:

<u>Month</u>	<u>Oxygen</u>	<u>Fuel Oil</u>	<u>Reamer Shells</u>	<u>Kelley &amp; Kelley Ext.</u>	<u>Burner Assembly</u>	<u>Piping</u>	<u>Misc. Oper. Supp.</u>	<u>Misc. Maint. Supp.</u>	<u>Royalty</u>	<u>Maint Labor</u>	<u>Oper. Labor</u>	<u>Reamers</u>	<u>Total</u>
April	—	460.94	178.21		180.00	146.15		10.58		111.46	247.01		1334.35
May	2401.60	130.06	141.12			34.93		272.52		15.20	976.33	330.58	4302.34
June	3786.85	205.07	1581.84			1830.19	40.43	48.85		43.93	1386.81	460.41	9384.38
July	5231.14	209.84	298.33		290.00	37.13	100.89	179.96		303.18	1377.67	488.40	8516.54
August	6071.56	455.15	364.89		440.00	574.48	143.58	416.39		229.54	1589.09	640.77	10925.45
Sept.	6278.33	584.68	676.68	1250.00	150.00	350.00	236.99	331.12		173.56	1458.49	1074.06	12563.91
October	6138.38	564.26	727.14		365.00	120.59	188.10	949.03	1924.92	524.18	1489.43	1188.86	14179.89
November	6304.79	630.67	393.83	200.00	190.00	237.47	293.65	634.17		344.63	1354.76	675.10	11259.07
December	8364.15	402.43	1307.89	200.00	450.00	193.32	264.22	963.68	5983.04	851.83	859.12	587.13	20426.81
Total	44576.80	3643.10	5669.93	1650.00	2065.00	3524.26	1267.86	3806.30	7907.96	2597.51	10738.71	5445.31	92892.74

Total Loaded Footage Jet Drilled Holes	14,191'
Total Drilled Footage Jet Drilled Holes	15,062'
Cost Per Foot of Loaded Footage	6.545
Cost Per Foot of Drilled Footage	6.167
Total Tons blasted Ore and Waste	401,835 Tons
Total Cost per ton Blasted Ore & Waste	.2312

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8. PLANT:

a. General:

The primary crusher received the first truck load of crude ore on February 22. The mill started operating on February 24 on a start-up, test, and adjustment basis. On February 27, the first concentrates were filtered and stockpiled. Operations continued through the year except for a scheduled shutdown period extending from November 23 to December 8 for plant changes.

Many of the usual problems and difficulties incident to starting up a new plant were encountered. Material handling presented the greatest difficulties; in the crushing and feeding sections due to snowy conditions and in the concentrator in pumping flotation froth. Considerable headway was made in solving these problems. A testing and research program was carried on in the plant which resulted in improvement of plant results month by month.

The following tables summarize the operating results:

b. Production by Months:

<u>Month</u>	<u>Tonnage</u>	<u>%Fe</u>	<u>% P.</u>	<u>% SiO<sub>2</sub></u>	<u>% Sul.</u>	<u>% H<sub>2</sub>O</u>
February-March	6,977	61.81	.089	9.54	.006	5.60
April	10,140	61.76	.090	8.42	.010	6.00
May	15,277	61.88	.093	8.56	.022	6.56
June	20,388	61.88	.092	9.22	.032	7.17
July	19,334	62.71	.092	8.70	.008	6.91
August	20,274	62.71	.074	9.00	.006	6.50
September	20,679	62.35	.070	9.63	.009	6.33
October	25,060	62.38	.083	9.17	.008	6.49
November	17,101	62.82	.069	8.91	.008	6.85
December	14,136	61.68	.073	10.50	.007	6.48
Totals:	169,366	62.28	.081	9.16	.012	6.52

c. Metallurgical Balance:

<u>Product</u>	<u>% Wt.</u>	<u>% Wt.</u>	<u>% Fe</u>	<u>% SiO<sub>2</sub></u>	<u>% Fe Unit</u>
		<u>Crude</u>			<u>Recovery</u>
Concentrate	45.95	41.50	62.28	9.16	77.80
Flotation Tailing	54.05	48.82	9.55	—	14.04
Flotation Feed	100.00	90.32	33.78	—	91.84
Secondary Cyclone O'Flo		9.68	28.01		8.16
Calculated Head		100.00	33.22		100.00



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8. PLANT: (Cont'd)d. Hourly Operating Rates:

	<u>Tons</u>	<u>Gross Hours Of Operating</u>	<u>Net Hours Of Operation</u>	<u>LTPH (Gross)</u>	<u>LTPH (Net)</u>
<u>Feed to Primary Crusher</u>					
1954 Season	403,708	2156.50	1481.50	187.21	272.50
Ore in Process	142				
<u>Fine Ore Bin to Concentrator:</u>					
1954 Season	403,566	6115.67	5606.67	65.98	71.98
<u>Concentrates:</u>					
1954 Season	169,356	6115.67	5606.67	27.69	30.21

e. Monthly Hourly Operating Rates:

	<u>Feed to Primary Crusher</u>	<u>Fine Ore Bin To Concentrator</u>	<u>Concentrates</u>
1) <u>Long Tons Per Hour - Gross</u>			
February- March	68.14	49.71	14.49
April	128.04	55.91	19.50
May	157.25	53.48	21.07
June	187.44	66.30	29.63
July	191.49	71.41	29.47
August	188.52	65.79	28.43
September	195.16	68.93	30.73
October	210.77	77.86	35.20
November	197.28	73.11	33.82
December	192.80	75.16	30.98
Year	187.21	65.98	27.69
2) <u>Long Tons Per Hour - Net</u>			
February-March	165.65	62.42	18.19
April	259.61	58.59	20.44
May	257.79	58.40	23.01
June	256.30	69.29	30.97
July	265.93	75.02	30.96
August	295.48	73.63	31.82
September	282.04	74.54	33.23
October	299.46	83.75	37.86
November	290.48	81.73	37.80
December	282.08	81.64	33.65
Year	272.50	71.98	30.21

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8. PLANT: (Cont'd)

f. <u>Pit - Crusher Delays:</u>					
		<u>Hours</u>	<u>Percent Delays</u>	<u>Percent Total Yearly Delay</u>	<u>Percent of Total Yearly Working Time</u>
1) <u>Pit</u>					
Shovel, Blasting, Etc.		<u>186.83</u>	<u>100.00</u>	<u>21.34</u>	<u>6.68</u>
Total		<u>186.83</u>	<u>100.00</u>	<u>21.34</u>	<u>6.68</u>
2) <u>Crusher</u>					
Initial Startup		60.50	11.68	6.91	2.16
Primary Crusher		90.00	17.38	10.28	3.22
Primary crusher chute		55.00	10.62	6.28	1.96
Ross Feeder		10.00	1.93	1.14	.36
Metal Detector		6.50	1.26	.74	.23
Conveyors & Buffer Belts		70.00	13.51	8.00	2.50
Chutes, Feed Boxes		58.67	11.33	6.70	2.10
#1 Screen		31.25	6.03	3.57	1.12
Secondary Crusher		49.25	9.51	5.63	1.76
Surge Bin Feeder		10.00	1.93	1.14	.36
#2 Screen		3.50	.68	.40	.13
Tertiary Crusher		28.50	5.50	3.26	1.02
Power Failure		12.00	2.32	1.37	.43
Miscellaneous		18.75	3.62	2.14	.67
Surge Bin Full		<u>14.00</u>	<u>2.70</u>	<u>1.60</u>	<u>.50</u>
Total		<u>517.92</u>	<u>100.00</u>	<u>59.16</u>	<u>18.52</u>
3) Fine Ore Bin Full		<u>170.75</u>		<u>19.50</u>	<u>6.10</u>
Totals		875.50		100.00	31.30

g. Pit-Crusher Delays By Months:

<u>Month</u>	<u>Hours Delay Time</u>	<u>Monthly Percent Operating Time</u>	<u>Monthly Percent Delay Time</u>	<u>Percent of Total Yearly Delays</u>	<u>Percent of Total Yearly Working Time</u>
February-March	197.50	41.13	58.87	22.56	7.06
April	93.25	49.32	50.68	10.65	3.33
May	97.50	61.00	39.00	11.14	3.49
June	64.75	73.46	26.54	7.40	2.32
July	65.50	76.28	23.72	7.48	2.34
August	90.50	63.80	36.20	10.34	3.24
September	73.00	69.20	30.80	8.34	2.61
October	77.00	70.38	29.62	8.79	2.75
November	60.00	67.91	32.09	6.85	2.14
December	<u>56.50</u>	<u>68.35</u>	<u>31.65</u>	<u>6.45</u>	<u>2.02</u>
Year	875.50	68.70	31.30	100.00	31.30



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8. PLANT: (Cont'd)h. Concentrator Delay Time:

	<u>Hours</u> <u>Delay</u>	<u>Percent</u> <u>Delays</u>	<u>Percent</u> <u>Total Yearly</u> <u>Delays</u>	<u>Percent of</u> <u>Total Yearly</u> <u>Working Time</u>
1) Operational				
Initial startup	28.45	16.18	5.59	.46
Startup & Shutdown- repair Sh.	52.50	29.86	10.31	.86
Charging rods - #1 Rod Mill	39.04	22.20	7.67	.64
Checking feed rate	23.49	13.36	4.61	.38
Grinding circuit overloaded	10.62	6.04	2.09	.17
Switching to #2 Rod Mill	1.75	1.00	.35	.03
Power Failure	<u>19.98</u>	<u>11.36</u>	<u>3.92</u>	<u>.33</u>
	175.83	100.00	34.54	2.87
2) Equipment				
Rod mill #1	32.80	15.14	6.45	.53
Rod mill #2 (high speed)	3.65	1.68	.72	.06
Ball Mill	9.94	4.58	1.95	.16
Hydroscillator	19.55	9.02	3.84	.32
Pumps	33.81	15.60	6.64	.55
Conveyors	3.53	1.63	.69	.06
Chutes, feed boxes	38.96	17.98	7.65	.64
Densifier	3.88	1.79	.76	.06
Conditioners	.88	.41	.17	.01
Flotation cells	2.25	1.04	.44	.04
Sutorbilt blower	20.83	9.61	4.09	.34
Low pressure air line	10.17	4.69	2.00	.17
Thickener	9.92	4.58	1.95	.16
Filters	1.00	.46	.20	.02
Fresh water line	2.83	1.31	.56	.05
Electrical	8.63	3.98	1.69	.14
Miscellaneous	<u>14.06</u>	<u>6.50</u>	<u>2.77</u>	<u>.23</u>
	216.69	100.00	42.57	3.54
3) Out of feed	<u>116.48</u>		<u>22.89</u>	<u>1.91</u>
Total	509.00		100.00	8.32

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8. PLANT: (Cont'd)i. Concentrator Monthly Delay Time:

<u>Month</u>	<u>Hours Delay Time</u>	<u>Monthly Percent Operating Time</u>	<u>Monthly Percent Delay Time</u>	<u>Percent of Total Yearly Delays</u>	<u>Percent of Total Yearly Working Time</u>
February-March	97.98	79.65	20.35	19.25	1.60
April	23.85	95.41	4.59	4.69	.39
May	59.92	91.58	8.42	11.77	.98
June	29.62	95.69	4.31	5.82	.48
July	31.58	95.19	4.81	6.20	.52
August	75.95	89.35	10.65	14.92	1.24
September	50.64	92.48	7.52	9.95	.83
October	50.08	92.97	7.03	9.84	.82
November	53.15	89.45	10.55	10.44	.87
December	<u>36.23</u>	<u>92.05</u>	<u>7.95</u>	<u>7.12</u>	<u>.59</u>
Year	509.00	91.68	8.32	100.00	8.32

j. Monthly Rod, Ball, & Reagent Consumption:

<u>Month</u>	<u>Rods</u>		<u>Balls</u>		<u>Reagent</u>	
	<u>#</u>	<u>#/Ton Crude</u>	<u>#</u>	<u>#/Ton Crude</u>	<u>#</u>	<u>#/Ton Crude</u>
Initial Charge	<u>91,332</u>		<u>77,333</u>			
February-March	6,802	.28	14,430	.60	16,496	.6 - .7
April	20,400	.74	21,384	.70	22,410	.74
May	33,048	.87	60,750	1.60	28,714	.75
June	73,728	1.62	60,750	1.33	30,515	.67
July	61,056	1.30	60,420	1.29	34,962	.75
August	68,320	1.46	70,700	1.51	48,742	1.03
September	68,600	1.48	68,510	1.48	54,822	1.16
October	81,480	1.47	62,310	1.12	64,357	1.16
November	55,720	1.51	52,130	1.41	44,553	1.21
December	51,800	1.51	36,000	1.05	44,655	1.30
Total	<u>520,954</u>	<u>1.29</u>	<u>507,384</u>	<u>1.26</u>	<u>390,226</u>	<u>.97</u>



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8. PLANT (Cont.)

k. Plant Testing:

A program of testing both laboratory and plant scale has been directed toward improvement of milling results since the plant was started. Considerable progress has been made. Reagent combinations have been changed, the flowsheet has been modified, and equipment has been added in order to effect improvements.

The plant was started up using red oil as the only flotation reagent. While this reagent was used, a buildup in pumps, pipelines and launders occurred which reduced capacities and required periodic cleaning of these facilities. By substituting substantial quantities of Neofat 139 for red oil it was found that these deposits were materially reduced with improved flotation results.

Experiments were carried on with a variety of frothers which were found to be beneficial in treating some types of ores. Aerofroth 77 and MIBC have been selected for normal use because of their effectiveness and lower price. Fuel oil and sulphuric acid have also been beneficial in the treatment of some ores. Emulsifying of fatty acids with 899 and Brunates has been tested and found to be effective on ores from the first knob area.

From the start of operations it was apparent that the Steffensen Cells were not entirely satisfactory, particularly in cleaning and recleaning operations. As tonnage rates were increased the capacity of these cells was also exceeded. Therefore, a 12 cell bank of No. 24 Denver cells was added to the circuit. Results immediately showed a marked improvement and as a further test of mechanical cells, six of the Steffensen air cells were modified by the addition of Fagergren mechanisms. In comparing the results of the three types of cells in use, it was found that the mechanical cells outperformed the air cells and in roughing, the Denver had a slight advantage over the Fagergren conversion.

In treating certain types of ores, particularly those that are high in sericite, it has been found beneficial to divert cleaner tailing to the tailing pump rather than to recirculate them to the head of the circuit. Launderers have been installed for this flow modification.

The desliming circuit as originally installed resulted in high slime losses, and a high circulating load with consequent high wear rates on the secondary cyclones. By diverting the secondary cyclone underflow directly to conditioning rather than to the densifier, this problem was largely corrected. The cyclone manufacturers replaced the secondary cyclone installation with a redesigned model having replaceable rubber wearing parts.

A reagent combination was developed and tested on a mill scale whereby a Bessemer grade of concentrate could be produced in the flotation circuit. The normal phosphorus content of .08% could be reduced to about .04% by adding sodium fluoride, sulphuric acid and fuel oil.

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8. PLANT (Cont.)

k. Plant Testing (Cont.):

It was demonstrated that a high grade concentrate (low in phosphorous content) could be made by treating products in the grinding circuit. The hydrooscillator sands respond to flotation treatment to produce a fairly coarse, high grade concentrate. Spirals indicated some promise in treating the ball mill discharge.

9. MAINTENANCE, REPAIR AND CHANGES

a. General

The ore treated has been very abrasive with the result that there has been considerable wear on machinery and handling facilities from the jet piercing machine through to the flotation circuit. Three and four welders in the shop have devoted most of their time to the routine work of building up dipper teeth, reamer shells for the jet and truck boxes. Chute liners, screens and crusher wearing parts have required frequent renewal.

b. Crushing Plant

Manganese wearing parts in the Symons secondary crusher have lasted approximately three months during which time 175,302 tons of ore were crushed. Manganese in the Hydrocone tertiary crusher have lasted approximately five months before replacement was necessary and have crushed 213,068 tons during that period.

A shutdown period was scheduled from November 23 to December 8 during which time a number of changes were made in the crushing section, primarily to improve winter operations. The changes made were as follows:

- (1) Replacement of the original splitter beam with a heavier member of different design.
- (2) Installation of a steel chute provided with electric strip heaters under the primary crusher.
- (3) Installation of an air operated door on the outlet of this chute.
- (4) Repositioning of the Ross Feeder.
- (5) Installation of a higher speed drive on the primary crusher.
- (6) Setting of the primary crusher to 6 $\frac{1}{4}$ " on the open side.

Dust collection in the crushing plant continued to be a serious problem. From April to November air and water sprays were used to effectively reduce the dust. During cold weather this method was not useable and it was found that the dry collecting system was not adequate for the job. Work on hooding and on duct work was continued in an effort to improve the system.

c. Concentrator

The speed of the No. 1 rod mill was increased from 55% to 72.6% of critical. The speed of the ball mill was likewise increased from 52% to 62% of critical. These changes were made to obtain greater production. The high-speed rod mill was operated from 25% to 30% of the time during some months.



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9. MAINTENANCE, REPAIR AND CHANGES (Cont.)

c. Concentrator (Cont.)

As mentioned earlier, a 12 cell bank of Denver No. 24 flotation cells was installed to supplement the Steffensen cells. Results were so favorable that six Fagergren 66" mechanisms and two Denver No. 24 mechanisms were installed in Steffensen cell tanks.

Froth pumping has presented a problem. The best solution has been to use oversize pumps, in multiple where necessary. The No. 5 Hydroseal BC frame pump was replaced with a CD frame pump. Also a 6" Wilfley pump with independent sump was added. A 5" Wilfley pump with sump was added to supplement the No. 6 BC frame Hydroseal pump. The No. 7 BC frame Hydroseal was supplemented by adding a duplicate pump and sump.

A pumping problem of a different nature was encountered with No. 1 pump which transfers No. 2 rod mill discharge to No. 1 rod mill. The wear on the 5" x 4" CW pump originally installed was prohibitive because speed was necessary for the desired capacity. A 5" Barrett Haentjens pump operated at lower speeds has been installed as a replacement.

During the fall shutdown period, a cone was installed in the fine ore bin. The purpose of this cone was to eliminate the cone of fines which formerly occupied this area. Chunks of frozen and consolidated material would break off from this cone and plug the feeders. The steel cone also provides access to the top of the feeders so that the feed openings can be effectively barred down. To further alleviate the freezing problem in the bin, the Arrowhead Company insulated and sheeted the outside of this bin as well as the steady head water tank located alongside the bin.

Another project completed during the shutdown was the remodeling of the conditioners. The three original 4' O.D. x 4' tanks were replaced by a compartmented rectangular tank giving each conditioner a volume of 4½' x 4½' x 4'. Propeller speeds were increased from 625' per minute to 1000' per minute.

The original 6" cyclones were replaced with cyclones having replaceable rubber parts.



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10. E & A's:a. Construction and Stripping E&A's:

	1954 <u>Expenditure</u>	Total <u>Expenditure</u>
HM-1 Lands	-	275,584.28
HM-2 Exploration	-	111,166.83
HM-3 Testing & Plant Design	-	95,198.31
HM-4A General Expense	1,955.17	213,339.89
HM-4B General Surface	9,510.13	116,766.72
HM-4C Shop, Office & Dry Building	7,608.33	381,088.03
HM-4Da Mill Crushing Section	276,920.29	1,809,007.41
HM-4Db Concentrator Section	328,649.92	1,950,272.05
HM-4Dc Stocking & Shipping Section	44.17	44.17
HM-4Dd Mill Reagent Section	607.37	3,797.07
HM-4E Power Distribution	5,201.38	61,207.70
HM-4F Pelletizing	-	-
HM-4G Mining Equipment	125,606.76	674,321.28
HM-4H Water Supply	12,974.65	124,758.38
HM-4I Tailing Disposal	3,041.68	48,945.87
HM-4J Stripping	<u>24,132.07</u>	<u>145,109.67</u>
Totals	792,341.58	6,010,607.66

E&A HM-4: Closed out July 31, 1954.

b. Plant Changes: E&A HM-5: Expenditures in 1954 Only:

	Total <u>Expenditure</u>
A - Primary crusher:	
1. Splitter beam	2,461.12
2. Speed primary crusher	1,137.46
3. Heated chute, etc.	9,997.12
5. Dust Collection	311.20
B - Secondary crusher:	
2. Dust collection	588.15
3. Rotating feeder	320.61
5. Chutes & hoppers	1,382.13
C - Concentrator	
3. Steel cone in fine ore bins	4,097.82
4. Fine ore bin chute	2,760.58
5. Sump pumps	5,014.86
7. Denver cells	16,678.06
8. Control valves	3,572.98
9. Fagergren flotation cells	2,767.44
Mechanical engineering	<u>525.09</u>
Total	51,614.62

Total amount authorized in E&A HM-5: 88,614.00



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11. COST OF PRODUCTION:

<u>Month</u>	<u>Total Cost At Mine</u>	<u>Pit Expense</u>	<u>Crushing &amp; Screening</u>	<u>Milling Expense</u>	<u>Tailings Disposal</u>	<u>Stocking Expense</u>	<u>General Mine</u>	<u>Crude To Oper</u>	<u>Taxes</u>	<u>Other Exp. &amp; Income</u>	<u>Depl. &amp; Deprn.</u>	<u>Shipping Expense</u>
February	444.03	48.47	24.28	41.35	.88	2.88	28.22	286.82	2.77	-	8.360	-
March	20.636	3.561	1.403	4.831	.027	.167	3.093	5.524	.216	.328	1.481	.005
April	10.801	1.820	.931	2.079	.017	.143	1.955	2.415	.148	.216	1.076	.001
May	8.180	2.132	.680	2.070	.024	.100	1.569	.149	.098	.206	1.093	.059
June	9.514	1.626	.616	2.600	.053	.077	.984	2.258	.073	.167	.980	.079
July	7.632	1.810	.598	1.959	.051	.153	1.383	.389	.078	.173	1.010	.028
August	7.721	1.851	.647	2.443	.068	.102	1.032	.244	.074	.186	1.040	.034
September	7.730	2.126	.744	2.345	.081	.071	.929	.132	.073	.144	1.011	.074
October	6.522	1.769	.463	1.979	.028	.013	.859	.104	.061	.167	.966	.113
November	7.581	2.193	.722	2.518	.028	.025	1.112	.047	.089	.333	.325	.189
December	<u>8.857</u>	<u>2.699</u>	<u>.974</u>	<u>2.407</u>	<u>.026</u>	<u>.074</u>	<u>.883</u>	<u>.022</u>	<u>.105</u>	<u>.671</u>	<u>.996</u>	<u>-</u>
Year	8.644	2.046	.711	2.378	.044	.083	1.215	.806	.089	.240	.965	.067

	<u>Operating</u>			<u>Maintenance</u>		<u>Total</u>
	<u>Labor</u>	<u>Power</u>	<u>Supplies</u>	<u>Labor</u>	<u>Supplies</u>	
Year 1954	1.747	.816	3.450	6.300	.640	7.283

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12. TAXES

	1954		1953	
	<u>VALUATION</u>	<u>TAXES</u>	<u>VALUATION</u>	<u>TAXES</u>
Humboldt Mine, including stockpile, supplies & equipment as placed by State Tax Commission:				
Real Estate	470,000	9,494.00	50,000	1,010.00
Personal Property	425,000	8,585.00	335,000	6,767.00
Total	<u>895,000</u>	<u>18,079.00</u>	<u>385,000</u>	<u>7,777.00</u>
Tax Rate		20.00		20.00

13. 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>
Louis Dudo	May 4, 1954	Lacerated left cornea	64	\$481.33
Ray Maki	October 4, 1954	Fractured right wrist	44	\$294.67
Henry Coron	August 30, 1954	Hernia	42	\$300.00
Ernest Anderson	Nov. 8, 1954	Broken right arm	37	\$216.00

14. PROPOSED NEW CONSTRUCTION

No new major construction projects are scheduled for 1955. Oxygen lines and power lines will be extended into the pit as needed. The tailing dikes will be raised to provide storage for an additional year. The new concentrate stocking area will be completed. The proposed new machinery shown in the following paragraph will be installed.



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15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT:

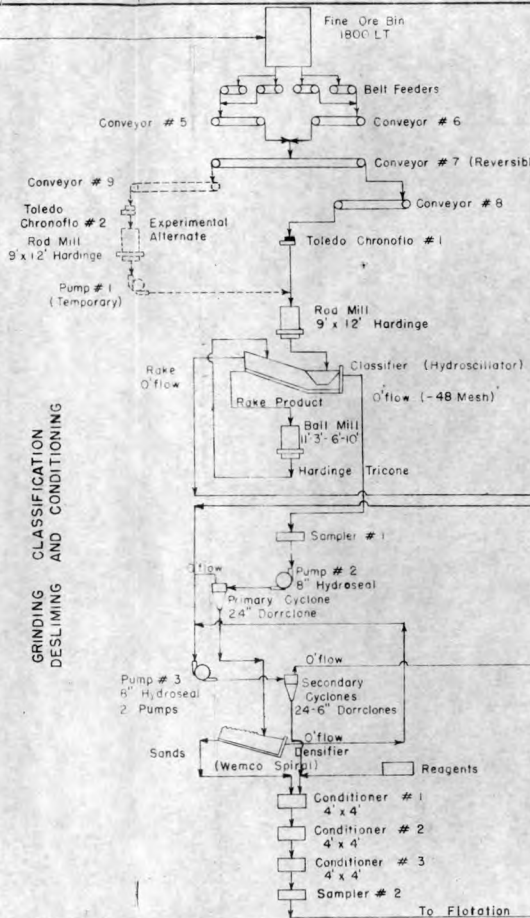
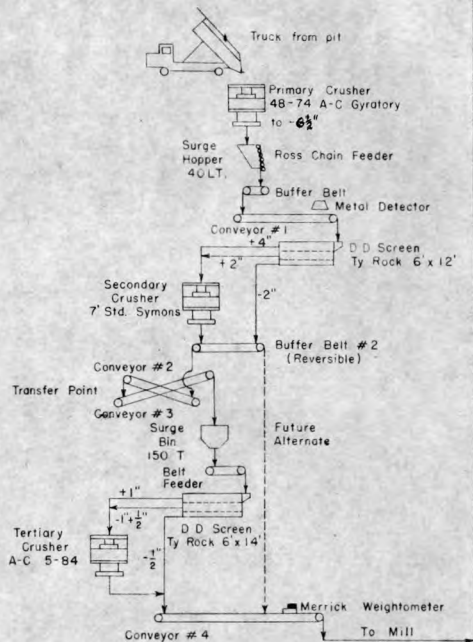
a. Equipment Received (Exclusive of E&A HM-4:)

- 1 - 6" Wilfley Pump with motor and drive
- 1 - 5" Wilfley Pump with motor and drive
- 1 - 12 cell No. 24 Denver Flotation Machine with motors and drives
- 2 sets - Automatic control valves for fresh and reuse water system
- 1 section - Electrical control center for flotation machines
- 1 - 3" Barrett Haentgen Sand Pump
- 1 - 5" Barrett Haentgen Sand Pump
- 24 - 6" cyclone (Replaced by manufacturer, free of charge)
- 2 - Denver No. 24 mechanisms with motors and drive
- 1 - Won Way backstop
- 3 - 34 ton Euclid Trucks, rented
- 1 - 600 Gyroflo Compressor, I.R., rental

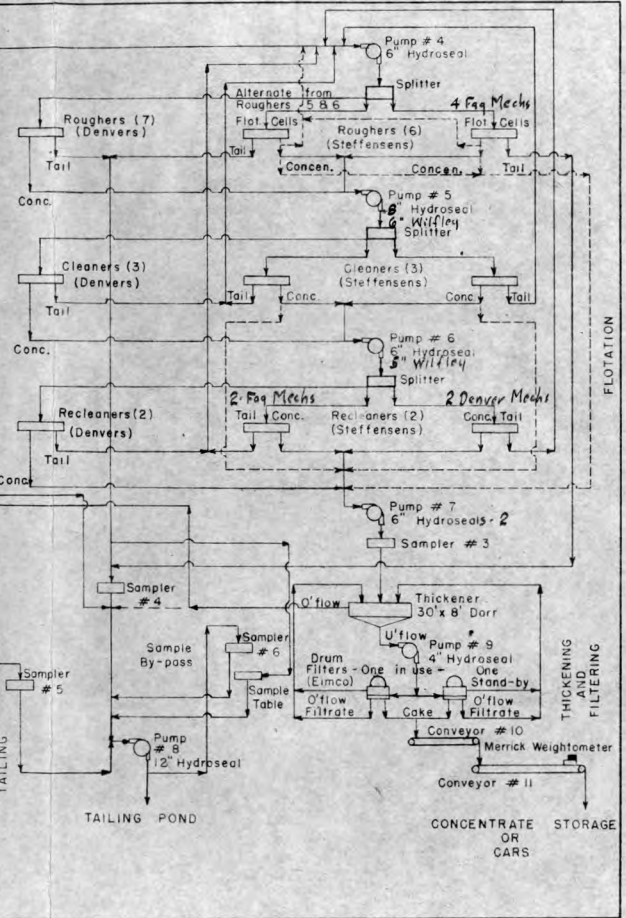
b. Proposed New Equipment:

- 1 - Heating unit for primary crusher building
- 1 - Fan for dust collecting system
- 5 - Fagergren mechanisms for flotation cells, with motors and drives
- 1 - Belt weighing scale for No. 2 rod mill
- 3 - Reagent feeders
- 1 - Section control center for flotation cells
- 1 - 13 cell bank of Denver Flotation Cells
- 1 - 18,000 gallon fuel oil storage tank
- 1 - Steam jenny
- 1 - Conditioner with motor and drive
- 1 - Ventilating equipment for shop
  - Primary cable for jet piercing machine
- 1 - Pickup truck
- 1 - Gardner Denver 4 $\frac{1}{2}$ " Drill

**HUMBOLDT MILL**  
CRUSHING SECTION  
(Designed for 480 LTPH)



**HUMBOLDT MILL**  
CONCENTRATING SECTION



GRINDING CLASSIFICATION AND CONDITIONING

TAILING

TAILING POND

CONCENTRATE STORAGE OR CARS



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1. GENERAL

The production, in 1954, was 156,600 tons of Lloydale ore compared with 138,900 tons (47% Lloydale, 53% Lloyd Silica) in the previous year. The product per man per day was 5.87 tons, which was the highest in the past 5 years.

The cost of production in 1954 was \$4.648 compared with the budget estimate of \$4.699 per ton. A comparison with 1953 would be of little value due to the heavy development program and high cost in that year.

Approximately 87% of the product was shipped during 1954. The analysis was above the guarantee, although the iron content of this sulphurous ore was somewhat lower than the diamond drilling and development indicated.

The operating schedule was reduced from 5 to 4 days per week on a company wide basis on April 5, 1954. Further curtailment was made on May 15, by reducing the labor force by about 25% or 29 men. Additional reductions resulted as men retired, quit, or died, and were not replaced.

General mining conditions were favorable during the year. The open stope mining method was used and appeared to fit the size and shape of the ore bodies very well. The 25 foot roof pillar, over the stoping area, allowed excellent mining conditions, with very little interference from water. It is quite evident that all known reserves will be exhausted during the latter part of 1955, and no program of exploration is planned for the future.

2. PRODUCTION

a. Production by Grade and Months

<u>Month</u>	<u>Days</u>	<u>Lloydale</u> <u>Tons</u>	<u>Rock</u> <u>Tons</u>	<u>Tons per</u> <u>Man per</u> <u>Day</u>
January	20	18,546	240	6.68
February	20	18,603	591	6.80
March	23	21,966	745	7.30
April	18	9,395	1,016	3.69
May	16	10,829	250	5.18
June	17	12,191	24	6.38
July	10	6,738	-	5.08
August	18	12,019	430	5.78
September	17	11,220	169	5.79
October	16	12,003	149	6.08
November	17	11,005	108	5.85
December	18	12,085	451	5.86
Total	210	156,600	4,173	5.87

b. Shipments

<u>Year</u>	<u>Lloydale</u>	<u>Lloyd Silica</u>	<u>Total</u>
1954	136,605	1,168	137,773
1953	44,603	70,043	114,646



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2. PRODUCTION (cont'd)c. Ore Statement

	<u>Lloyddale</u> <u>Tons</u>	<u>Lloyd Silica</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>	<u>Total Last</u> <u>Year</u>
On hand Jan. 1, 1954	26,356	162,049	188,405	164,151
Output for Year	156,600	-	156,600	138,686
Transfers				(714)
Overrun				214
Total	182,956	162,049	345,005	303,051
Shipments	136,605	1,168	137,773	114,646
Balance on Hand	46,351	160,881	207,232	188,405
Increase in Output	92,111	74,197	17,914	
Increase in Shipments	92,002	68,875	23,127	
Increase in Ore on Hand	19,995	1,168	18,827	

The operating schedule for the past two years follows:

1954 - Hoisting and mining operations 3 - 8 hour shifts per day, 5 days per week, January 1 to April 5. Effective April 5, 4 days per week.

1953 - Hoisting and mining operations 3 - 8 hour shifts per day, 5 days per week.

d. Division of Product by Levels

<u>Level</u>	<u>Lloyddale</u>	<u>Total</u>
10th	156,600	156,600

e. Production Delays

During the afternoon shift on June 17, the bullgear on the underground winze hoist cracked. The shutdown for temporary repairs resulted in a production loss of 400 tons. During the following week, additional cracks appeared in the bullgear spider. Production was stopped and the spider was strengthened by welding plates to the spokes. A 1,000 ton loss in production resulted.

On two other occasions, it was necessary to cancel an eight hour shift due to structural failures in equipment. However, these shifts were made up on the following Friday.

3. COST OF DEVELOPING AND OPERATINGa. Comparative Mining Costs

	<u>1954</u>	<u>1953</u>
Product - Tons	156,600	138,900
Underground Costs	3.100	4.040
Surface Costs	.514	.920
General Mine Expenses	<u>1.034</u>	<u>1.143</u>
Cost of Production	4.648	6.103
Depreciation	1.185	.567
Taxes	.057	.064
Loading and Shipping	<u>.081</u>	<u>.116</u>
Total Cost at Mine	5.971	6.850



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3. COST OF DEVELOPING AND OPERATING (cont'd)

a. Comparative Mining Costs (cont'd)

	<u>1954</u>	<u>1953</u>
Budget Estimated at Mine	6.017	6.850
No. of Shifts and Hours	2-1-8 hr 3-2-8 hr <u>205-3-8 hr</u>	2-1-8 hr 248-3-8 hr <u>250</u>
Total Operating Days	210	250
Average Daily Product	746	556

Proportion of Labor, Supplies and Expenses

	<u>1954</u>	<u>Per Cent</u>
Labor	552,679.02	76
Supplies & Expenses	<u>175,241.14</u>	24
Total	727,920.16	100

b. Detailed Cost Comparison

Note: At the start of 1954 a new card of accounts for cost sheet items was put into use. Several changes were made to consolidate the various headings, as well as detailing others, to improve its value from the operating standpoint. Due to these changes a comparison between 1954 and 1953 costs are of little significance.

	<u>1954</u>		<u>1953</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
Development	74,416.10	.475		
Mining	189,147.84	1.209		
Tramming	94,144.17	.601		
Auxiliary Hoisting	41,224.33	.263		
Ventilation	3,922.89	.025		
Pumping	13,544.83	.087		
Compressors & Air Lines	11,284.19	.072		
Underground Superintendence	26,423.96	.169		
Maint-Pockets & Chutes	5,784.59	.037		
-Mining Equipment	14,870.40	.095		
-Levels & X-Cuts	4,784.35	.030		
-Shaft	<u>5,884.69</u>	<u>.037</u>		
Total Underground Costs	485,432.34	3.100	<u>560,293.97</u>	<u>4.040</u>
Hoisting	26,088.79	.167		
Crushing & Screening-Surface	28.15			
Stocking	19,793.36	.127		
Timber Yard	5,505.63	.035		
Dry House	7,244.71	.046		
Policing	14,171.96	.090		
General Surface	5,101.47	.033		
Maint-Headframe Bldg. & Equip.	1,361.69	.008		
-Other mine Bldgs.	<u>1,248.17</u>	<u>.008</u>		
Total Surface Costs	80,543.93	.514	<u>127,547.52</u>	<u>.920</u>



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3. COST OF DEVELOPING AND OPERATING (cont'd)

b. Detailed Cost Comparison (cont'd)

	1954		1953	
	Amount	Per Ton	Amount	Per Ton
Geological Department	2,024.18	.013		
Mining Engr. Department	5,891.11	.037		
Mech. & Elect. Engr. Department	4,133.28	.027		
Safety Department	1,893.40	.012		
Analysis & Grading-Laboratory	11,419.01	.073		
-Shipping	1,749.66	.011		
Telephone & Safety Devices	5,672.46	.037		
Welfare-General	982.15	.006		
-District	147.07	.001		
Special Expense-Pensions	28.26			
-Retirements	1,538.29	.010		
-Legal	1,003.93	.007		
-Hygiene Clinic	2,271.88	.015		
-Employment Off.	463.73	.003		
-Other	326.55	.002		
Ishpeming Office	18,184.71	.116		
Mine Office-Supts. & Clerks	19,359.54	.123		
Central Warehouse Overhead	3,823.90	.025		
Insurance-Property	994.31	.006		
-Group, Health & Life	5,799.41	.037		
-Group Annuity	3,414.82	.022		
-Catastrophe	1,167.58	.007		
Personal Inj.-Comp. & Doctors	25,750.76	.164		
-Comp. Department	791.25	.006		
Vacation Pay-Current Year	23,844.50	.151		
-Prior Year Adj.	4,600.00	.029		
Holiday Allowance	10,665.30	.068		
Taxes-Unemployment Ins.	4,766.38	.030		
-Old Age Benefit	8,436.47	.054		
Total General Mine Expense	161,943.89	1.034	158,529.31	1.143
Cost of Production	727,920.16	4.648	846,370.80	6.103

4. ANALYSIS

a. Average Mine Analysis on Output

Grade	Tons	Iron	Phos.	Sil.	Sulph.
Lloyddale	156,600	56.69	.134	8.84	.500

b. Average Analysis of Shipments

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist
Lloyddale	136,605	57.60	.122	8.04	.27	2.69	1.37	.81	.504	3.49	10.82
Lloyd Silica	1,168	52.45	.096	16.10	.24				.297		6.80

c. Average Analysis of Ore in Stock December 31, 1954

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist
Lloyddale Dried	46,351	56.75	.142	9.02	.27	2.69	1.37	.81	.491	3.49	
Lloyddale Natural		50.61	.127	8.04	.24	2.40	1.22	.72	.438	3.11	10.82
Lloyd Silica Dried	160,881	51.85	.130	18.71	.23	2.32	.51	.55	.052	3.07	
Lloyd Silica Natural		45.83	.115	16.53	.20	2.05	.45	.49	.045	2.71	11.61



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4. ANALYSIS(Cont'd)

d. Analysis of Straight Cargo Shipments

There were no straight cargo shipments during 1954.

5. ESTIMATE AND ANALYSIS OF ORE RESERVES

The estimated ore reserves are limited to the ore above the 10th Level. Several small pillars of ore remain above the 9th Level, which can only be recovered by caving as mining operations above the 10th Level progress. The extent of the ore in the sulphurous deposit is very well defined, with the major portion of the reserves lying between the 10th Level and the main transfer sub-level 50' above. The depth of the standard ore body has not been exactly determined at this time. The total amount of these reserves that may be mined is wholly dependent on economic conditions during the coming year.

As depth of mining increased, a lower iron content and a higher sulphur analysis was experienced than had been indicated by the results of the diamond drilling program. Several small dikes and seams of argillite were found to intersect each ore body. It is impossible to segregate this barren material as mining progresses, and the resulting contamination further reduces the grade of ore being mined.

a. Comparison of Production to Reserves

Reserves on January 1, 1954	276,352
Production Jan. 1 to Dec. 31, 1954	156,600
Balance	<u>119,752</u>
Reserves as of Dec. 31, 1954	168,294
New Ore Developed	48,542

b. Developed Ore

The following is an estimate of ore reserves as of December 31, 1954, using a factor of 12 cubic feet per ton.

	<u>Standard Ore</u>	<u>Sulphurous Ore</u>	<u>Total</u>
Total Gross as of Aug. 31, 1954	89,834	161,972	251,806
Less Prod. Aug. 31, to Dec. 31, 1954	<u>14,133</u>	<u>44,199</u>	<u>58,332</u>
Total Gross as of Dec. 31, 1954	75,701	117,773	193,474
Less 10% for Mining Loss and Rock	<u>8,983</u>	<u>16,197</u>	<u>25,180</u>
Net Total as of Dec. 31, 1954	66,718	101,576	168,294

<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>
Lloyddale Dried	58.50	.129	6.50	.30	2.50	.70	.50	.745	3.50	
Lloyddale Natural	51.48	.114	5.72	.26	2.20	.62	.44	.656	3.08	12.00

6. LABOR AND WAGES

a. Labor Relations

Membership in the union was 99% of the eligible employees. Relations between management and the employees remained excellent throughout the year. Three meetings with the local grievance committee sufficed to settle several minor complaints. No formal grievances were submitted.

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6. LABOR AND WAGES (cont'd)

b. Employment

	<u>1954</u>	<u>1953</u>
Number of Men Beginning of Year	134	137
Added During Year	15	25
Separations	39	28
Total End Of Year	110	134
Avg. No. of Men as Per Dec. Labor Statement	121½	135¾

Four men quit, three men were retired, two died, and thirty men were laid off. Eight men were transferred from other mines, four were rehired, and three men returned from Military Service.

c. Statement of Wages

A 5 cent per hour wage increase was made to all hourly employees effective July 1 in conjunction with the Company agreement with the Union. The company account Job Class 14 is now \$2.28½ per hour or \$18.28 per day. The average contract miner's wage rate for the year was \$2.702 per hour, or 18.25% above the company account rate. In order to maintain the original incentive development and production rates, the 5 cent wage increase has been treated as an "add on".

A comparison of the average hourly and daily wage is shown below.

<u>Year</u>	<u>Per Hour</u>	<u>Per Day</u>
1954	2.445	19.56
1953	2.377	19.02

7. SURFACE

a. Buildings

There were no major repairs or additions to the existing surface buildings.

b. Stocking Grounds

Some additional relocation of track and grading work was done to facilitate the spotting of cars for stockpile loading purposes. The north trestle, east of the shaft, was dismantled as stockpile loading progressed, and a new trestle consisting of 20 bents was erected for the 1955 season.

8. UNDERGROUND

a. Development

At the close of 1953, four stope areas were in full production in the sulphurous deposit. These stopes, supported by 25 foot pillars, were located in each end of the ore body (east and west) and along the north and south sides. As mining progressed, and caving in the stope areas occurred, it was necessary to reduce the size of the pillars and redevelop the main pillars for mining. As the west end of the deposit was exhausted, small scam stopes were mined in the pillars left between the transfer drifts below the stopes.

In the standard ore body, development work for mining purposes was started early in the year. This area was developed for mining by two lifts, with the top lift 30' below the 9th Level elevation. Sub level stopes were developed at the



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8. UNDERGROUND (cont'd)

a. Development (cont'd)

east and west ends of the deposit and mined toward a center pillar. Because the west end of this ore body is very wet above the 9th Level, it was necessary to drive a drainage raise from the 10th Level to the top sub-level. This raise drains the majority of the water from this area and makes possible the mining of comparatively dry ore.

As mining progresses, and caving commences, or a pillar is mined out, it becomes necessary to shift the emphasis from mining to development with a resulting abnormally high cost and low production for this period. This may well be illustrated by the fact that in January the development cost amounted to 14.7 cents per ton, while in April, as a result of the caving stopes, the accelerated development to open new working places, increased the cost to \$1.785 per ton.

b. Mining

During 1954, mining operations were confined to the four stopes mentioned above. Late in March, the roof pillars of three of the large sulphurous deposit stopes commenced caving and production abruptly dropped from a 3 month average of 6.94 to 3.69 tons per man per day for April. At this time, and for the remainder of the year, the production was largely derived from small scam stopes.

In June, sub-level stoping was started in the standard deposit and continued throughout the year. Thus, on the average, the operation includes five stoping contracts and one additional single shift contract to carry on incidental development in advance of mining.

The greatest deterrent to increased production has been the winze hoist between the 8th and 10th Levels. The maximum amount that can be hoisted per shift is approximately 115 cars or 460 tons. However, the hoisting of men, supplies, and rock, as well as daily inspections, reduce this figure to an average of 75 cars or 300 tons per shift. It should be mentioned that the auxiliary hoist requires 12 extra men to operate in place of direct connection with the shaft. During the year, the total cost of operation amounted to about \$41,000.00 or 26.3 cents per ton.

c. Timbering

The amount of timber used during the year was approximately 40.2% less than in the previous year due to a smaller development program. The major use for timber in the sulphurous deposit was the relining and resupporting of the existing transfer drifts as weight increased due to mining.

A considerable amount of rock bolting was done in the 8th Level main drift. This resulted in a substantial saving over the cost of timber or steel set support.

During the second half of the year, as a result of curtailment, all stulls and fir lumber were purchased from the Cambria-Jackson Mine in an effort to reduce inventories.

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8. UNDERGROUND (cont'd)c. Timbering (cont'd)Statement of Timber Used

	Lineal Feet	Avg. Price Per Foot	Amount 1954	Amount 1953
Cribbing	10,779	.1185	1,276.83	3,302.34
Stulls	8,004	.2337	1,870.21	3,422.92
H-Beams	2,910	.8373	2,436.43	1,018.26
Lagging	60,984	.0225	1,373.26	5,480.58
Poles	50,718	.0377	<u>1,914.41</u>	<u>1,606.71</u>
Total Timber Expense			8,871.14	14,830.81

Explosives

	Quantity Lbs.	Average Price	Amount 1954
Gelamite 1	5,000	.1745	872.50
Gelamite 1-X	62,500	.1745	10,906.25
Gelatin Hi-Pressure 60% 5x5	17,250	.2350	4,053.75
Hercomite 2-X	750	.1670	125.25
Total Powder	85,500	.1866	15,957.75
Fuse, Caps, Etc.			<u>4,848.23</u>
Total Expense, Development & Mining			20,805.98

	1954	1953
Product - Tons	156,600	138,900
Lb. Powder Per Ton of Ore	.546	.666
Cost Per Ton-Powder	.102	.122
Cost Per Ton-Fuse, Caps, Etc.	.031	.025
Cost Per Ton-All Explosives	.133	.148

Grand Total Explosives Used in Mine	\$20,805.98	\$25,439.07
Average Price Per Lb. for Powder	.1866	.1852

d. Pumping

An average of 214 GPM was pumped during 1954 as compared with 220 GPM in 1953.

The mine pumping system is completely automatic, and incorporates three stations working in relays (10th Level to 8th Level, 8th Level to 5th Level, and 5th Level to surface). Each station is equipped with emergency standby pumps and sumps, and warning lights and signals located on surface. The policemen observe the operating lights and recording clocks during non-operating hours and notify the electrician in case of pump failure. Very little emergency attention has been required since its installation.



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9. TAXES

The following shows a comparison of the taxes paid in 1954 and 1953.

	<u>1954</u>		<u>1953</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
<u>Lloyd &amp; Section 6</u>				
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6, 47-27 40A)				
N $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6, 47-27 81.67A)	90,000.00	1,926.78	90,000.00	1,922.51
N $\frac{1}{2}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27 80A)				
Pers., Ore in Stock, Supplies & Eqt.	<u>275,000.00</u>	<u>5,887.39</u>	<u>260,000.00</u>	<u>5,553.91</u>
Total by State Tax Commission		7,814.17		7,476.42
Collection Fee		<u>78.14</u>		<u>74.76</u>
Total	<u>365,000.00</u>	<u>7,892.31</u>	<u>350,000.00</u>	<u>7,551.18</u>
<u>C.C.I. Co. Misc. Lands</u>				
S $\frac{1}{2}$ of NE $\frac{1}{4}$ of Sec. 6, 47-27 80A	550.00	11.79	550.00	11.74
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6, 47-27, ExcR/W41.08A	550.00	11.77	550.00	11.75
S $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6, 47-27, 81.26A	900.00	19.27	900.00	19.21
SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27	550.00	11.77	550.00	11.75
SE $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27	600.00	12.84	600.00	12.82
NE $\frac{1}{4}$ of NE $\frac{1}{4}$ of Sec. 19, 48-27 40A	<u>135.00</u>	<u>2.89</u>	<u>135.00</u>	<u>2.88</u>
Total	<u>3,285.00</u>	<u>70.33</u>	<u>3,285.00</u>	<u>70.15</u>
Collection Fee		.70		.70
Total Lloyd & Miscellaneous	<u>368,285.00</u>	<u>7,963.34</u>	<u>352,285.00</u>	<u>7,622.03</u>
<u>West Ishpeming</u>				
Lot 4, Block 2	75.00	1.62	75.00	1.62
<u>North Lake Location</u>				
Store on Sec. 6, 47-27	<u>1,000.00</u>	<u>21.62</u>	<u>1,000.00</u>	<u>21.58</u>
Total Ishpeming Township	<u>369,360.00</u>	<u>7,986.58</u>	<u>354,360.00</u>	<u>7,645.23</u>
Tax Rate		21.4087		21.3612
<u>Ely Township</u>				
Lloyd Mine-Pers. Prop.-Stockpile	30,000.00	840.00	45,000.00	1,260.00
Taxes Per Ton Produced	<u>1954</u>	<u>1953</u>	<u>1952</u>	<u>1951</u>
	.056	.064	.117	.037
Taxes Per Ton Shipped	.064	.078	.140	.042
		.041		

10. ACCIDENTS AND PERSONAL INJURY

The safety record for the year, at the Lloyd Mine, was eighth in rating as compared with first in 1953. There were 6 compensable accidents, one of which accounted for 300 out of a total 440 days lost.

<u>Year</u>	<u>Frequency Rate</u>	<u>Severity Rate</u>
1954	63.90	2.163
1953	19.10	0.202
Average all UG properties 1954	29.63	1.243

During the latter part of the year, two occupational disease cases were settled at a total cost of \$21,000.00. Thus, the personal injury account totaled \$25,750.76 or 16.4 cents per ton. Due to the relatively high average age of the Lloyd Mine employees, there are several men who are physically handicapped through injury or illness. As a result, it becomes increasingly difficult to fit the job to the man or the man to the job.

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10. ACCIDENTS AND PERSONAL INJURY (cont'd)

The accidents are listed as follows:

Accident No. 919, February 26, 1954, Louis H. Mayotte, Welder-Standard. Crushing injury to middle and ring fingers of left hand necessitating amputation. Time lost - 22 days. (300 day compensation period).

Accident No. 920, March 8, 1954, Michael Coluccio, Stope Scrapperman. Twisted right ankle. Time lost - 23 days.

Accident No. 921, March 9, 1954, Elmer G. Olson, Stope Scrapperman. Injury to left ankle. Time lost - 13 days.

Accident No. 922, April 2, 1954, George Brighenti, Truck Driver. Bruised right instep. Time lost - 12 days.

Accident No. 923, September 30, 1954, Emelio Baldini, Stope Scrapperman. Hernia. Time lost - 33 days.

Accident No. 924, December 6, 1954, George Brighenti, Truck Driver. Strained muscle of right chest wall. Time lost - 15 days to the end of the year.

11. POWER

As a result of a general change in power distribution, sales and supply, from a subsidiary utility company to a Cleveland-Cliffs department, there was a sharp reduction in the cost of electric power as shown below.

<u>Year</u>	<u>K.W.H.</u>	<u>Cost</u>	<u>Rate</u>
1954	2,111,339	\$19,670.44	.00932
1953	2,259,033	\$41,163.52	.01822



MATHER MINE "A" SHAFT  
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1. GENERAL:

The Mather Mine, "A" Shaft production for the year 1954 was 915,405 tons. Shipments from the pocket and stockpile were started on April 22nd and were continued until the 22nd of November. A total of 674,803 tons were loaded out during that period. Operations for the first three months of 1954 were on a five day basis with a four day schedule commencing on April 5th. The working force was reduced on May 15th by 25% with no replacement of severances. This necessitated a two shift, four day operation for the remainder of the year. By grades 892,223 tons were of the Standard grade and 23,182 tons were of the Special grade.

The analysis of the Mather Mine, "A" Shaft product for the year was 58.46 Fe., 9.16 Si., and .051 Sul. in the Standard grade and 58.30 Fe., 7.43 Si., and 1.012 Sul. in the Special grade. This analysis is a very substantial improvement over 1953.

The cost of production decreased \$.044 per ton as compared to 1953, and the total cost at the mine including depreciation, taxes, loading and shipping costs showed a decrease of \$.520 per ton. These costs were attained despite an across the board wage increase for hourly rate employees and a general increase in the purchase price of most supplies. The tons per man per day increased from 7.46 in 1953 to 8.04 in 1954.

Replacement of 10,000 feet of skip guide 80# shaft rail was undertaken during the vacation period scheduled for the last half of July. The cost of this replacement was taken up in operating and amounted to \$.043 per ton of the total annual production.

The high physical inventories at the mine gave cause for considerable concern at the start of 1954. A vigorous campaign to reduce these inventories to a more reasonable level was undertaken with the result that the supply balance was reduced from \$601,173.93 as of January 1, 1954 to \$328,101.37 as of January 1, 1955, a reduction of \$273,072.56.

Ore reserves were outlined by diamond drilling from the 3rd, 7th, and 8th Levels during the year. The gross reserves were increased by 4,979,885 tons.

Labor relations continued to be very satisfactory as indicated by the fact that there were no formal grievances presented.

Mining operations were conducted on the 5th, 6th, and 7th Levels. Production ceased on the 6th Level in February. Production on the 5th Level, which had stopped in 1953, was resumed over the #7 Cross-cut in April 1954. By levels production was as follows: 5th Level - 23,198 tons or 2.6% of the total product; 6th Level - 13,642 tons or 1.5% of the total product; 7th Level - 866,022 tons or 95.9% of the total product.

Main level development was continued on the 8th and 9th Levels. The connection between "A" and "B" Shafts on the 8th Level was completed in December 1954. The 9th Level footwall drift was advanced a distance of 2,600 feet east of "A" Shaft at the end of the year.

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1. GENERAL: (Continued)

The use of rock bolts for ground support has proven very satisfactory and during 1954, 81.6% of the main level development was done using rock bolts. The drift cost per foot was reduced from \$75.09 in 1953 to \$53.46 in 1954. This decrease of \$21.63 per foot for a total of 5,334 feet represents a saving of \$115,374 for the year.

The rate of water pumped to surface decreased slightly in 1954. Four hundred fifty-two gallons per minute were pumped in 1953, whereas, four hundred forty-one gallons per minute were pumped during the current year.

A considerable amount of experimenting was done with the installation of circular tubes as raise lining. The tubes are 42" in diameter by 30" in length, each tube butting against the next for the entire length of the raise. This type of lining has proven far superior to a cribbed raise lined with plank and steel plate. Maintenance has been greatly reduced as it is possible to keep the raise full of dirt without the ore hanging up. This prevents excessive wear from abrasion and eliminates the problem of replacing decayed cribbing and plank.

Experiments with rotary drilling without percussion progressed during the year to the use of water as a coolant and specially designed tungsten carbide bits for drilling hard ground that cannot be drilled dry. These experiments met with some success as drilling speed was increased in some areas. There are certain design problems, however, that remain to be ironed out.

A sub-level conveyor belt feeding the main storage trench at the crusher site on 7th Level was put into operation during 1954. This installation was an experiment to determine what proportion of uncrushed ore could be handled to the best advantage over a belt and secondly, to determine the amount of tramming labor and maintenance that could be saved by belt haulage versus motor haulage. It was found that about 97% of the uncrushed ore could be handled over the belt without difficulty. Substantial savings in labor and maintenance are also indicated for belt haulage.



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2. PRODUCTION:a. Production by Grade and Months:

<u>Grade:</u>	<u>Product</u>	<u>Stockpile Overrun</u>	<u>Total</u>	<u>1953 Total</u>
Mather	879,680	12,543	892,223	
Mather Special	23,182	-	23,182	
Total	902,862	12,543	915,405	1,159,749
Rock			70,521	74,686

<u>Months:</u>	<u>Ore</u>	<u>Rock</u>
January	104,350	6,820
February	112,088	6,963
March	108,530	8,811
April	91,010	6,941
May	67,527	4,884
June	63,375	4,598
July	33,780	1,782
August	68,370	4,961
September	58,954	6,017
October	61,953	6,358
November	65,613	6,017
December	79,855	6,369
Total	915,405*	70,521

\* Total includes 12,543 tons, current year stockpile overrun pro-rated monthly.

b. Shipments:

	<u>Pocket</u>	<u>Stockpile</u>	<u>Total</u>	<u>1953 Total</u>	<u>Decrease</u>
Mather	289,372	373,498	662,870	909,328	
Mather Special	11,315	618	11,933	279,814	
	300,687	374,116	674,803	1,189,142	514,339

The center stockpile was loaded out by the end of the season and developed an overrun of 12,543 tons. The north stockpile was not entirely loaded out during the year and no loading was done from the south stockpile.



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2. PRODUCTION: (Continued)

c. Ore Statement:

	<u>Mather</u>	<u>Mather Special</u>	<u>Total</u>	<u>1953 Total</u>
On Hand January 1, 1954	282,821	-	282,821	312,214
Output for Year	885,987	16,875	902,862	1,157,735
Transfers	6,307	6,307	-	-
Overruns	12,543	-	12,543	2,014
Total	1,175,044	23,182	1,198,226	1,471,963
Shipments	662,870	11,933	674,803	1,189,142
Balance on Hand	512,174	11,249	523,423	282,821
Decrease in Output			254,873	
Increase in Output				154,664
Decrease in Ore on Hand				29,393
Increase in Ore on Hand			240,602	

Working Schedule:

- 1954 - 3-8 hr. shifts, 5 days per week, Jan. 1st to March 1st.  
(Excluding a small production crew, Saturday, day shift.)  
3-8 hr. shifts, 5 days per week, March 1st to April 5th.  
3-8 hr. shifts, 4 days per week, April 5th to May 15th.  
2-8 hr. shifts, 4 days per week, May 15th to Dec. 31st.
- 1953 - 3-8 hr. shifts, 5 days per week, Jan. 1st to Dec. 31st.  
(Excluding a small production crew, Saturday, day shift.)
- 1952 - 3-8 hr. shifts, 5-2/3 days per week, Jan. 1st to May 31st.  
3-8 hr. shifts, 5-1/2 days per week, June 1st to Sept. 30th.  
3-8 hr. shifts, 5-1/3\* days per week, Oct. 1st to Dec. 31st.  
(\*Excluding a small production crew, Saturday, afternoon shift.)
- 1951 - 3-8 hr. shifts, 6 days per week, Jan. 1st to Mar. 31st.  
3-8 hr. shifts, 5-2/3 days per week, April 1st to Dec. 31st.
- 1950 - 3-8 hr. shifts, 5 days per week, Jan. 1st to Aug. 20th.  
3-8 hr. shifts, 6 days per week, Aug. 21st to Dec. 31st.



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2. PRODUCTION: (Continued)

d. Division of Product by Levels and Months:

<u>Months</u>	<u>Fifth (2050') Level</u>	<u>Sixth (2200') Level</u>	<u>Seventh (2400') Level</u>	<u>Total</u>	<u>Rock</u>
January		10,315	92,835	103,150	6,820
February		3,327	107,561	110,888	6,963
March			107,150	107,150	8,811
April	943		88,987	89,930	6,941
May	1,508		65,059	66,567	4,884
June	2,842		59,483	62,325	4,598
July	838		32,431	33,269	1,782
August	3,814		63,476	67,290	4,961
September	3,466		54,467	57,933	6,017
October	4,427		56,565	60,992	6,358
November	2,335		62,258	64,593	6,017
December	3,025		75,750	78,775	6,369
	<u>23,198</u>	<u>13,642</u>	<u>866,022</u>	<u>902,862</u>	<u>70,521</u>

Current Year Stockpile Overrun

12,543  
915,405

e. Production Delays:

The plant operated throughout 1954 without any except minor interruptions in production.

The vacation period scheduled during the last half of July was utilized to install the skip guide rails as described in Section 7.

MATHER MINE "A" SHAFT  
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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>
Mather	58.46	.110	9.16	.051
Mather Special	58.30	.061	7.43	1.012

The Mather Standard ore average iron analysis improved during the current year by .60 of a point over 1953. The silica analysis was lower by .71 of a point, and the sulphur analysis dropped .085 of a point.

The iron analysis of the Special grade ore improved by 1.07 points; the silica decreased by 2.30 points, while the sulphur content increased by .412 points, as compared with 1953.

b. Average Analysis of Shipments:

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sulphur</u>	<u>Lime</u>	<u>Mag.</u>	<u>Loss</u>	<u>Moist.</u>
Mather	57.83	.105	9.84	.34	3.11	.050	.54	.80	1.86	12.43
Mather Special	57.60	.078	8.24	.27	2.60	.950	1.80	.46	2.31	12.44

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

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sul.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Loss</u>	<u>Moist.</u>
Mather	512,174	51.04	.097	8.15	.30	2.72	.010	.47	.43	2.75	12.43
Mather Special	11,249	51.49	.044	5.66	.24	2.28	.977	1.23	.40	1.59	12.43



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

Capital account expenditures amounted to \$664,708.57, which brought the total at the end of the year to \$9,503,127.50. The total figure does not include an additional \$318,223.11 charged in a prior year to Negaunee Mine Company "Idle Expense". By including the "Idle Expense" the grand total expended to date amounts to \$9,821,350.61. The following table shows the main items of capital expenditures which are included in the total capital account charges above.

	<u>Percentage of Total Capital</u> <u>Account Charges in 1954</u>
Main Level Development	65.2
9th Level Pumphouse	8.6
Underground Conveyor Belt & Crusher Systems	11.1
Underground Exploration	10.9
Underground Equipment	2.6
Surface Equipment	1.3
Surface Projects	0.3
Total Charge-Offs	\$352,167.40
Total Capital Account Charges as Above	<u>664,708.57</u>
Actual Net Increase in Capital Account	\$312,541.17



MATHER MINE "A" SHAFT  
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4. COST OF OPENING, EQUIPPING,  
DEVELOPING AND OPERATING: (Continued)

Comparative Mining Costs:

The Cost of Production decreased \$.044 per ton as compared with the previous year. An increase of \$.010 in the Surface Costs and \$.051 in the General Mine Expense was offset by a decrease of \$.105 in the Underground Costs. The substantial decrease in the Underground Costs reflects the increase in the tons per man per day from 7.46 in 1953 to 8.04 in 1954.

A decrease of \$.516 per ton in the Depreciation rate was largely due to a credit of \$.014 per ton under Section 309, as compared to a charge of \$.508 per ton the previous year. The decrease in the Depreciation rate combined with an increase of \$.064 for Taxes, and a decrease of \$.013 for Loading and Shipping, brought the Total Cost at Mine to \$4.956. This cost was \$.520 less than the previous year.

	<u>1954</u>	<u>1953</u>
Product	915,405	1,159,749*
Underground Costs	2.964	(1) 3.069
Surface Costs	.413	(1) .403
General Mine Expense	<u>.802</u>	(1) <u>.751</u>
Cost of Production	4.179	(1) 4.223
Cost of Production (including Mather "B")		(2) 4.221
Depreciation: Pre-Production Development	.013	(1) .014
Plant & Equipment	.171	(1) .135
Movable Equipment	.008	(1) .006
Development	.104	(1) .166
Miscellaneous Equipment	.001	
Amort. of Defense Facilities	.103	(1) .073
Allowance under Section 309	<u>.014</u>	(1) .508
Taxes	.300	(1) .236
Administration	.050	(2) .050
Loading and Shipping	<u>.041</u>	(2) <u>.054</u>
Total Cost at Mine	4.956	(2) 5.476
Budget - Cost of Production	4.403	
Budget - Total Cost at Mine	5.136	5.182
Number of Shifts and Hours	209	242-2/3 3-8 hr.
Total 8 hour Operating Shifts	507	728
Number of Operating Days	209	242-2/3 3-8 hr.
Average Daily Product	4,380	4,779

\*The production total for 1953 of 1,159,749 tons includes 2,362 tons of Mather Mine, "B" Shaft production that was hoisted through Mather Mine, "A" Shaft. Those costs indicated by (1) have been calculated using 1,157,387 tons as the divisor. Those indicated by (2) have been calculated using 1,159,749 tons as the divisor.



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

Detailed Cost:

	1954	
	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs:</u>		
Development	777,721.90	.850
Mining	948,921.16	1.037
Tramming	402,749.41	.440
Ventilation	17,530.76	.019
Pumping	61,456.46	.067
Compressors and Air Lines	69,421.44	.076
Crushing and Screening - UG	15,354.75	.016
Underground Superintendence	208,201.95	.227
Maintenance:		
Pockets and Chutes	9,973.70	.011
Mining Equipment	137,055.95	.150
Levels and X-Cuts	20,034.79	.022
Shaft	<u>44,849.81</u>	<u>.049</u>
Total Underground Cost	2,713,272.08	2.964

Surface Costs:

Hoisting	149,297.05	.163
Crushing and Screening - Surface	15,290.18	.017
Stocking	61,347.00	.066
Timber Yard	49,648.32	.054
Dry House	43,730.42	.048
Policing	20,355.39	.023
General Surface	15,188.75	.017
Maintenance:		
Headframe Bldg. and Equipment	7,803.56	.008
Other Mine Buildings	<u>15,506.51</u>	<u>.017</u>
Total Surface Cost	378,167.18	.413

General Mine Expenses:

Geological Department	11,428.27	.012
Mining Engineering Department	42,883.38	.047
Mech. and Elec. Eng. Dept.	29,717.11	.032
Safety Department	8,821.30	.009
Research Laboratory	3,115.53	.003
Analysis and Grading - Laboratory	45,633.17	.050
"    "    "    - Shipping	9,135.73	.010
Telephones and Safety Devices	60,993.28	.067
Welfare - General	4,911.01	.006
"    - District	735.26	.001



MATHER MINE "A" SHAFT  
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4. COST OF OPENING, EQUIPPING,  
DEVELOPING AND OPERATING: (Continued)

Detailed Cost: (Continued)

	1954	
	<u>Amount</u>	<u>Per Ton</u>
<u>General Mine Expenses:</u> (Continued)		
Special Expense - Pensions	141.29	
"    "    - Retirements	7,691.81	.009
"    "    - Legal	5,019.92	.006
"    "    - Hygiene Clinic	11,843.52	.013
"    "    - Employment Office	2,318.74	.002
"    "    - Other	3.64	
Ishpeming Office	96,015.63	.105
Mine Office - Supt. and Clerks	65,858.03	.072
Central Warehouse Overhead	25,548.10	.028
Insurance - Property	5,455.24	.006
"    - Group, Health and Life	29,380.25	.032
"    - Group Annuity	20,206.08	.022
"    - Catastrophe	5,620.45	.006
Personal Injury - Comp. & Doctors	31,937.62	.035
"    "    - Comp. Department	3,956.41	.005
Vacation Pay - Current Year	105,478.00	.115
"    "    - Prior Year Adj.	18,640.00	.020
Holiday Allowance	52,518.12	.057
Taxes - Unemployment Insurance	23,784.87	.026
"    - Old Age Benefit	42,187.60	.046
 Total General Mine Expenses	 <u>733,699.36</u>	 <u>.802</u>
 COST OF PRODUCTION	 3,825,138.62	 4.179

Because of the revision in the mine accounting system wherein certain accounts were combined and others eliminated, the cost comparison shown below is limited to the total underground costs, total surface costs, total general mine expenses, and the total cost of production.

	<u>1954</u>	<u>1953</u>
Underground Cost Per Ton	2.964	3.069
Surface Cost Per Ton	.413	.403
General Mine Expense Per Ton	<u>.802</u>	<u>.751</u>
 Total Cost of Production	 4.179	 4.223



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

	<u>Proportion of Labor and Supplies</u>		
Labor	\$2,505,042.50	2.736/ton	56%
Supplies	<u>1,950,450.46</u>	<u>2.131/ton</u>	<u>44%</u>
Total Cost at Mine	\$4,455,492.96	*4.867/ton	100%

\*Does not include Amortization of Defense Facilities and Allowance under Section 309.

MATHER MINE "A" SHAFT  
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5. ESTIMATE AND  
ANALYSIS OF  
ORE RESERVES:

The net ore reserves reported to the Michigan Tax Commission on December 31, 1954 were 7,840,332 tons. This is an increase of 4,064,480 net tons over the 1953 estimate. Included in the 1954 estimate are 1,291,736 net tons in Section 1, 47-27 to be mined by Mather Mine, "A" Shaft. Previous to 1954 the greater part of this tonnage had been included in the Mather Mine, "B" Shaft reserve estimate. Between the 7th and 8th Levels there has been proven to date 4,001,510 gross tons by underground development and 164,933 gross tons by surface diamond drilling. Ore reserves below the 8th Level total 543,524 gross tons by underground development and 591,666 gross tons by surface diamond drilling.

The 1954 estimate indicates a gross gain in reserves of 4,979,885 tons as compared to a gross gain of 81,903 tons in 1953.

Net Total December 31, 1953	3,775,852
Net Total December 31, 1954	<u>7,840,332</u>
Net Gain in Reserves	4,064,480
1954 Production	<u>915,405</u>
Gross Gain in Reserves	4,979,885

Expected Average Natural Analysis of Ore Reserves as of December 31, 1954

<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>
Mather - Surface Diamond Drilling.....	680,939	53.15	.122	5.08	0.25	2.62	.58	.60	.014	1.97	12.50
Mather - Underground Development.....	<u>7,159,393</u>	51.15	.100	8.75	0.20	2.45	1.00	.50	.110	2.25	12.50
	7,840,332										

The tonnage and analysis figures shown in the preceding table are the same as the figures that were turned into the Michigan State Tax Commission.



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6. LABOR AND WAGES:a. Employment:

The total mine payroll at the end of the year was 538 with a net loss of 182 men during the year.

Number of Men 1/1/54.....	720
Added to Roll During the Year.....	18
Total.....	<u>738</u>
Separations.....	200
Total on Payroll 12/31/54.....	538
Average Number of Men as per December Labor Statement.....	458

Of the separations, 110 were laid off, 61 were transferred to the Mather Mine, "B" Shaft, 11 quit, 7 entered the service, 5 retired, 2 were discharged, 2 were transferred to the General Roll, 1 died, and 1 was transferred to the Main Office. Of the additions, 13 were returned servicemen and 5 were transferred from the Negaunee Mine.

b. Statement of Wages

	<u>1954</u>	<u>1953</u>
<u>Average Wages Per Day:</u>		
Surface	\$17.51	\$17.87
Underground	21.08	<u>19.22</u>
Total	<u>\$20.32</u>	<u>\$18.94</u>
<u>Average Wages Per Month:</u>	(17½ Days)	(20¼ Days)
Surface	\$306.43	\$361.87
Underground	368.90	<u>389.20</u>
Total	<u>\$355.60</u>	<u>\$383.54</u>
<u>Tons Per Man Per Day:</u>		
Surface	38.05	35.91
Underground	10.20	<u>9.42</u>
Total	<u>8.04</u>	<u>7.46</u>
<u>Labor Cost Per Ton:</u>		
Surface	\$ .460	\$ .498
Underground	2.067	<u>2.041</u>
Total	<u>\$2.527</u>	<u>\$2.539</u>

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6. LABOR AND WAGES: (Continued)

c. Labor Relations:

Labor relations continued to be very satisfactory as indicated by that fact that there were no formal grievances presented for the entire year.

On May 15th the working force was decreased by 25% with no replacement of severances. This necessitated a two shift, four day operation for the remainder of the year. There was a net reduction of 182 employees during 1954.

The period beginning on the 16th of July and ending on the 3rd of August was set aside as a regular vacation period.

The men benefited by six paid holidays, New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas, in accordance with the provisions of the labor contract.

Absenteeism decreased somewhat over 1953, averaging about 5.7% for the year.



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7. SURFACE:

Buildings:

Maintenance of buildings was of a routine nature throughout the year. Two 1900 gallon capacity hot water tanks in the miner's dry and one 700 gallon capacity hot water tank in the surfacemen's dry were replaced because of excessive damage due to corrosion.

Headframe and Trestles:

The headframe equipment operated with only minor delays throughout the year. New wheels and shafts, complete with hardened bushings, linkages, and seven new pads were installed on the Kennedy Van Saun feeder. The north and south head sheave bearings were rebabbitted.

Stocking:

Trestle cars operated throughout the year with few delays.

Engine House:

Operation of hoisting equipment and compressors continued without any delays.

Skips:

Two skip boxes were repaired and equipped with new aluminum bales during the year. New style rail guide rollers were installed on the skips to reduce the wear on guide shoes and shaft rails.

Underground Cars:

Thirty underground Lohed cars were completely repaired at the mine shops during the year. This work consisted of replacing or rebuilding worn parts, and making necessary modifications to improve the car's operation.

Shaft Rail:

As a result of extreme wear, as much as 11/16" across the riding surfaces on the 80# skip guide rails, it was found necessary to replace these rails to maintain the proper skip clearances. Special flame hardened rail was purchased and then drilled at the mine shops prior to installation. During the mine shut-down commencing on July 16th and ending on August 3rd, 9,835 feet of rail was installed in the north and south skip compartments from the 7th Level plat elevation to the skip dump in the headframe.

Hoisting Ropes:

Two hoisting ropes were removed during the year. The first rope was removed on January 2, 1954 from the south skip after hoisting 723,606 tons with no cage service. The second rope was removed on July 25, 1954 after hoisting 942,124 tons and operating for one year and seven months on the cage.

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7. SURFACE: (Continued)

D.D.H. #65:

The U. S. Bureau of Mines and the Cleveland-Cliffs Iron Company cooperative subsidence study continued at D.D.H. #65 during the year. The record interpretations showed a comparatively low level of seismic activity, which appears to indicate the capping is not subject, at the present, to sufficient stress to induce failure. Mr. Harold Schroeder was assigned to this area during the year to keep the Bureau of Mines in closer contact with the subsidence project.



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8. UNDERGROUND:

5th Level:

The 5th Level produced 23,198 tons or 2.6% of the total mine production. All of the ore was of the Special grade and came from above the #7 Cross-cut.

The ore is being mined from a stope located in the "ore pipe" which has been mined upward from the footwall on 6th Level. The ore body is a "hanging wall" ore body, and, as such, its limits have been difficult to define.

Six undercutting transfers have been developed. Some difficulty is being encountered in inducing a good caving action, and at present sub-level drifts are being developed to permit long hole drilling in an effort to prevent arching and stabilization of the back of the stope.

Underground diamond drilling of this structure during the year consisted of four holes. Early in the year two holes, #228 and #232, were drilled from the #9 Cross-cut on 3rd Level to test for a flattening and northeast pitch. The drilling failed to encounter enrichment indicating the "ore pipe" to be rising more vertically to the west. Later in the year a fault was exposed in a mining transfer on the -260' sub-level, and subsequently Underground Holes #276 and #277 were drilled to test for possible enrichment east of the fault. As little enrichment was encountered, this fault was proven to be a limiting feature to the "ore pipe" structure.

6th Level:

13,642 tons or 1.5% of the total mine production was produced from the 6th Level. Mining operations on this level ceased in February. A small reserve tonnage still remains to be mined, but this tonnage cannot be developed until the mining over #7 Cross-cut on the 5th Level is completed.

One diamond drill hole, #254, was drilled from the #7 West Cross-cut to provide an ore section and footwall contacts for mining development above the 7th Level.

7th Level:

The 7th Level produced 866,022 tons or 95.9% of the total mine output. The production came from ten caving areas in Section 2 and three areas in Section 1. During the year mining operations were completed over the #2, #4, #6, and #7 North Cross-cuts and in the area known as the North Block East, the latter being an area north of the main footwall drift and immediately to the north of the loading end of the 7th Level conveyor belt. Other areas, in Section 2, in which mining operations are still being continued are over the #1, #7 South, and #5 North Cross-cuts; the 780 top-timber area and the North Block Center are also active. The North Block Center is an area north of the footwall drift and west of the loading end of the 7th Level conveyor belt, and the 780 top-timber services an area approximately 400 feet east of the #7 South Cross-cut. The latter area was developed by a top-timber from the main haulage drift due to heavy ground conditions which would have made development of a cross-cut too difficult. In Section 1, caving and development work is in progress in the areas over the #7 and #8 Cross-cuts, while operations over the #9 Cross-cut have been confined to development for stoping.

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8. UNDERGROUND: (Continued)

7th Level: (Continued)

The entire output from the 7th Level was transported to the shaft by conveyor belt. A short tram by underground locomotive was required to bring the bulk of the tonnage to the loading end of the 7th Level conveyor belt. A substantial tonnage was transferred to the loading end of the belt by direct scraping from caving areas above the loading end storage trench. In addition, 50,817 tons have been transferred to the loading end storage trench by sub-level conveyor belt which was installed during the early part of the year.

A summary of the active mining areas in Section 2 is listed below.

The area over the #1 Cross-cut produced 158,616 tons. More undercutting drifts will be developed and it is anticipated that this area will be producing ore throughout the coming year. Operations were continued in the North Block Center with a production of 42,997 tons for the year. A small tonnage is still available and mining should continue for the greater part of 1955. Production from the #7 South Cross-cut was 70,631 tons. Operations will continue for most of 1955. Production from the #5 North Cross-cut was 69,376 tons. The 780 top-timber transfer area produced 4,476 tons from development. A substantial tonnage of ore of good grade is now available and production from the 780 area should be maintained at an increased rate during the coming year.

The production for the year in areas in Section 2 in which operations ceased during the year was as follows: Over #2 Cross-cut, 10,484 tons; over #4 Cross-cut, 23,873 tons; North Block East, 92,100 tons; over #6 Cross-cut, 124,242 tons. One diamond drill hole, #273, was drilled from the 7200 Cross-cut. The hole did not prove sufficient reserves to warrant developing.

There were three active areas in Section 1; #7B Cross-cut, #8B Cross-cut, and #9B Cross-cut. The area over #7B Cross-cut produced 131,077 tons. A substantial developed tonnage is still available and some developing is still required to increase the mineable reserves. Over the #8B Cross-cut a production of 117,377 tons was attained. Reserves are substantial. 12,475 tons were produced from development work over the #9B Cross-cut. Stopping operations over the #9B Cross-cut should be started about the middle of 1955.

The major part of the underground diamond drilling was from the 7th Level. In the area west of the 7100 Cross-cut, Underground Holes #236, #237, #240, #242, #243, #248, #249, #256, #257, and #263 continued to outline the extent and southern limits of an ore body trending westward and controlled by several intrusives. The drilling proved substantial reserves, but also indicated that the ore body pinched out to the west along the intrusives and above the 7100 West Cross-cut.

From the breast of the 7100 Cross-cut, Underground Hole #210 was reentered to test for a major fault trending east-west along the 3,000 S. Coordinate. The hole passed from graywacke into iron-formation between the 10th and 11th Levels thereby proving at least 1,000 feet of displacement.

Diamond drilling continued from the 7400, 7600, and 7700 Cross-cuts to outline ore reserves available to 8th Level mining. From the 7400 Cross-cut, Underground Hole



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8. UNDERGROUND: (Continued)

7th Level: (Continued)

#250 indicated a normal extension of the ore body west of the Mather Fault below 7th Level. From the 7600 and 7700 Cross-cuts, Underground Holes #227, #233, #241, #246, and #267 have indicated a continuation of known conditions from 7th Level and above, and also have proven a substantial reserve of ore available for 8th Level mining east of the Mather Fault.

A 5" - 16.0# section arch and circle set was used throughout the year in the mining areas. Steel set inventories were reduced during the year and held to a minimum as a result of improved steel deliveries.

A 36" conveyor belt has been in operation on the -875 sub-level above the 7th Level since early in 1954. 50,817 tons were transported over this belt and the installation proved that under the proper conditions a sub-level conveyor belt could be successfully applied. Present mine planning includes sub-level conveyor belts on the 8th and 9th Levels.

The 2,500' conveyor belt system on the 7th Level operated throughout the year with very little maintenance required. A total of 866,022 tons of ore was transported by this system during the year bringing the total ore and rock handled to date to 2,014,863 tons.

8th and 8½ Levels:

The plat on 8th Level and the storage trench on the 8½ Level were completed. The 8th Level footwall drift connection between "A" and "B" Shafts was completed. "A" and "B" Shafts are now connected on the 6th, 7th, and 8th Levels.

Prior to the connection of the 8th Main Haulage Level, the Mather Mine, "B" Shaft undertook part of the preliminary drilling in Section 2 in order to provide information for cross-cutting and mining development to commence immediately following the main line connection. Diamond drill stations were cut adjacent to the footwall drift at 250' intervals. Underground Holes #244, #255, and #262 on the 10,600 W. cross-section indicated an excellent section of ore. Underground Hole #269 on the 10,850 W. cross-section indicated a flattening of the footwall due to a minor fault structure and less ore than anticipated. Drilling on the 11,350 W. cross-section, by Underground Holes #272 and #279, proved a normal eastward continuation of concentration from the Mather Fault. This preliminary drilling has also indicated the footwall and ore to be cut off by the Negaunee Shaft Fault.

There has been no drilling from 8th Level in the structure west of the Mather Fault, but available information indicates a flattening of the footwall to the Negaunee Shaft Fault, and in general, a complicated structure which will warrant extensive testing before development.

9th Level:

The footwall drift was advanced to a distance of 2,600 feet east of "A" Shaft. A ventilation raise is being driven from the 9th Level to the 8th Level. This raise will improve working conditions on the 9th Level and will permit additional development crews to be added to the 9th Level development program.

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8. UNDERGROUND: (Continued)

9th Level: (Continued)

Excavation for a 30" width conveyor belt 3,100 feet in length on the 9th Level commenced during the year. The system is designed to handle 500 long tons per hour with a 500 feet per minute belt speed, and includes a scalper screen and jaw crusher to give approximately a minus 4" product.

The conveyor belt drift development is progressing satisfactorily with the heading being advanced to a distance of 720 feet east of the shaft. The conveyor belt drift is being driven parallel to the footwall drift and the center-line distance between the two drifts is 36 feet. Connecting drifts between the conveyor belt drift and the main haulage drift, have been driven at 500' intervals. This system of development permits faster excavation of the conveyor belt drift because a number of headings can be worked at one time. In addition, with the main haulage drift being driven as a separate heading, the advance is at a much faster rate and development of the loading end of the conveyor belt as well as of the stoping areas can be undertaken at an earlier date. Timing of development is a very important factor because of the rapid depletion of mineable reserves on the 7th Level. Excavation of the head end of the conveyor belt drift is about completed.

Main Level Development:

In 1954, 81.6% of the main level drifts were driven with rock bolting as the means of support. The drifting cost per foot of drift was reduced from \$75.09 in 1953 to \$53.46 in 1954. The decrease of \$21.63 per foot in the drifting cost represents a saving for the year in the amount of \$115,374.

The following table of main level development includes drifting on the 3rd, 7th, 8th, and 9th Levels:

	<u>Timbered Ore Drift</u>	<u>Timbered Rock Drift</u>	<u>Naked Rock Drift</u>	<u>Total</u>
NM 97 - 3rd Level	-	100'	-	100'
NM 97 - 7th Level	-	160'	-	160'
NM 97 - 8th Level	-	420'	1,837'*	2,257'
NM 97 - 9th Level	-	305'	2,512'*	2,817'
	-	<u>985'</u>	<u>4,349'*</u>	<u>5,334'</u>

\* Rock bolted.





Loading point of conveyor belt located on the -875 sub-level above the 7th Level.



Drilling holes for installation of rock bolts in 9th Level drift heading.



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8. UNDERGROUND: (Continued)

Statement of Timbering Supplies Used in Operating Accounts

<u>ITEM</u>	<u>AMOUNT</u>	<u>COST PER TON</u>
Cribbing	\$ 7,281.39	.0080
Stulls	601.12	.0007
Lagging	15,143.28	.0165
Poles	17,167.59	.0187
Steel	271,341.59	.2964
Minecrete Supplies	<u>605.34</u>	<u>.0007</u>
Total 1954	\$312,140.31	.3410
Total 1953	\$400,105.29	.3457

Explosives:

The following tables show the cost of explosives used in mining 915,405 tons of ore (Table I), the unit costs and consumption of explosives (Table II), and the cost per ton of explosives used in Development for Mining as compared to the cost per ton for mining (Table III).

TABLE I

Cost of Explosives - Operating

	<u>1954</u>	<u>1953</u>
Powder - All Kinds	\$ 90,073.20	\$118,655.62
Miscellaneous Blasting Supplies (Fuse, Caps, Bags, etc.)	<u>39,378.60</u>	<u>56,579.82</u>
Total	\$129,451.80	\$175,235.44

TABLE II

Unit Costs and Consumptions of Explosives

	<u>1954</u>	<u>1953</u>
Pounds of Powder per Ton of Ore	0.575	0.537
Tons of Ore per Pound of Powder	1.738	1.860
Cost per Ton for Powder	0.098	0.092
Cost per Ton for Fuse, Caps, etc.	0.043	0.043
Cost per Ton for all Explosives	0.141	0.135

TABLE III

	<u>1954</u>
Cost per Ton in Development for Mining	\$.037
Cost per Ton in Mining	<u>.104</u>
Total	\$.141



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8. UNDERGROUND: (Continued)

Explosives: (Continued)

The tables indicate an increased unit consumption of explosives; however, prior to 1954 the mine accounting system separated the "Development in Ore" and "Development in Rock" accounts; whereas, in the revised accounting system, both accounts are combined into a single "Development for Mining" account. Costs and consumptions prior to 1954 did not include charges from the "Development in Rock" account.

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8. UNDERGROUND: (Continued)

Pumping:

Pumping of underground water was continued on the 3rd and 6th Levels.

Pumping increased on the 3rd Level from an average 85 gallons per minute in 1953 to 94 gallons per minute in 1954, an increase of 10.6%. However, the quantity pumped by the 6th Level decreased from an average of 367 gallons per minute in 1953 to 347 gallons per minute in 1954, a decrease of 5.5%.

A quantity of the Cambria-Jackson water is pumped from the 3rd Level and all Mather "B" water is pumped by Mather "A" from the 6th Level. These figures are shown in tabular form below.

	<u>Mather "A"</u> <u>Water</u> <u>GPM Av.</u>	<u>Mather "B"</u> <u>Water</u> <u>GPM Av.</u>	<u>Cambria-Jackson</u> <u>Water</u> <u>GPM Av.</u>	<u>Total Water</u> <u>Pumped</u> <u>GPM Av.</u>
3rd Level	57	-	37	94
6th Level	191	156	-	<u>347</u>
Total				<u>441</u>

The mine discharge water is carried through a 16" pipe line and then by ditch to the Carp River, approximately two miles towards the west.

The trend on new, or additions to old pump installations, has been towards automatic systems which are briefly described below.

3rd Level:

Two 100 gpm automatic pumps were installed in the existing 3rd Level pumphouse to pump water from the 3rd Level to surface through the 10" discharge line.

6th Level:

Installation of a 400 gpm four stage experimental Byron-Jackson pump in the fourth pump stall of the 6th Level pumphouse was completed. Water is pumped through a 6" discharge line to the 1st Level sump, then pumped by an Ingersoll-Rand automatic pump into the 10" discharge line to surface.

9th Level:

Three sumps were completed and a pumphouse excavated and concreted for the installation of two 500 gallon capacity automatic turbine pumps. Water will be pumped by these pumps from the 9th Level through an 8" discharge line to the 6th Level sumps.



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9. TAXES:

Taxes for the year at the Mather Mine, "A" Shaft totaled \$274,817.57. The assessed valuation set for Section 2, 47-27 by Mr. Hardenberg, the state mine appraiser, was \$55,000 higher than 1953. The real estate valuation increased by \$165,000 but the personal property valuation decreased by \$110,000. The tax rate of \$38.95 per thousand of valuation remained the same as for 1953.

	1954			1953		
	VALUATION	RATE	TAXES	VALUATION	RATE	TAXES
Section 2, 47-27 Except the N 600' NE of NE and the Rights of Way						
Real	\$4,635,000		\$180,533.25	\$4,470,000		\$174,106.50
Personal	2,420,000		94,259.00	2,530,000		98,543.50
Total	<u>\$7,055,000</u>	<u>\$38.9500</u>	<u>\$274,792.25</u>	<u>\$7,000,000</u>	<u>\$38.9500</u>	<u>\$272,650.00</u>
Mather Mine Pipe Line, parcel in Section 3, 47-27	\$ 650	\$38.9500	\$ 25.32	\$ 650	\$38.9500	\$ 25.32
Total Mather Mine "A" Shaft (Sec. 2, City of Ishpeming)	\$7,055,650	\$38.9500	\$274,817.57	\$7,000,650	\$38.9500	\$272,675.32

	1954		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total Operating	\$274,817.57	\$0.300	\$0.407
	1953		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total Operating	\$272,675.32	\$0.236	\$0.229

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10. ACCIDENTS  
AND  
PERSONAL  
INJURY

There were 18 compensable injuries during the year, for a lost time total of 1,382 days. Twelve non-compensable injuries increased the total lost time from compensable and non-compensable injuries to 1,415 days. The severity rate was 1.424 days lost per thousand man hours and the frequency rate was 30.18 injuries per million man hours compared with company averages for underground mines of 1.243 on severity and 29.63 on frequency. The total hours worked were 993,998 as compared with 1,370,147 in 1953. The following is a brief summary of the compensable accidents.

<u>DATE</u>	<u>NAME</u>	<u>NATURE OF INJURY</u>	<u>NUMBER OF DAYS LOST</u>
1/13/54	Dominic Carello	Laceration, 5th finger, left hand.	8
1/13/54	William Hakala	Bruise and pain on left side above hip.	44
1/27/54	Donald Roberts	Cut 3rd finger, left hand.	53
1/27/54	Gerald Connors	Contusion, left testicle.	20
4/19/54	Toivo Pellinen	Severe sprain of right wrist joint. No fracture noted on X-ray examination.	82
5/ 8/54	Adolph Niemi	Laceration right thumb, comminuted fracture proximal phalanx, right thumb.	66
5/18/54	Toivo Koski	Sprain of right ankle. Much swelling. No fracture.	9
5/26/54	Frithiof Peterson	Traumatic amputations, index (distal proximal phalanx), middle (distal proximal phalanx), ring (distal proximal phalanx) and 5th (proximal phalanx) fingers, left.	750
6/17/54	Steven Ivey	Contusions and bruises of right arm and right side of body. Severe and deep lacerations requiring debridement of tissue and dirt and suturing of right forearm.	12
6/21/54	Arvo Lammi	Fracture internal malleolus - right ankle.	114
6/21/54	Adolph Mussatto	Contusion with swelling over right side of face at region temporo mandibular joint. Superficial laceration to left of chin. Fracture of lower jaw at right temporo mandibular.	39
6/22/54	William Presse	Contusion and hematoma, right foot.	22
6/22/54	Kenneth Ball	Fracture - anterior ends - 8th and 9th ribs.	27
8/23/54	George Korpi	Bruised right side of back.	10
9/29/54	Charles Jurvelin	Sprained ankle, left, severe.	37
10/11/54	Norman Powers	Oblique fracture through lower end of right fibula. No displacement.	40
11/ 4/54	Andrew Guizzetti	Bruised right knee.	24
12/ 6/54	Victor Hilgren	Contusion and hematoma, right foot.	<u>25</u>
		Total Days Lost	1,382



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11. POWER:

A total of 14,249,248 kilowatt hours of electric power was consumed during 1954. This was approximately 3,182,000 kilowatt hours lower than the preceding year. The reduction is a direct result of the shorter work week.

Under the new system in which the Cleveland-Cliffs Electric Power Department generates the power and the Upper Peninsula Power Company distributes it over their transmission lines, an average cost of \$.0093 per kilowatt hour was paid in 1954 in contrast to \$.0164 the previous year.

The power rate was determined by dividing the total operating cost of the Cleveland-Cliffs 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 property.

	<u>CONSUMPTION</u> <u>K.W. HOURS</u>	<u>AVERAGE</u> <u>MAX. DEMAND</u>	<u>AVERAGE</u> <u>DEM. FACTOR</u>	<u>COST OF</u> <u>CURRENT</u>	<u>AVERAGE PRICE</u> <u>PER K.W. HOUR</u>
1954	14,249,248	3550 K.W.	46%	\$132,087.61	\$.0093
1953	17,431,000	3720	54	283,853.29	.0164
1952	14,534,000	3120	54	230,920.07	.0159
1951	16,213,000	3130	60	248,362.70	.0153
1950	15,053,000	3100	56	235,302.80	.0156

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I. GENERAL:

The production for the year was 324,269 tons compared with 328,342 tons in 1953. Production from Fee Lands was 84,843 tons or 26.1% of the total production. The working schedule has been continued at 2-8 hour shifts per day for 5 days per week throughout the year. Some improvement in efficiency over the previous year is reflected in the increase in tons per man per day from 6.51 in 1953 to 6.90 in 1954.

Total shipments were slightly in excess of production and amounted to 326,001 tons. The stockpile carry-over at the close of the year was 36,788 tons compared with 38,520 tons in 1953.

There was no exploration drilling done in 1954 but developing and mining has proved a substantial tonnage of new ore. The engineer's estimate of 3,448,503 tons shows a net gain of 116,812 tons in the reserves after deducting the 1954 production from the 1953 estimate. The additional reserves have been proven principally in Chase Lease #9 and a smaller tonnage in Chase Lease #24. On the Fee Lands, a small net loss in reserves has been estimated.

Deep-well surface pumping has been continued and at the end of the year seven wells were operating and one was down for repairs. Surface-well pumping averaged 1312 g.p.m. compared with 1237 g.p.m. in the previous year. The downward trend in the underground water pumped has continued for the second year as indicated by the average of 1574 g.p.m. in 1954 compared to 1621 g.p.m. in the previous year.

Development of the 10th level has been continued throughout the year after completing shaft sinking late in 1953. The loading pockets and storage trench were constructed so skip loading from this elevation could be done. Excavation of the shaft plat was completed and also a portion of the sump development prior to starting the drift south towards the ore body. At the close of the year the main-level haulage drift had been advanced 800' south of the shaft in footwall slate.

2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Production

	<u>Grade</u>	<u>Tons</u>
1954	Morris	324,269
1953	"	328,342

The 1954 production came from Fee and Leased Lands in the following proportions:

	<u>Fee</u>	<u>Leased</u>	<u>Total</u>
Production - Tons	84,843	239,426	324,269
Percentage	26.1%	73.9%	100.0%
Percentage 1953	26.2%	73.8%	100.0%

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

	<u>Tons</u>	<u>Percent</u>
Lease Ore Production 1933-1954	4,917,283	74.6
Fee Ore Production 1933-1954	1,676,748	25.4
Total	6,594,031	100.0



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

b. Shipments

<u>Grade</u>	<u>Pocket</u>	<u>Stockpile</u>	<u>Total</u>
Morris	186,337	139,664	326,001
<u>Grade</u>	<u>Fee</u>	<u>Lease</u>	<u>Total</u>
Morris	91,900	234,101	326,001

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

<u>Year</u>	<u>Total</u>
1954	326,001
1953	324,150
1952	294,569
1951	353,704
1950	307,357

Total shipments since Inland acquired lease in 1933 - 6,557,242 tons.

c. Ore in Stock December 31, 1954

<u>Grade</u>	<u>Tons</u>
Morris	36,788

d. Production by Months

	<u>Days</u> <u>Worked</u>	<u>Average</u> <u>No. of Men</u>	<u>Tons Per Man</u> <u>Per Day</u>	<u>Production</u>
January	20	197	7.08	27,536
February	20	199	6.41	24,850
March	23	200	6.08	26,616
April	22	198	6.32	25,936
May	20	195	6.59	24,379
June	22	195	7.48	30,140
July	21	196	7.77	27,869
August	21	196	6.36	24,193
September	21	198	6.63	25,632
October	21	197	7.42	29,333
November	21	202	6.85	25,973
December	21	205	6.33	25,576
Total	253	198	6.90	318,033
Stockpile Overrun				6,236
Total				324,269

e. Working Schedule

The mine operated 2-8 hour shifts per day 5 days per week.

f. Delays

There were no significant delays to operations during the year.



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3. ANALYSIS:

a. Shipments

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sul.</u>	<u>Moisture</u>
Morris	326,001							
Dried		55.60	.083	12.47	.52	2.66	.036	-
Natural		49.05	.075	11.12	.47	2.48	.033	11.87

b. Ore in Stock December 31, 1954 (Natural)

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sul.</u>	<u>Moisture</u>
Morris	36,788	48.11	.071	13.70	.42	2.00	-	11.70

c. Ore Reserves - Expected Natural Analysis

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sul.</u>	<u>Moisture</u>
Morris	3,022,798	49.06	.071	12.00	.44	2.25	.015	12.00
Hi-Sul	453,396	49.06	.093	12.00	.40	2.23	.393	12.00

4. ESTIMATE OF ORE RESERVES:

The estimated reserves after allowance for ore mined in 1954 shows 116,812 tons of new ore developed. The bulk of the tonnage that accounts for this increase has been proven between the 8th and 9th levels in Chase Lease #9. Development and mining in this principal production area has proven an ore outline exceeding that used for estimating purposes. For a number of years a relatively small tonnage in Chase Lease's #25 and #26-~~7~~ has been included in the reserves but this tonnage has now been excluded until such time as the Barnes-Hecker Mine is de-watered. The 10th level development will, of course, add substantially to the reserves due to the fact that ore is now included to a depth of only 50' below the 9th level for estimating purposes.

	<u>Estimate</u> <u>10- 1-53</u>	<u>Production</u> <u>10-1-53 to</u> <u>10- 1-54</u>	<u>Estimated</u> <u>Deducting</u> <u>Product</u>	<u>Actual</u> <u>Estimate</u> <u>10- 1-54</u>	<u>Incr. or Decr.</u> <u>from</u> <u>1953 Estimate</u>
Chase Lease #26	26,140	-	26,140	-	26,140
Chase Lease #25	33,273	-	33,273	-	33,273
Chase Lease #24	150,672	79	150,593	103,069	47,524
Chase Lease #24 Hi-Sul	420,212	71,286	348,926	394,215	45,289
Chase Lease #9	2,023,765	162,362	1,861,403	2,057,249	195,846
Total Chase Leases	2,654,062	233,727	2,420,335	2,554,533	134,198
CCI Lands	975,128	89,356	885,772	862,480	23,292
CCI Lands Hi-Sul.	33,184	7,600	25,584	31,490	5,906
Total CCI Lands	1,008,312	96,956	911,356	893,970	17,386
<b>GRAND TOTAL</b>	<b>3,662,374</b>	<b>330,683</b>	<b>3,331,691</b>	<b>3,448,503</b>	<b>116,812</b>

5. LABOR & WAGES

The labor force was decreased from an average of 205 men the previous year to 198 men in 1954. The industry-wide wage increase of \$.05 per hour was put into effect July 1st, 1954.