

THE CLEVELAND-CLIFFS IRON COMPANY  
One Mining Department  
ANNUAL REPORT OF GENERAL MANAGER  
For Year Ending December 31, 1955

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THE CLEVELAND-CLIFFS IRON COMPANY  
ORE MINING DEPARTMENT

Manager's Annual Report Year 1955

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	Bunker Hill	Cambria-Jackson	Cliffs Shaft	Humboldt	Lloyd	Maas	Morris
<u>Ishpeming, Negaunee and Iron River Districts:</u>							
General	138-139	156	1	20	44	175	80
Production, shipments and inventories	140-141	157-158	2-3	20-21	45-46	176-177	80-81
Analysis	141	159	3-4		48	178	82
Estimate of ore reserves	142	163	7-8	22	49	178-179	82
Labor and wages	142-144	164-165	8-9	22-24	49	180-181	82
Surface	144-145	166	9-10	25	49	182	83
Underground	145-150	167-171	10-16	26-39	49-50	183-187	84-85
Cost of opening, equipping, developing and operating	150-152	160-162	4-7	40-41	46-48	188-191	
Taxes	153	172	17	42	51	191	
Accidents & personal injuries	153-154	173	17-19	42	51-52	192	
Power	154-155	174	19		52	192	
		Mather					
		"A"	"B"	Ohio	Republic	Spies	Tilden
<u>Ishpeming, Negaunee and Iron River Districts:</u>							
General		53-55	193-194	86	106-123	220	127
Production, shipments & inventories		56-58	195-197	87		221-223	127-128
Analysis		59	198	88		223	128
Estimate of ore reserves		65	202	103-104		223	134-136
Labor & wages		66-67	203-204	90-91	124-125	224	130-132
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Underground or open pit operations		70-75	207-216	88-89		225-226	132-134
Cost of opening, equipping and developing		60-64	199-201	91-102		226-229	129-130
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	Agnew	Alworth	Canisteo	Cushing	Hawkins
<u>Mesaba District:</u>					
General	231	240	248-249	271	273
Production, shipments & inventories	231-232	240	249-251		273-274
Analysis	232-233	241	251-253		275
Estimate of ore reserves	233-234	241-242	254-255		276-278
Labor and wages	234-235	243	255-256		278
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Underground and open pit operations	235-236	244-245	257-260		279-280
Beneficiations	236	245	260-263		280-286
Maintenance and repair	236	245	263-264		286
Cost of operation	236-238	245-246	264-267		286-289
Exploration and future exploration	238	246	267		289
Taxes	238	246-247	267-268	272	289-290
Accidents and personal injury	239	247	268		290
Proposed new construction	239	247	269		290
Equipment received and proposed new equipment	239	247	270		290
	Holman-Cliffs	Hill-Trumbull	Sally	Open Pit Sargent	Wanless
<u>Mesaba District:</u>					
General	314	291-293	335	336-337	347
Production, shipments & inventories	314-316	293-294		338	
Analysis	316-318	295-296		338-339	
Estimate of ore reserves	318-321	296-298		339-340	
Labor and wages	321	298		340-341	
Surface	321-322	299		341	
Open pit and underground	322-324	299-302		342-343	
Beneficiation	325-329	302-307		343	
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Cost of operation	330-332	308-310		343-344	
Exploration and future exploration	332	310		344-345	
Taxes	332-333	310-311	335	345	347
Accidents and personal injury	333	311		346	
Proposed new construction	333	311		346	
Equipment received and proposed new equipment	333-334	312-313		346	

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CLIFFS SHAFT MINE  
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I. GENERAL

The production in 1955 was 551,310 tons and the budget estimate was 494,200 tons. The above tonnage includes 38,606 tons of accumulated stockpile overrun that was realized after all the stockpile tonnage was shipped. The operating schedule was 3-8 hour shifts per day with hoisting on 2-8 hour shifts per day for 4 days per week through April 15th. Effective April 16th, the operating schedule was increased to 5 days per week. Production through "C" Shaft began on December 2nd and with this larger hoisting capacity the budget tonnage was hoisted on one shift. The mine was idle one week in August for vacation purposes and also one day (July 1st) because of the industry-wide strike.

The Cost of Production was \$5.852 and the total cost was \$6.558 compared with \$6.526 and \$7.285 respectively in 1954. The lower costs in 1955 are attributed to some improvements in efficiency as evidenced by the comparison of 5.49 tons per man per day in 1955 with 4.47 tons per man per day in 1954. The reduction in labor resulting from the "C" Shaft going into operation and the substantial stockpile overrun were factors also effecting a reduction in costs.

There was an average of 71 contracts working in the mine during 1955, the same average number as the previous year. Numerous mining areas were depleted, however the budget production was maintained by reentering old workings to recover relatively small areas left behind and continuing a pillar recovery program. A few new mining areas were also brought into production.

Shipments totalled 644,445 tons leaving a balance of all grades of 38,119 tons on stockpile at the end of the year. This compares with a total of 131,254 tons on hand at the end of the previous year. The bulk of the product, except for the Crushed grade, was stockpiled and shipments were made from stockpile to insure better blending of Lump Ore shipments.

The product has continued to be screened to -2" fines and +2" lump, yielding an average during the year of 74.6% lump and 25.4% fines. Second-class ore continued to be processed through both primary and secondary crushing and shipped as a third grade. This product averaged 15.6% of the total production.

The "C" Shaft project, under E. & A. CC-560, was completed late in the year and the new plant was placed into operation on December 2nd. Work continued on some project details to the end of the year. Installation of two automatic, oil-fired boilers was completed for the central heating plant under E. & A. CC-686. The new heating plant went into operation in October and replaced the old coal-fired system. An automatic pumping system, under E. & A. CC-731, will be installed and work on this project was started with sump development on the 15th level. Renovation of the Shop building began under E. & A. CC-730. The old boiler house is being converted into a central shop to consolidate the various scattered shops into one building.



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2. PRODUCTION

a. Production by Grade and Months

Month	Optg. Days	CLIFFS SHAFT			BANCROFT			SECTION 10			Total	Rock
		Lump	Crushed		Lump	Crushed		Lump	Crushed			
			#1	#2		#1	#2		#1	#2		
Jan.	17	13,181	5,124	1,862	2,884	1,121	178	3,400	1,333	-	29,083	3,208
Feb.	16	13,324	5,164	1,708	3,031	1,168	230	4,763	1,852	-	31,240	2,770
March	19	21,079	8,176	1,917	1,941	763	627	3,943	1,611	-	40,057	2,984
April	18	16,216	5,749	5,715	<b>1,971</b>	700	947	5,616	2,000	52	38,966	3,204
May	21	20,605	8,936	6,283	1,988	858	1,883	5,724	2,436	1,327	50,040	2,972
June	22	22,227	7,071	7,090	2,611	743	1,250	3,960	1,147	1,682	47,781	3,844
July	19	21,519	7,981	4,996	1,612	586	799	4,095	1,500	183	43,271	3,050
Aug.	18	17,198	7,085	3,661	3,906	1,562	795	3,716	1,488	940	40,351	2,856
Sept.	21	16,515	7,205	7,698	2,565	1,046	1,456	3,883	1,646	1,479	43,493	3,014
Oct.	21	19,100	7,877	8,796	3,596	1,464	801	5,750	2,333	1,074	50,791	3,284
Nov.	21	20,969	7,189	6,396	2,029	612	1,132	6,191	2,355	1,184	48,057	1,854
Dec.	21	<u>18,329</u>	<u>6,274</u>	<u>10,165</u>	<u>3,263</u>	<u>1,201</u>	<u>719</u>	<u>6,227</u>	<u>2,142</u>	<u>1,254</u>	<u>49,574</u>	<u>1,072</u>
Total		218,367	85,726	66,287	31,397	11,824	10,817	57,268	21,843	9,175	512,704	34,112
Current Year's												
Stkp. Overrun		33,699	-1,313		2,484	-117	-58	4,070	-159		38,606	
Total	234	252,066	84,413	66,287	33,881	11,707	10,759	61,338	21,684	9,175	551,310	34,112

b. Shipments

	Pocket Tons	Stockpile Tons	Total Tons 1955	Last Year Tons
Cliffs Shaft Lump	35,266	266,170	301,436	226,140
Cliffs Shaft Crushed	57,974	53,546	111,520	94,770
Cliffs Shaft Crushed #2	48,115	13,835	61,950	-
Bancroft Lump	4,495	38,821	43,316	28,394
Bancroft Crushed	7,343	5,312	12,655	12,236
Bancroft Crushed #2	8,743	1,179	9,922	-
Section 10 Lump	11,301	62,808	74,109	46,027
Section 10 Crushed	14,554	7,178	21,732	20,650
Section 10 Crushed #2	<u>7,805</u>	<u>-</u>	<u>7,805</u>	<u>-</u>
Total	195,596	448,849	644,445	428,217

c. Ore Statement

	On Hand 1-1-56	Output For Year	Transfers	Overruns	Total	Shipments	Balance on Hand
C. S. Lump	81,196	220,263	<b>24,347</b>	33,698	310,810	301,436	9,374
C. S. Crushed #1	10,722	83,831	<b>24,347</b>	<b>645</b>	118,255	111,520	6,735
C. S. Crushed #2	7,668	66,287		<b>668</b>	73,287	61,950	11,337
Bancroft Lump	11,104	31,397		2,484	44,985	43,316	1,669
Banc. Crushed #1	2,227	11,824		<b>117</b>	13,934	12,655	1,279
Banc. Crushed #2	126	10,817		<b>58</b>	10,885	9,922	963
Section 10 Lump	15,955	57,268		4,070	77,293	74,109	3,184
Section 10 Crush #1	2,256	21,843		<b>159</b>	23,940	21,732	2,208
Section 10 Crush #2		<u>9,175</u>		<u>-</u>	<u>9,175</u>	<u>7,805</u>	<u>1,370</u>
Total	131,254	512,705	-	38,605	682,564	644,445	38,119
Total Last Year	115,164	438,951		5,356	559,471	428,217	131,254

Increase in Output - 107,003 tons



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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>
1955	3-8 hour shifts per day with hoisting on 2-8 hour shifts per day, 4 days per week Jan. 1 through April 15th - 5 days per week April 16th through November 28th - then 2-8 hour shifts per day with hoisting on 1-8 hour shift per day for the balance of the year.
1954	3-8 hour shifts per day with hoisting on 2-8 hour shifts per day, 5 days per week Jan. 3rd through March 31st - 4 days per week April 1st through December 31st.
1953	3-8 hour shifts per day with hoisting on 2-8 hour shifts per day, 5 days per week.
1952	3-8 hour shifts per day with hoisting on 2-8 hour shifts per day, 6 days per week May 1st to November 15th - 5 days per week Nov. 15th through Dec. 31st.
1951	3-8 hour shifts per day with hoisting on 2-8 hour shifts per day, 6 days per week.

e. Production Delays

The only major delay occurred in July when the pinion shaft broke loose on the "B" Shaft hoist. Loss in production on this account was 1,100 tons.

3. ANALYSIS

a. Average Mine Analysis of 1955 Output

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
Combined Cliffs Shaft Lump	58.93	.107	8.11
Combined Cliffs Shaft Crushed #1	56.75	.116	10.48
Combined Cliffs Shaft Crushed #2	54.77	.090	14.83

b. Average Analysis of Shipments for 1955:

<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>Moisture</u>
° Lump Ore	60.40	.111	7.15	.32	2.14	.99	.87	.005	1.38	.55
° Crushed Ore #1	56.80	.110	10.29	.35	2.64	1.19	1.11	.008	1.82	2.56
° Crushed Ore #2	55.15	.089	14.23	.25	2.12	.98	1.42	.005	1.42	.71
° Crushed Ore #3	55.00	.099	14.43	.28	2.15	1.10	.98	.005	1.57	.54

(°) 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, 1955

		<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	58.18	.107	9.38	.32	2.44	1.00	.87	.005	1.89	-
	Nat'l.	57.86	.106	9.33	.32	2.43	.99	.87	.005	1.88	.55
" C. S. Crush #1	Dried	56.33	.109	10.78	.35	2.64	1.49	1.11	.006	1.82	-
	Nat'l.	54.89	.106	10.50	.34	2.57	1.45	1.08	.006	1.77	2.56
" C. S. Crush #2	Dried	50.40	.081	20.90	.25	2.12	.98	1.42	.008	1.42	-
	Nat'l.	50.04	.080	20.75	.25	2.10	.97	1.41	.008	1.41	.71

4. COST OF OPENING, EQUIPPING, DEVELOPING AND OPERATING

Comparative Mining Costs

Product	<u>1955</u>		<u>1954</u>	
	<u>Amount</u>	<u>Cost/Ton</u>	<u>Amount</u>	<u>Cost/Ton</u>
	551,310		444,307	
Underground Costs	\$2,363,487.97	4.287	\$1,953,826.29	4.397
Surface Costs	421,711.10	.765	320,743.40	.722
General Mine Expense	<u>441,264.22</u>	<u>.800</u>	<u>625,114.41</u>	<u>1.407</u>
Cost of Production	3,226,463.29	5.852	2,899,684.10	6.526
Depreciation	69,613.99	.126	45,085.65	.101
Taxes	240,106.25	.436	233,164.45	.525
Loading & Shipping	<u>79,481.36</u>	<u>.144</u>	<u>59,060.83</u>	<u>.133</u>
Total Cost at Mine	\$3,615,664.89	6.558	\$3,236,995.03	7.285
Budget Cost of Production		6.219		6.601
Number of Shifts and Hours		2-8 hr.		2-8 hr.
Number of Days Operated		234		209
Average Daily Product		2,191 tons		2,151 tons



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

Detailed Cost Comparison

	<u>Total 1955</u>		<u>Total 1954</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs</u>				
Development	\$ 160,212.82	.291	\$ 213,095.75	.478
Mining	1,066,731.39	1.935	842,337.53	1.895
Tramming	371,412.94	.674	380,087.46	.854
Ventilation	11,691.51	.021	4,210.33	.010
Pumping	42,998.25	.078	37,970.97	.085
Compressors & Air Lines	104,934.93	.190	66,524.07	.150
Crushing & Screening - Undg.	15,943.82	.029	-	-
Underground Superintendence	159,608.04	.290	149,424.93	.340
Maint: Pockets & Chutes	66,424.70	.120	63,187.47	.143
Mining Equipment	207,454.97	.376	187,868.89	.422
Shaft	10,136.04	.018	9,118.89	.020
Holiday Pay	38,586.17	.070	-	-
Vacation Pay	85,435.25	.155	-	-
Telephones & Safety	21,917.14	.040	-	-
Total Underground Costs	<u>2,363,487.97</u>	<u>4.287</u>	<u>1,953,826.29</u>	<u>4.397</u>
<u>Surface Costs</u>				
Hoisting	86,233.28	.156	71,428.70	.160
Crushing & Screening-Surface	80,522.48	.146	93,261.65	.210
Stocking	115,014.71	.209	51,896.46	.117
Timber Yard	-	-	4.27	-
Dry House	32,013.25	.058	22,685.75	.051
Policing	13,460.06	.024	14,738.98	.033
General Surface	25,222.94	.046	32,394.38	.073
Maint: Headframe Bldg. & Equip.	6,280.42	.011	12,252.58	.028
Other Mine Buildings	26,745.45	.049	22,080.63	.050
Holiday Pay	10,260.64	.019	-	-
Vacation Pay	21,358.81	.039	-	-
Telephones & Safety	3,255.09	.006	-	-
Deferred Accts.-Top Tram Car	1,343.97	.002	-	-
Total Surface Costs	<u>421,711.10</u>	<u>.765</u>	<u>320,743.40</u>	<u>.722</u>
<u>General Mine Expenses</u>				
Geological Department	13,545.62	.025	19,965.51	.047
Mining Engineering Department	22,832.59	.041	26,022.88	.060
Mech. & Elect. Eng. Department	-	-	30,228.10	.069
Safety Department	8,478.42	.015	8,235.48	.018
Research Laboratory	4,962.74	.009	1,688.04	.004
Analysis & Grading-Laboratory	32,478.12	.059	49,364.20	.111
" & " -Shipping	5,952.91	.010	7,546.92	.017
Telephones & Safety Devices	-	-	30,240.65	.068
Welfare - General	-	-	4,235.84	.009
" - District	-	-	634.18	.001
Special Expense - Pensions	134.32	-	121.87	-
" " - Retirements	6,577.11	.012	6,634.34	.015
" " - Legal	-	-	3,646.54	.007
" " - Hygiene Clinic	7,523.26	.014	9,257.18	.021
" " - Employment Office	1,470.12	.003	1,999.95	.004
Ishpeming Office	100,056.90	.181	78,427.28	.177
Mine Office - Supt. & Clerks	46,691.27	.085	52,529.26	.115
Central Warehouse Overhead	22,048.41	.040	21,064.43	.050



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

Detailed Cost Comparison (Cont'd)

<u>General Mine Expenses</u> (Cont'd)	<u>Total 1955</u>		<u>Total 1954</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
Insurance - Property	\$ 4,285.92	.008	\$ 2,799.24	.006
" - Group, Health & Life	25,162.09	.046	27,240.29	.061
" - Group Annuity	12,615.12	.023	14,493.14	.033
" - Catastrophe	4,693.35	.009	4,856.67	.011
Personal Injury-Comp. & Doctors	30,144.63	.055	15,218.31	.034
" - Compensation Dept.	534.82	-	3,203.50	.007
Vacation Pay - Current Year	-	-	90,248.89	.203
" - Prior Year's Adj.	-	-	1,400.01	.003
Holiday Allowance	-	-	49,211.07	.110
Taxes - Unemployment Insurance	6,091.55	.011	18,871.37	.042
" - Old Age Benefit	41,983.96	.076	34,270.64	.077
Electrical Engineering Dept.	14,826.52	.027	-	-
Mechanical Engineering Dept.	15,111.88	.027	-	-
Design Department	3,644.59	.007	14,294.61	.033
Employees Insurance & Compensation	9,418.00	.017	-	-
Greenhouse Expense	-	-	111.44	-
Retroactive Pay Adjustment	-	-	147.40	-
Total General Mine Expenses	441,264.22	.800	625,114.41	1.407
<b>COST OF PRODUCTION</b>	<b>\$3,226,463.29</b>	<b>5.852</b>	<b>\$2,899,684.10</b>	<b>6.526</b>

The lower cost, compared with 1954, is due principally to the higher production resulting from more operating days in 1955. The wage increase, effective July 1st, and increased supply and material costs increased the expense in some accounts.

Underground Costs - The reduction in the labor force effected most the underground crew and accounts for some of the reduction in cost. Trammig costs were chiefly affected by the reduction in force. Completion of the underground drilling program also reduced this expense.

Surface Costs - The increase in this expense is due to rebuilding and grading the sollar in all of the lump ore stocking area. Repairs to mine buildings was more extensive during 1955.

General Mine Expense - There was a large reduction in this expense for the following reasons. Analyses work on Cliffs Shaft ores was reduced by eliminating daily determinations of some elements that are now run on a weekly basis. Mechanical and Mining Engineering expense on the "C" Shaft project was less as construction work approached completion. The overhead expense on the new project was all charged to operating.

Expenditure & Authorization Summary

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

Work was completed on this project in December with a total expenditure of \$2,853,865.94. The new plant was placed in operation late in the year.

E. & A. CC-671 - Platform Dump Truck

This unit was purchased in June to replace a 1949 model which was completely worn out. This expenditure was \$4,631.19.

E. & A. CC-682 - Dial Communication System

A dial telephone system was installed throughout the "C" Shaft plant, both surface and underground. The expenditure under this account was \$4,732.32.



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

Expenditure & Authorization Summary (Cont'd)

E. & A. CC-686 - Central Heating Plant

A central automatic oil-fired heating plant was installed, replacing the old coal-fired system. This expenditure was \$44,342.56.

E. & A. CC-704 - New Moro Mine Shaft Fan

A new exhaust fan, with automatic controls, was installed over the old Moro Mine "K" Shaft to improve ventilation in the Section 10 area. This expenditure was \$1,766.19.

E. & A. CC-705 - Gismo-Diesel Loader Transport

This unit was acquired on a trial basis and will be thoroughly tested underground to determine its application to the Cliffs Shaft Mine. Amount of Authorization - \$28,400.

E. & A. CC-730 - Automatic Pumping System

Work on the new pumping system was started in November with development of a sump on the 15th level. The new system will increase pumping efficiency and lower pumping costs. The project amount authorized was \$76,870.00 and expenditure for 1955 totalled \$7,321.36.

E. & A. CC-731 - Central Shop Facilities

The old boiler house building, 54' x 110', is being converted into a Central Shops. This will eliminate the presently scattered shop buildings. This will result in improved efficiency in the maintenance and repair of mine equipment and minimize handling of equipment between the shops and the "C" Shaft. The project amount authorized was \$44,000.00 and expenditure for 1955 totalled \$14,725.60.

5. ESTIMATE & ANALYSIS OF ORE RESERVES

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

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

The 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. No significant ore reserve additions were realized this year.

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

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>Section 10</u>	<u>Total Lease</u>	<u>Total Tons</u>
Estimated Reserves-Dec. 31, 1954	938,842	133,573	397,537	531,110	1,469,952
Less 1955 Production	<u>402,766</u>	<u>56,347</u>	<u>92,197</u>	<u>148,544</u>	<u>551,310</u>
Balance as of 1954 Estimate	536,076	77,226	305,340	382,566	918,642
Estimated Reserves-Dec. 31, 1955	<u>666,653</u>	<u>88,165</u>	<u>346,866</u>	<u>435,031</u>	<u>1,101,684</u>
New Developed Ore	130,577	10,939	41,526	52,465	183,042

Expected Average Analysis of Ore Reserves

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulphur</u>	<u>Loss</u>	<u>Moisture</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, 1954 and 1955. Based on the 1955 revision and that portion of the second-class ore which will be mined, the proven and probable ore reserve is estimated at 3,931,250 tons as of December 31, 1955. The necessity of making a better second-class or intermediate grade ore and the information obtained from mining during 1955, accounts for the reduction in reserves as compared with 1954.

6. LABOR AND WAGES

Labor relations have been quite satisfactory although the Committee has been very active in submitting formal grievances. There were eight grievances submitted during the year and one continued from 1954.

<u>Name</u>	<u>Nature of Grievance</u>	<u>Step of Grievance Procedure</u>
Eino Maki	Disputes disciplinary layoff	Arbitration (denied)
Timber Crew	Violation of Contract	4 (dropped)
Jerome Guibord	Pay Shortage	4 (settled)
Folke Kurin-August Barbieri	Violation of basic agreement	2 (dropped)
Nicholas Valenti-James Quayle	Dispute disciplinary layoff	4 (dropped)
William C. Maki-Alvin Bailey	Dispute calculation of Incentive Earnings for a pay period	Arbitration (pending)
Underground Repairmen (11)	Dispute work scheduling	Arbitration (pending)
William Cowling	Disputes change in job assignment	4 (dropped)
Gordon Fitzgerald	Disputes disciplinary layoff	4 (dropped)
Clifford Felt	Disputes job posting	3 (dropped)

Employment

No. of Men Beginning of Year	489
Separations	139
Added During Year	<u>50</u>
Decrease in Men	<u>89</u>
Total End of Year	400
Avg. No. of Men as per Labor Statement (Statistical)	429
Avg. Absenteeism (Statistical)	30



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6. LABOR AND WAGES (Cont'd)

Employment (Cont'd)

The following table shows a classification of separations in 1955:

	<u>No. of Men</u>
Military Service	1
Quit	25
Retired	8
Transfers	13
Discharged	2
Deceased	2
Reduction in Force	88
Total	139

During 1955, 181 employees were eligible for three week vacations, 185 for two weeks and 97 for one week with the remainder not eligible for vacation privileges.

Statement of Wages

a. Average Wages Per Day

	<u>1955</u>	<u>1954</u>
Total Surface & Underground	21.06	19.64

b. Average Wages Per Month

	<u>1955</u>	<u>1954</u>
Total Surface & Underground	410.67	343.70

The mine operated an average of  $19\frac{1}{2}$  days per month in 1955 while averaging  $17\frac{1}{2}$  days per month in 1954.

c. Tons Per Man Per Day

	<u>1955</u>	<u>1954</u>
Total Surface & Underground	5.49	4.47

d. Labor Cost Per Ton

	<u>1955</u>	<u>1954</u>
Total Surface & Underground	3.83	4.39

7. SURFACE

A. New Shaft

The "C" Shaft project was completed late in the year. Fabrication and erection of all the structural steel for the surface structures, including the insulated aluminum siding, was done by Wisconsin Bridge and Iron Company under contract. All structural slabs and foundations in the motor-generator room and the headframe, together with the concrete service tunnels, were formed and poured by mine personnel.

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7. SURFACE (Cont'd)

A. New Shaft (Cont'd)

The following tabulation summarizes some of the events prior to commencement of operations in "C" Shaft:

1. The first skip was installed on August 12th, 1955.
2. The first rock was hoisted through "C" Shaft with the Koepe equipment on September 1, 1955.
3. The second skip was installed on September 20, 1955.
4. The first ore was hoisted through "C" Shaft with the Koepe equipment on November 8, 1955.
5. The "C" Shaft was placed into operation December 2nd, 1955.
6. The "C" Shaft cage was installed on December 12th with motive power being supplied by the temporary sinking hoist.
7. A record production of 2,816 tons was hoisted through the "C" Shaft plant on December 15th, in one shift.

The two oil-fired boilers and related equipment and the fuel tank were received and installed in the new central heating plant beginning in July. Installation was completed in time for the plant to assume the regular fall heating load.

B. Old Plant

Approximately two-thirds of the stocking area was re-graded with rock hoisted from "C" Shaft development and a three-inch hemlock plank was laid over this area. Rebuilding the sollar was necessary because the old sollar had been laid directly on black muck that was continually settling. Drainage was poor and equipment was frequently bogging down in the unstable soil.

The entrance of the manway tunnel into the dryhouse necessitated the relocation of the fuse room into the south end of the lamp room. With minor changes in the underground dryhouse, the reduced surface force is now using the same building. This eliminated one dryhouse attendant and maintenance of separate dryhouse facilities for the surface crew.

8. UNDERGROUND

During 1955, the development program gradually reduced in extent as shaft development neared completion and ore areas were depleted. New Shaft development was completed by September and the Automatic Pump project was begun in November. Operational development was heavy early in the year but was reduced to two contracts at the close of the year. Continued stress on analysis, depletion of a number of stoping areas, ore tied up by haulage and the lack of possible ore exploration areas all contributed to a program of continual stoping area changes and revisions. Pillar recovery work continued at the same high level experienced in 1954.

A. New Shaft

A large portion of the underground development program for the year was related to the New Shaft project. This development consisted of the sinking of "C" Shaft to bottom at elevation ~~+67'~~; a skip pit at elevation ~~+117'~~; the development of a skip-leading station at elevation ~~+221'~~; a crusher station, above elevation ~~+322'~~, this being approximately 32' wide by 105' long by 70' high at the highest step. Other major rock development consisted of driving an ore-pass raise above the crusher station to a top timber control drift at 15th level elevation; a separate ventilation raise from the crusher station to 15th level; and two ore-pass



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8. UNDERGROUND (Cont'd)

A. New Shaft (Cont'd)

raises, one for standard ore and one for second-class ore, extending above control gates at 15th level to each of the tramping levels above. Car-dumping facilities were constructed at all dumping stations on the various levels. A waste rock raise was extended above the east measuring pocket to 15th level with a branch extending into the crusher station for disposal of waste material removed from the flow sheet.

The installation of foundations, structural steel and flow-sheet equipment in the crusher station, pocket station and at the dump stations was performed by mine personnel augmented by steel erectors from the General Shops. All air for general underground consumption was routed through a new 10-inch main air line located in "C" Shaft.

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 tramping 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, upright and floor pillars. At the beginning of the year, 23% of the stoping contracts were mining pillars and at the end of the year the proportion had increased to 25% of the contracts.

Sinking operations in the New Shaft were completed in September, at which time the majority of the shaft miners were returned to production work. The drill hole incentive plan for the miners and a scraping incentive plan for the scraper operators continued to be used throughout the year. Experience gained to date with both of these incentive plans indicates they are an improvement over the car rate incentive system.

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 Conts.</u>			<u>No.-Double-Shift Contracts</u>			<u>Total Cont.Shifts or Equiv.(°)</u>		
	<u>12/53</u>	<u>12/54</u>	<u>12/55</u>	<u>12/53</u>	<u>12/54</u>	<u>12/55</u>	<u>12/53</u>	<u>12/54</u>	<u>12/55</u>
"A" Shaft	16	18	23	2	2	0	18	20	24
"B" Shaft	23	17	17	1	4	0	24	21	19
Banc. & "A" Shaft Northeast	11	11	13	1	2	0	12	13	16
Sec. 10 & Moro	11	10	14	7	6	0	18	16	23
"A" Shaft East	<u>7</u>	<u>5</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>9</u>	<u>6</u>	<u>2</u>
Total	68	61	69	13	15	00	81	76	84

(°) For each drill hole incentive contract there is a scraping contract.

Available stoping areas are decreasing as haulage tie-ups become more prominent and as exploration drilling has reached 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. The drifting was done on 1st and 15th levels to allow raising to stopes. The drifting on 5th was done to facilitate tramping on the level to "ore-pass" raises. Seven raises were driven between two or three levels at various elevations to provide shorter scraping distances in some contracts and in one case a traveling road. One raise was driven from 14th to 15th level "B" Shaft to develop ore encountered in U.H. #884 and one raise is currently being driven from the 5th level Barnum to the 1145 sub-level to develop ore encountered in U.H. #805.

The number of contracts working in "B" Shaft remained the same in 1955 as in 1954. Two contracts are on the drill hole incentive plan. Six contracts of 17 stoping contracts are mining below 1st level and 6 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. The "Lake Bancroft" structure, drilled in 1953, is now completely depleted above 2nd level elevation. Mining in this area disclosed a much smaller ore body above 1st level than had been anticipated.

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

Main-level drift development in "A" Shaft was begun on 15th level for the new sump and pumping station installation. Considerable raising was done in "A" Shaft with a major portion of it being "ore-pass" development for the "C" Shaft. Three raises were driven from one level to the next at different elevations to provide shorter scraping distances in several contract stopes. One raise and two branches from this main raise are currently being driven from 15th to 10th level in the vicinity of old #46 Contract stope to develop ore encountered in several diamond drill holes in the area.

The number of stoping contracts increased by five as compared with 1954, largely due to increased pillar recovery work and mining in old stopes. Seven contracts have no reserves other than upright or floor pillars. Reserves in "A" Shaft are dispersed and in part, tied up by tramping operations. During the year, the 6th level traveling and supply road was relocated and mining of the 6th level floor pillar was begun. As time goes on, other such areas will be opened to mining upon the relocation of traveling and tramping roads.

3. Bancroft & "A" Shaft Northeast

Main-level drifting, considerable sub-level drifting and raising was done on the 8th level and above in a second-class conglomerate ore body developed as a shrinkage stope. The development was completed in the Fall of 1955 and mining begun. By the end of 1955, six separate and individual argillite seams, ranging in thickness from 6" to 3', were disclosed by mining. Obviously, this information necessitated the shutdown of the stope for grade reasons. A diamond drilling program and early development had indicated a clean, uniform ore body in this area which didn't materialize.



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8. UNDERGROUND (Cont'd)

B. Mining Area (Cont'd)

3. Bancroft & "A" Shaft Northeast (Cont'd)

Considerable raising was done in other locations throughout the Bancroft Lease and the "A" Shaft Northeast area. Two raises were driven from 15th to 10th level elevation to allow mining in two new areas. Raises were also extended from 12th to 10th levels and from 10th to 9th levels to provide for contract relocation and to develop an ore body disclosed in a diamond drill hole on 10th level.

The number of stoping contracts increased by two as compared with 1954. The increase resulted from the development of the new area proven by the diamond drill hole and the raising from 15th to 10th level to pick up a 10th level floor.

Reserves of ore in the Bancroft Lease and the "A" Shaft Northeast area are now concentrated between the 9th and 11th levels. The second-class conglomerate ore body described in 1954 has now been dropped from the estimated reserve because of disappointing analyses.

4. Section 10 Lease and the Moro Mine

Development in the Section 10 Lease was fairly extensive during the year. Main-level drifting was done on 10th level to develop three separate ore bodies occurring between 10th and 8th levels. Three raises were extended from 10th to 8th levels to develop ore and to facilitate mining on 8th level. The development of two shrinkage stopes, which was begun in 1954, was completed in 1955 and mining begun. This development included sub-level drifting and considerable raising. Two top timber drifts were driven on 10th level to develop an ore body occurring on 10th level and above.

The mining continues to be concentrated on 5th and 8th levels. In 1955, the majority of stoping contracts in this area were on the drill hole incentive plan. The number of stoping contracts increased by four as compared with 1954. This increase in contracts resulted from the development of several new ore bodies and the relocation of several contracts.

The major portion of the reserves remaining in this area lie between 5th and 10th levels. In 1955, diamond drilling was done in all possible structures in the old Moro Mine with the result being no tonnage additions to the estimated reserve in the area. The old Moro Mine is now considered completely depleted and will not be considered in the future.

5. "A" Shaft East - (East of 2800 E and extending from the south boundary of the Bancroft Lease to 1200 S)

No development was done in the "A" Shaft East area this year. All known ore bodies have been developed.

The number of contracts mining in this area was reduced to two, as compared to five in 1954, by depletion and bad back conditions. It is probable that the number of contracts which will be operating in this area will remain constant now for several years.

The known ore reserves remaining in this area lie between the 4th and 8th levels. Emphasis on mining the east and northeast areas will continue to be stressed as we attempt to deplete the outlying ore structures before retreating towards shaft. Plans are presently being made to make this retreat as orderly and constant as is possible.

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8. UNDERGROUND (Cont'd)

C. Delimiting Ore

The underground diamond drilling program was continued until September, 1955 at which time the remaining diamond drill rig was removed from the mine. A total of 1,054' of drilling was done in 9 holes. Drilling was done in the "A" Shaft, "A" Shaft East, Section 10 Lease and Moro Mine areas. Underground drilling in the Cliffs Shaft Mine, for hard ore, can be considered completed.

The table below summarizes the material encountered:

<u>Hole Numbers</u>	<u>Material</u>	<u>Feet</u>	<u>Percent</u>
Series #917 to #926	Ore	140	13.28
	Lean & Second-Class Ore	167	15.84
	Iron Formation	309	29.32
	Intrusive	264	25.05
	Argillite & Quartzite	<u>174</u>	<u>16.51</u>
	Total	1054	100.00

Drilling in "A" Shaft, Section 10 and Bancroft Leases, "A" Shaft East, "A" Shaft Northeast and "B" Shaft, is complete. The old Moro Mine workings have been drilled completely with results indicating a lack of significant ore bodies. The "B" Shaft Far West workings were not drilled. Following a study of the Far West workings, the area was dropped from consideration. No significant tonnage additions were proven in 1955.

The underground drilling incentive which was instituted in 1954 again resulted in significant labor savings for the year. Since the incentive has been in effect, a savings in direct labor costs of \$1,084 was obtained. This amounts to a savings in labor costs of \$0.51 per foot for the holes drilled under the incentive system.

The cost per foot increased as compared with 1954 due to longer moves, greater traveling time to the working places, increased ground hardness and greatly increased indirect drilling costs.

D. New Equipment

Most of the equipment purchased in 1955 was related to the E. & A. projects. However, a substantial amount was required for maintenance of existing plant and replacement. Miscellaneous spare parts for the new flow-sheet were also purchased and placed in stock. The following major items were purchased in 1955:

<u>Item</u>	<u>Amount</u>
1 - Impact Wrench	\$ 405.00
112 - Pacific Clevis Blocks	5,977.00
10 - COPCO Drills	5,410.00
1 - Thor Drill-390	805.00
1 - CP-9 Hand Drill	180.00
1 - Steam Jenny	735.00
1 - Power Grinder	102.00
9 - Unit Heaters	1,702.00
1 - Condensate Return Pump	108.00
1 - Circulating Pump	48.00
1 - Battery Charger	158.80
1 - 48 MUM Battery (Locomotive)	1,999.00
1 - 6" Badger Water Meter	1,331.20
1 - Pan Section, Picking Feeder	465.00
Misc. Spare Parts, UNDG. Flow Sheet	13,200.00



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§ UNDERGROUND (Cont'd)

D. New Equipment (Cont'd)

<u>Item</u>	<u>Amount</u>
1 - 16" Flat Drive Belt, Primary Crusher	\$ 340.00
2 - 30 x 42 Crusher Jaws	2,047.00
1 - Spare Skip	10,400.00
1 - Insulation Tester	212.00
Misc. Spare Parts for Koepe hoist	5,761.00
1 - Lincoln Electric Welder	549.00
1 - Herringbone Pinion, "B" Shaft hoist	<u>810.00</u>
Total	\$52,745.00

E. Explosives

Powder consumption per ton of ore increased slightly compared with 1954 due to the sizeable carry-over of broken ore in the stopes at the end of 1955. The average price of powder increased from \$17.26 per cwt. to \$17.50 per cwt. The net result was an increased explosives cost per ton which is summarized in the following tables:

TABLE I

Cost of Explosives-Operating

	<u>Quantity</u>	<u>Avg. Price</u>	<u>1955</u>	<u>1954</u>
Powder, Lbs. - All Kinds	637,600	17.50	\$111,590.55	\$ 84,665.51
Misc. Supplies (Caps, Fuse, Testers, etc.)			<u>47,322.62</u>	<u>33,543.03</u>
Total			\$158,913.17	\$118,208.54

TABLE 2

Unit Cost & Consumption of Explosives

	<u>1955</u>	<u>1954</u>
Pounds Powder Per Ton of Ore	1.157	1.104
Tons Ore Per Lb. of Powder	.865	.906
Cost Per Ton for Powder	.202	.191
Cost Per Ton for Blasting Supplies	.086	.075
Cost Per Ton for All Explosives	.288	.266

TABLE 3

	<u>1955</u>	<u>1954</u>
Cost Per Ton Developing	.046	.057
Cost Per Ton Mining	<u>.239</u>	<u>.209</u>
Total	.285	.266

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8. UNDERGROUND (Cont'd)

F. Tungsten Carbide Insert Bits

Since tungsten carbide insert 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>1955</u>	<u>Amount</u> <u>1954</u>
Ing. Rand, Series 113 - 1-3/8"	2,577	10.56	\$27,213.12	\$ 8,549.85
" " 113 - 1-1/2"	195	11.60	2,262.00	407.00
" " 113 - 1-5/8"	25	12.90	322.50	-
" " 115 - 1-5/8"	1,484	12.90	19,143.60	17,488.92
" " 115 - 1-3/4"	66	13.40	884.40	815.46
" " 115 - 2"	11	14.45	158.95	-
Rockbits " 113 - 1-3/8"	295	10.30	3,038.50	699.30
" " 115 - 1-5/8"	46	11.40	524.40	2,838.60
" " HM - 2-1/4"	3	19.10	57.30	19.10
Copco " 113 - 1-3/8"	70	11.20	784.00	1,195.00
Vascoloy " 113 - 1-3/8"	50	9.50	475.00	-
Timken " HM - 1-1/2"	0	-	-	528.00
<b>Total</b>	<b>4,833</b>	<b>11.38</b>	<b>\$55,020.85</b>	<b>\$32,555.51</b>
Production - Tons			551,310	444,307
Cost Per Ton of Ore Produced			.100	.073
Feet Drilled - Rock & Ore			867,271	573,908
Average Feet Drilled Per Bit			183	203
Cost Per Foot of Hole			.063	.057

Bit prices, generally, were higher this year compared to 1954. The Ingersoll-Rand Company increased bit prices 10% while other bit manufacturers increased prices in varying degrees, none of which were greater than 10%. The average cost per bit, the cost per ton of ore produced and the cost per foot of hole drilled all increased due to price increments and a lower average feet drilled per bit. There was considerably more footage drilled in ore in 1955 and the average feet per bit in ore is much lower than in the rock development.

G. Pumping

A study of the pumping system indicated substantial savings in labor could be realized with an automatic pumping plant. Development of the sump and new pump station began in November and all equipment necessary for the project were on order at the close of the year.



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9. TAXES

Comparative data for 1955 and 1954 is shown below:

	<u>1955</u>		<u>1954</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Realty	3,200,000	131,200.00	3,275,000	127,561.25
Personal	1,116,100	45,760.10	1,111,100	43,277.35
Lot 2, Sec. 3,47-27, Bancroft	580,000	23,780.00	600,000	23,370.00
Lot 174, Nelson's Addition	100	4.10	100	3.90
S. 35.91' of Lot 179	50	2.05	50	1.95
S $\frac{1}{2}$ of NW $\frac{1}{4}$ of Sec. 10, 47-27	<u>960,000</u>	<u>39,360.00</u>	<u>1,000,000</u>	<u>38,950.00</u>
Total Cliffs Shaft Mine	5,856,250	240,106.25	5,986,250	233,164.45
Taxes per ton produced		.436		.525
Taxes per ton shipped		.373		.545

10. ACCIDENTS & PERSONAL INJURY

Twenty-four compensable and thirteen non-compensable injuries occurred in 1955 for a total time lost of 3,895 days. This record of 37 accidents, compared with the 17 incurred during 1954, ranked Cliffs Shaft sixth on Safety during 1955 among the Company's underground mines.

Comparison of Frequency and Severity in 1955 and 1954 is as follows:

<u>Year</u>	<u>Frequency</u>	<u>Severity</u>
1954	20.04	.771
1955	40.58	4.272

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:

#1324 - Walter Palomaki - Shaft Miner - January 4, 1955 - right hand caught between cage and endwall of New Shaft. Laceration of ring finger, linear fracture of 1st phalanx same finger - lost time, 28 days.

#1325 - Henry Johnson, Jr. - Motorman - January 11, 1955 - a chunk of ore rolled off car dropping on his right foot, while running ore from chute to car. Contusion, dorsum, right foot, moderate-severe - time lost, 16 days.

#1326 - Richard Nyman - Scraper Operator - January 4, 1955 - slipped from transfer and fell about 5 feet onto controller of motor. Contusion of chest over sternum - right hand and left knee, fracture of sternum.- time lost, 47 days.

#1327 - William Bussiere - Diamond Drill Operator - January 20, 1955 - twisted back while helping 3 men to carry scraper blade. Twisted back - time lost, 7 days.

#1328 - Anthony Manzoline - Scraper Operator - January 27, 1955 - his footing slipped while reaching out to hang a block, and fell. Contusions of back and ribs - time lost, 50 days.

#1329 - Reino Katajamaki - Shaft Miner - February 7, 1955 - while loading car of rock from chute a chunk hit him on right wrist. Broken bone, right wrist - time lost, 74 days.

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10. ACCIDENTS & PERSONAL INJURY (Cont'd)

#1330 - Ralph Young - Shaft Miner - February 7, 1955 - fell 15' off hanging stage while unloading plank from cage. Fractured right ankle - time lost, 90 days.

#1331 - Elmer Anttonen - Underground Laborer - March 14, 1955 - while standing under area miners had been barring, a slab of slate fell striking him. Fractures of left leg, left and right arms, lacerations and abrasions - time lost, 3,000 days.

#1332 - Paul Rosten - Contract Miner - April 11, 1955 - a chunk of ore rolled down pile and struck him on left leg below knee. Contusion of knee - time lost, 9 days.

#1333 - Ronald Jensen - Contract Miner - May 20, 1955 - while taking drill machine off rod he lost his balance and fell. Strain of left hip, time lost, 19 days.

#1334 - Arne Manninen - Contract Miner - May 23, 1955 - chunk of ore fell from ore back and struck him on upper part of his back. Fractures and contusions - time lost, 39 days.

#1335 - George R. Maki - Skip Rider and Cage Tender - June 6, 1955 - fingers squeezed between cage guides and side of cage. Avulsion, nail, ring finger, partial avulsion, nail, middle finger, left hand - time lost, 44 days.

#1336 - Nels Santti - Contract Miner - June 15, 1955 - while inspecting area following blast, a piece of ore fell from the back striking him on left leg. Fracture of left tibia at 2 levels, fibula and 2nd and 3rd metatarsals, lacerations and abrasions - time lost, 140 days.

#1337 - Undg. Repairman Foreman - June 16, 1955 - while riding cage, cage over travelled and struck hoisting gate on 8th level. Hurt left knee, left ankle, back and neck - time lost, 16 days.

#1339 - Raymond Pascoe - Contract Miner - July 26, 1955 - while drilling holes from a pile, the rod broke causing him to fall with the machine, landing on his chest. Contusions, auxiliary region of chest wall - lost time, 14 days.

#1340 - Robert Homeier - Timberman - August 19, 1955 - while disconnecting power tools from 2" air line, the line came apart at a coupling, blowing dirt and mud in his face and eyes - time lost, 11 days.

#1341 - Orville Dishno - Contract Miner - October 3, 1955 - air hoist swung and struck him on right knee. Bump on right knee - time lost, 11 days.

#1342 - Roy Torma - Contract Miner - October 5, 1955 - while holding drill rod for his partner his rubber mitt twisted around drill and broke his right thumb - time lost, 51 days.

#1343 - George White - Timberman - October 14, 1955 - twisted ankle while picking up 3/4" x 6" x 6' collar strap. Fracture, fibula, right, complete - time lost, 46 days.

#1344 - Gordon Rock - Motorman - October 20, 1955 - He was thrown against another motor car as two motors collided head-on. Severe lacerations of left side of chin. Compound fracture of lower jaw with loss of front teeth - time lost, 60 days.

#1345 - Dominic Tasson - Cement Mixer Operator - November 2, 1955 - while hooking cable from tractor to ore car the cable broke and whipped sideways striking him on right arm. Transverse fracture, lower 1/3, right ulna - time lost, 37 days.

#1346 - John Blocken - Picking Feeder Attendant - December 5, 1955 - A chunk of ore shifted and squeezed his hand while he was removing rock off the picking feeder. Fracture of 1st phalanx, left little finger - time lost, 30 days.



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10. ACCIDENTS & PERSONAL INJURY (Cont'd)

#1347 - Walfred Mantela - Contract Miner - December 6, 1955 - While lifting a chunk of ore it broke in two, one piece hitting him on right foot. Fracture, distal phalanx, and severe contusion, big toe - time lost, 10 days.

#1348 - Donald Racine - Skip Rider - December 27, 1955 - While lifting a 300-foot coil of 5/8" steel rope he kinked his back. Severe pain in back - time lost, 10 days.

11. POWER

	<u>1955</u>	<u>1954</u>
Total Money	97,017.06	67,093.55
K. W. H.	10,412,790	7,153,135
Average Cost Per K.W.H.	.0093171	.0093796
K.W.H. Per Ton	18.9	16.1
Cost Per Ton	.176	.168

The increase in K.W.H. consumption per ton is due to the absorption of all energy charges on the "C" Shaft project, except hoisting, into operating accounts and to the installation of a new ventilating fan in the old Moro Mine Shaft.

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.

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1. GENERAL:

The Humboldt Mine was opened in February of 1954 and continued the production of concentrates into 1955 with the ore operation being temporarily discontinued as of October 31, 1955. For the remainder of the year a program of stripping and repairing was carried out in an effort to prepare for the 1956 season.

During the operating months of 1955, the mill produced concentrates on a schedule of 20 shifts per week, the only shutdown being the day shift on Thursday of each week. The pit operation involving ore was scheduled for seven days per week, one shift per day with an additional 13 shifts (seven days - six afternoons) per week required for stripping. This stripping schedule was not placed into effect until April as during the first quarter of the year stripping was limited to approximately five shifts per week. Following the operating season the stripping program was continued on a basis of four pit crews working five shifts per week, the actual schedule depending on the immediate project being undertaken.

A short strike occurred at the end of the midnight shift on June 30th. Production was resumed on Tuesday, July 5th, following the general settlement with the steelworkers.

For the year, a total of 588,599 tons of crude ore, 214,532 tons of concentrate, 227,670 cubic yards of earth and 154,588 cubic yards of rock were handled at the Humboldt Mine.

A monthly production record was set during September when 26,592 tons of concentrate were produced. During October, a new high for mill feed rates was established when 123 L.T.P.H. (net) was averaged throughout the month. With this average, a total of 80,600 tons of crude were milled to produce 26,277 tons of concentrate. This crude ore average is the largest monthly pit production recorded within the present life of the mine.

The total cost of production at the mine averaged \$7.346 for the year compared to \$8.644 realized during 1954. Since this year continued to represent part of the break-in period for the operation, the yearly average still does not reflect an exact picture of probable future costs. The low for the year was achieved in October when the cost of the concentrate in cars totalled \$6.160 per ton.

At the end of the year the southern half of the pit was developed and being mined encompassing the areas known as knobs 1, 2 and 3.

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	293	1 & 2	8	498
Hauling and Crushing	288	1	8	288
Mill Operating	288	2 & 3	8	822



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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>	
January	47,792	47,682	19,736
February	33,404	33,523	14,255
March	58,720	58,427	20,778
April	55,071	55,405	19,002
May	57,353	57,200	21,832
June	61,730	61,105	22,007
July	60,023	60,428	20,723
August	68,125	67,477	23,330
September	65,314	65,664	26,592
October	81,067	80,600	26,277
Total	588,599	587,511	214,532

c. Production Averages:

	<u>1955</u>	<u>1954</u>
Average Crude Ore Per Day	2009 Tons	1500 Tons
Average Concentrate Per Day	745 "	629 "
Tons Per Man Per Day - Crude Ore	30.3 "	21.2 "
Tons Per Man Per Day - Concentrate	11.05 "	8.90 "
Average Weight Recovery	36.51	41.50

d. Shipments, Inventory and Analysis:

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
<u>Shipments</u>						
On Hand December 31, 1954	15,618	61.73	.074	10.37	.007	6.35
Production 1955	214,532	61.65	.082	9.41	.009	8.00
Stkpile to Presque Isle	109,041	61.45	.093	9.62	.008	6.72
*Stkpile to McDowell Co.	183	60.50	.103	9.21	.009	7.67
Pocket to Presque Isle	64,330	61.47	.102	9.02	.009	8.24
On Hand December 31, 1955	56,596	61.60	.094	9.43	.009	7.84

\*All Rail

e. Estimated Production and Analysis: 1955

	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
Dried		61.80	.081	9.50	.015	
Natural	262,400	57.17		8.79		7.50

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3. ESTIMATE OF ORE RESERVES:

a. Estimated Reserves:

1955 Estimate - 40% Recovery

	<u>Total Crude</u>	<u>Concentrates</u>		<u>Total</u>
		<u>Humboldt Mining Co.</u>	<u>Weber</u>	
1210' Elev.(Proven)	30,578,500	11,410,200	821,200	12,231,400
1110' Elev.(Probable)	7,566,100	2,776,300	250,100	3,026,400
1010' Elev.(Prospect)	7,514,600	2,758,000	247,800	3,005,800
Grand Total	45,659,200	16,944,500	1,319,100	18,263,600

	<u>Cu. Yds.</u> <u>Surf.</u>	<u>Stripping</u>	<u>Cu. Yds. Total</u> <u>Equiv. Stripping</u>
		<u>Cu. Yds.</u> <u>Rock</u>	
1210' Elevation	1,904,000	8,891,300	22,229,510
1110' Elevation	503,800	6,040,700	14,297,410
1010' Elevation	575,200	7,790,500	18,493,350

4. LABOR AND WAGES:

a. General:

The hourly rate crew at Humboldt averaged 94 men during the operating season. This force was reduced to 63 men at the end of October and at the end of the year all remaining men were laid off or transferred to other properties.

One new job classification was created when a dropball crane was placed in use at the mine, the job class for the operator of this machine being set at ten.

Labor relations continued on a high level as no formal grievances were filed and only one disciplinary action was necessary.



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4. LABOR AND WAGES:

a. General (Cont.):

The following changes were made involving salaried personnel during 1955:

<u>Name</u>	<u>Title</u>	<u>Status</u>	<u>Date</u>
Jacqueline Lundquist	Secretary	Resigned	January
E. W. Lindroos	Superintendent	Transferred to Republic	June
K. C. Olson	Superintendent	Transferred from Republic	June
Allen Perry	Chemist	Transferred from Lab.	August
Clarence Thomas	Chemist	Resigned	August
Robert Berkhahn	Metallurgist	Hired	August
Milo Martell	Warehouseman	Transferred to Republic	October
R. R. Smith	Metallurgist	Transferred to Republic	November
Allen Perry	Chemist	Transferred to Lab.	November
Everett Waisanen	Mill Foreman	Transferred to Republic	December

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	98	2		1		99
February	99					99
March	99					99
April	99	4		3	4	96
May	96	5			8	93
June	93	3	2		4	94
July	94		2			96
August	96	1			1	96
September	96			2		94
October	94		2	29	8	59
November	59			3	4	52
December	52			35	16	1
<b>Total</b>	<b>98</b>	<b>15</b>	<b>6</b>	<b>73</b>	<b>45</b>	<b>1</b>

The above table includes 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>
1955	95	5000	\$11,405.00	2.281
1954	63	3040	\$ 6,323.06	2.136

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4. LABOR AND WAGES:d. 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	173,572 $\frac{3}{4}$	\$370,851.09	2.136
Overtime	1 $\frac{1}{2}$	3,781 $\frac{1}{4}$	4,329.76	1.145
Shift Diff. - Aft.	18 $\frac{1}{4}$	50,308	3,063.32	.060
Shift Diff. - Nite	4 $\frac{1}{2}$	12,408 $\frac{1}{2}$	1,132.54	.091
Holiday Allowance		3,584	7,758.64	2.165
Holiday Worked		191 $\frac{1}{2}$	434.85	2.270
Vacation Pay Accrual			11,562.40	
Total Hourly Employees	63	173,572 $\frac{3}{4}$	\$399,205.42	2.300
<u>Salaried Employees</u>				
Mine Payroll	1 $\frac{1}{2}$	4,268	13,414.49	3.143
Total Mine Payroll	64 $\frac{1}{2}$	177,840 $\frac{3}{4}$	\$412,619.91	2.320
<u>General Payroll</u>				
Salaried Straight Time	3	8,162	19,819.53	2.428
Overtime		62 $\frac{1}{2}$	69.66	1.114
Labor from Other Mines	5 $\frac{3}{4}$	15,789	42,770.93	2.709
Total Labor	73 $\frac{1}{4}$	201,791 $\frac{3}{4}$	\$475,280.03	2.355

Distributed as Follows:

Operating Humboldt Mine	56 $\frac{1}{2}$	155,392 $\frac{1}{2}$	360,483.68	2.320
Stripping	11 $\frac{1}{2}$	31,635	78,532.17	2.482
Uncompleted Construction	1 $\frac{1}{4}$	4,065 $\frac{1}{2}$	10,085.78	2.481
Other Mines	1 $\frac{1}{4}$	3,390 $\frac{1}{2}$	7,879.41	2.324
Other Accounts	2 $\frac{1}{2}$	7,308 $\frac{1}{4}$	18,298.99	2.504
Total as Above	73 $\frac{1}{4}$	201,791 $\frac{3}{4}$	\$475,280.03	2.355

e. Labor Cost:

Production of Concentrates - Long Tons	214,532
Number of Days Operated	288
Number of Shifts Operated	822
Average Daily Production - Concentrates	745
Average Production Per Shift	261
Tons of Concentrate Per Man Day	11.05
Average Wages Per Man Day	18.84
Average Job Class	10
Total Amount Paid for Labor (Production)	\$360,483.68
Labor Cost Per Ton of Concentrate	1.68



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9. GENERAL SURFACE:

a. Buildings and Repairs

To accommodate a test program involving the use of a balling disc a 24' x 26' extension was added to the southeast corner of the mill building in January. Since this research project was completed at the end of September, this addition was removed during the following month.

b. Water Supply

Lake Lory continued to provide the fresh water make-up for the Humboldt plant. The elevation of water in the lake ranged from a high of 1559.8' in August to a low of 1558.0' in October. Periodic checks were made of the acidity and solids content of the 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	6.95	19.6
2. Lake Lory Water	7.05	3.6
3. Tailing Dam Overflow	7.10	308.2
4. Reuse water at Pumphouse	7.20	391.0

c. Roads, transmission lines, etc:

A new road was constructed connecting old highway U. S. 41 to the stripping dump west of the pit. This road supplies a shorter access way to the dump for hauling stripping from the central portion of the pit and will also act as a dike to retard swamp drainage from some areas west of the operation.

Following the termination of operations in the fall, the crushing plant was utilized for a short period to provide crushed rock to surface all roads at the mine. A total of 6,045 cubic yards of rock were placed on the roads during this period.

Also during November, a program of increasing the height of the tailings pond dike was started along the far east end of the pond. It is intended to complete this work during 1956.

During the summer months, the transmission line spanning the pit was moved 1,000' to the north to allow for the continued development of the mining area in that direction. The line extending along the western edge of the pit was moved approximately 200' further to the west and away from the pit to avoid damage from blasting.

The six inch air line to the pit from the mill used during the early development of the pit and the 12" lines between Lake Lory and the pit for hydraulicing were picked up and stocked.

All heavy equipment that was stored in the area immediately west of the Humboldt garage was moved to the large storage area south of the loading tracks.



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6. OPEN PIT:

a. Stripping:

The stripping program was carried out throughout every month of the year with the schedule being accelerated in April and again in November following the end of the operating season. The earth removed represented stripping in the area of the third and fourth knobs as preparation for the initial mining in this portion of the pit, and stripping along the present hanging wall mining limits of the pit in the area of the first and second knobs. This latter development work opened this area for eventual mining at a low bench elevation (1550').

The rock stripping during 1955 represented material from all sections of the presently developed pit. The bulk of the yardage however, was lean or unoxidized formations along the footwall of knobs 1, 2 and 3 and hanging wall conglomerate from knob three.

During December a large rock blast was fired in the footwall unoxidized formation in the knob 1 area, marking the beginning of work on a footwall access road to the primary crusher plant.

The following tabulation summarizes the stripping for 1955:

<u>Month</u>	<u>Surface</u>	<u>Rock</u>	<u>Total</u>	<u>Man Days</u>	<u>Yds. Per Man Day</u>
January	12,490	1,105	13,595	169	80.44
February	8,905	1,380	10,285	125	82.41
March	5,950	5,725	11,675	114	102.41
April	2,645	21,280	23,925	194	123.32
May	17,020	16,435	33,455	310	107.92
June	12,750	11,500	24,250	251	96.61
July	25,840	6,735	32,575	225	144.78
August	15,620	19,775	35,395	373	94.89
September	22,080	6,045	28,125	244	115.27
October	46,475	5,556	52,021	452	115.11
November	39,745	14,340	54,085	716	75.53
December	18,150	44,712	62,862	780	80.59
Total 1955	227,670	154,588	382,258	3,955	96.65
Total 1954	82,430	36,410	118,840	1,154	102.98
Total to Date	528,161	190,998	719,159	7,333½	98.06

b. Stripping Expenditures:

	<u>Amount Authorized</u>	<u>Amount Expended</u>	<u>Amount Unexpended</u>
E&A HM-8	\$123,480.00	\$127,103.69	\$ 3,623.69
E&A HM-12	95,400.00	78,417.84	16,982.16



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6. OPEN PIT:

c. Open Pit Mining:

A total of 588,599 tons of crude ore was hauled to the crusher from the pit. Although small tonnages were mined from the formation remaining in the areas of knob 1 and knob 2, the bulk of the tonnage was mined from knob three. This material proved to be very lean, averaging approximately 27% iron. Except for an enriched portion along the hanging contact in the southern half of the knob, this formation was very argillaceous with the ore being finely disseminated rather than in a banded state as is the usual case. The northern half, which was a more typical jasper, was extremely cherty. At the end of the year a cut had been made through the knob down to the 1580' elevation, although a substantial tonnage of lean ore remained along the footwall side of the knob.

Practically all primary drilling during the year was accomplished by the jet piercing machine. However, during the last quarter of 1955 a rotary drill rig was tested which resulted in a comparatively small additional footage of drill hole in both ore and rock.

Another new piece of equipment of major importance utilized in 1955 was a large drop-ball crane which arrived in June. This machine smashed ore chunks very satisfactorily and definitely increased the efficiency of the pit operation.

Other new successful developments in open pit mining at Humboldt included the testing of an air-trac wagon drill which greatly speeded up the secondary drilling operation, new three inch percussion bits that threaded directly to the drill steel instead of requiring an adapter and the use of ammonium nitrates explosives which decreased the cost of blasting by at least 25%.

In addition to the two regular Humboldt shovels, the Ohio Mine 54-B was in use during the early part of the year for stripping. Upon returning this machine to the Ohio, the Spies Mine 54-B was moved to the Humboldt. In August this shovel was transferred to the Lloyd Mine and was replaced at Humboldt by a two and one-quarter yard Marion shovel (Model 1929) which could be used only as a stockpile shovel.

There was only one delay of a major type in the pit operation excluding periodic power failures, that being a breakdown of the P. & H. shovel on October 19 when the swing shaft failed. Although 32 hours were consumed in procuring parts and repairing the machine the mine was kept operating on a limited extent through the use of auxiliary equipment.

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6. OPEN PIT:

c. Open Pit Mining:

Summary of Pit Production

Crude from Pit to Crushing Plant		584,276 Tons
Crude from Stockpile to Crushing Plant		4,323 Tons
Total Crude from Pit to Crushing Plant		588,599 Tons
Crude in Stockpile December 31, 1954		40,920 Tons
Crude from Pit to Stockpile 1955		-
Crude from Stockpile to Crushing Plant 1955		4,323 Tons
Crude Ore in Stockpile December 31, 1955		36,597 Tons
Waste Rock, Pit to Dump - Yards		25,221 Yards
Total Footage Drilled Jet Piercing		21,664 ft.
Total Footage Drilled Wagon Drills		41,695 ft.
Jackhammer Hours - Secondary Drilling		1,971 hrs.
Average Grade of Crude Ore	27.63 Iron	59.53% Silica
Cost Per Ton of Crude Ore		.699

Working 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 Holes

<u>Type</u>	<u>Unit Cost</u>	<u>Amount Used</u>	<u>Total Cost</u>
E. P. 158	18.59 C	92,191 lbs.	17,141.08
E.P. 167	10.55 C	176,325 lbs.	18,601.42
E.P. 152	17.76 C	108,306 lbs.	19,238.01
Titan No. 3	16.19 C	14,500 lbs.	2,348.47
Plastic Primacord	37.15 M	41,300 ft.	1,534.53
17 M.S. Connectors	44.59 C	550	245.25
XC-45 Boosters	39.76 C	1,575	626.25
Electric Delays	21.77 C	104	22.64
Connecting Wire	1.01 lb.	230 lbs.	232.90
Primacord	32.44 M	69,568 ft.	2,256.55
			<u>62,247.10</u>
Cost per ton of material broken			.089



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6. OPEN PIT:c. Open Pit Mining:Primary Blasting - Wagon Drill Holes

Type	Unit Cost	Amount Used	Total Cost
2 $\frac{1}{4}$ x 16 Gelamite	17.78 C	14,700 lbs.	2,614.70
2 $\frac{1}{2}$ x 16 Gelamite	17.72 C	4,100 lbs.	726.78
1 $\frac{1}{2}$ x 16 Gelamite	17.45 C	250 lbs.	43.63
1 x 24 Gelamite	17.54 C	11,625 lbs.	2,038.67
1 $\frac{1}{2}$ x 24 Gelamite	17.45 C	100 lbs.	17.45
1 $\frac{1}{4}$ x 8 Gelamite	17.45 C	600 lbs.	104.70
2 x 8 Gelamite	15.43 C	1,565 lbs.	241.59
Primacord	32.44 M	46,379 ft.	1,504.37
Dry Fuse	.625C	48 ft.	.30
#6 Blasting Caps	1.73 C	144	2.49
Cap Crimpers	2.15 ea.	7	15.05
			7,309.73

Secondary Blasting

Type	Unit Cost	Amount Used	Total Cost
7/8 x 8 Gelamite	19.90 C	932 lbs.	185.48
1 x 8 Gelamite	19.90 C	110 lbs.	21.89
1 $\frac{1}{4}$ x 8 Gelamite	17.58 C	3,096 lbs.	544.40
1 $\frac{3}{4}$ x 8 Gelamite	17.45 C	175 lbs.	30.54
2 x 8 Gelamite	10.23 C	275 lbs.	28.13
1 $\frac{3}{4}$ x 16 Gelamite	17.46 C	50 lbs.	8.73
2 $\frac{1}{4}$ x 16 Gelamite	17.85 C	1,550 lbs.	276.66
2 $\frac{1}{2}$ x 16 Gelamite	17.95 C	225 lbs.	40.39
1 $\frac{1}{2}$ x 24 Gelamite	17.62 C	1,063 lbs.	187.32
1 $\frac{3}{4}$ x 24 Gelamite	17.45 C	300 lbs.	52.34
Primacord	32.44 M	89,151 ft.	2,852.94
Electric Delays	21.77 C	8	1.74
#6 Blasting Caps	1.73 C	61	1.08
Dry Fuse	.625C	384 ft.	2.22
17 M.S. Connectors	40.50 C	100	40.50
Cap Crimpers	2.15 ea.	6	12.90
			4,287.26

Summary of Footages Drilled

Month	Jet Piercing	Wagon Drilling
January	1,988	5,459
February	1,215	5,200
March	2,303	3,619
April	2,103	2,962
May	1,947	4,212
June	2,137	6,620
July	1,949	3,818
August	2,285	6,623
September	2,249	2,501
October	2,567	681
November	833	0
December	88	0
Total	21,664	41,695

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6. OPEN PITC. Open Pit Mining:Summary of Jet and Joy 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>
1-8	11	37.0	20x19 to 16x16	1.86	10,460	
1-19	9	44.8	20 x 19	2.02	13,560	
1-22	8	41.9	22 x 20	2.03	10,920	1,680
2-12	16	45.6	22x20 & 17x17	1.98	20,820	4,160
2-21	10	41.4	22x22 & 18x18	2.00	11,220	3,160
2-23	6	30.7	17 x 18	1.72	1,510	3,130
3-7	12	27.0	18 x 17	1.91		8,970
3-8	3	44.7	18 x 18	1.91	3,810	
3-11	17	28.6	18 x 19	1.73	11,590	1,000
3-18	16	29.0 & 38.2	18x19 & 20x21	1.86	14,610	1,000
3-24	15	27.9	18 x 19	1.60	10,100	1,000
3-28	6	44.9	20 x 19	1.91	8,340	
3-31	15	29.6 & 42.9	18x19 & 20x21	2.10	16,280	2,500
4-4	26	39.9	20x18 to 16x16	2.04	10,460	18,200
4-7	11	35.2	20 x 20	1.84	10,870	2,020
4-8	8	44.1	21 x 22	2.01	14,840	
4-19	12	44.8	21 x 20	1.72	19,020	
5-5	15	26.4	18x17, 3 rows	1.57	6,820	4,040
5-12	20	27.2	18x18, 4 rows	1.64	13,040	680
5-20	21	27.0	19x18, 3 rows	1.62	16,180	
6-1	19	28.6	17x17, 4 rows	1.51	13,520	
6-8	20	43.3	22x22, 3 rows	2.04	8,900	31,890
6-15	27	32.1	18x17, 3 rows	1.68	23,350	
6-27	30	29.8	18x18, 3 rows	1.74	23,150	
7-18	31	33.5	18x20, 3 rows	1.57	20,590	9,940
7-22	6	45.0	20 x 19	1.64	9,150	
8-1	23	32.7	18x20, 2 rows	1.62	17,000	5,000
8-8	8	26.3	20 x 18	1.68	3,000	3,300
8-12	7	39.9	20 x 18	1.57	8,600	
8-15	11	34.0	20 x 21	1.82	13,200	
8-25	23	35.0	20x20, 3 rows	1.87	14,000	12,300
8-26	9	40.4	24 x 20	2.32	17,300	
9-7	22	40.8	24x20 & 20x20	1.68	34,400	
9-26	9	34.6	18 x 21	1.62	8,890	1,000
9-30	21	43.4	24x18 & 18x19	1.67	10,880	20,240
10-7	10	34.7	21 x 21	1.63	11,630	1,160
10-11	16	35.1	20x22, 3 rows	2.09	18,000	1,030
10-18	22	25.7	19x19 & 19x20	2.11		16,170
10-19	20	33.6	20x21 & 18x21	1.90	23,320	
10-28	4	27.0	21 x 18	2.62	4,060	
12-8	14	21.5	20x18 & 18x18	3.79		10,900
12-15	25	33.0	24x18 to 20x18 4 rows	2.50		27,750
12-21	42	33.2	24x20 to 20x20 3 rows	2.49		53,350
<b>Total 676</b>					<b>507,390</b>	<b>245,570</b>

Average stemming 12 feet

All drilling four feet below bench grade

\* Tons of material broken per pound of powder used



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6. 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</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>Reamer</u>	<u>Total</u>
January	2189.43	224.96	424.41	1480.93	640.00	334.10	209.03	52.51	247.91	637.11	1646.84	259.39	7497.80
February	5887.40	597.57	288.88	350.81	6.38	78.08	415.91	489.56	666.34	779.27	1440.25	186.60	11187.05
March	7335.13	772.55	350.55	235.95	8.87	275.04	413.44	292.46	830.19	344.09	2084.21	144.86	13087.34
April	7373.74	999.14	110.00	363.58	11.29	35.92	355.55	421.37	834.56	283.01	1614.91	319.86	12722.93
May	5838.60	915.98	310.47	272.22		216.63	271.51	81.32	1289.99	544.32	1601.86	113.43	11023.07
June	4216.98	862.42	324.64	320.30		3.37	487.11	877.62	943.47	444.66	1326.70	285.21	10092.48
July	6188.56	891.46	165.78	75.00	205.00	57.28	794.15	212.20	1081.98	676.40	1355.89	352.18	12055.88
August	6794.10	968.51	259.34	135.47	39.20	15.61	515.39	879.80	1700.61	493.82	1871.12	363.28	14036.25
September	6935.42	1052.50	150.29	104.00		1014.89	632.38	515.29	1531.47	711.97	2047.29	563.10	15258.60
October	5608.57	1204.62		310.32	2.28	4.55	478.54	574.42	1305.54	335.07	1739.61	419.06	11982.58
November	1412.27	344.43	77.21	114.00		.56	749.67	216.37	389.81	581.80	776.59	105.92	4768.63
December	1209.63	540.78	236.81				602.30	71.59	38.95	402.42	84.85	27.27	3214.60
<b>Total</b>	<b>60989.83</b>	<b>9374.92</b>	<b>1849.56</b>	<b>3762.58</b>	<b>913.02</b>	<b>1602.77</b>	<b>5924.98</b>	<b>4684.51</b>	<b>10860.82</b>	<b>6233.94</b>	<b>17590.12</b>	<b>3140.16</b>	<b>126927.21</b>

Total Loaded Footage Jet Drilled Holes	21,150'
Total Drilled Footage Jet Drilled Holes	21,664'
Cost Per Foot of Loaded Footage	6.001
Cost Per Foot of Drilled Footage	5.859
Total Tons Blasted Ore and Waste	696,360 Tons
Total Cost Per Ton Blasted, Ore & Waste	.182



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7. PLANT:a. General:

Great progress was realized during the year in the operation of the Humboldt mill. Although numerous difficulties were encountered as the mill was only in the second year of operation, it was still possible to increase the feed rate to a high of 123 L.T.P.H. net during the month of October. This gradual increase in feed rates became possible after the conversion of the high speed 9' x 8' rod mill to a conventional 9' x 12' rod mill in May.

Concerning delays, one of the most outstanding that requires mention is the time lost due to feed checks. The feeding arrangement utilized after the conversion of the second rod mill required two weightometers. Since only one was available, a delay was necessary for the mill operator to route all feed over the one weightometer as a check on the total tonnage of crude being sent to the plant.

b. Production by Months:

<u>Month</u>	<u>Tonnage</u>	<u>%Fe</u>	<u>% P.</u>	<u>% SiO2</u>	<u>% Sul.</u>	<u>% H2O</u>
January	19,736	62.05	.080	10.04	.007	7.38
February	14,255	62.33	.076	9.46	.008	7.37
March	20,778	61.91	.075	9.78	.006	7.65
April	19,002	61.40	.085	10.14	.009	7.56
May	21,832	62.23	.094	8.05	.013	7.56
June	22,007	61.59	.081	9.14	.017	8.36
July	20,723	62.02	.072	9.12	.008	7.74
August	23,330	61.92	.090	8.72	.007	8.57
September	26,592	60.84	.123	9.18	.006	8.80
October	26,277	60.79	.129	9.13	.010	8.37
Total	214,532	61.65	.082	9.41	.009	8.00

c. Metallurgical Balance:

<u>Product</u>	<u>% Wt.</u>	<u>% Wt. Crude</u>	<u>% Fe</u>	<u>% SiO2</u>	<u>% Fe Unit Recovery</u>
Concentrate	34.97	33.90	61.65	9.41	75.64
Flotation Tailing	65.03	63.05	9.48		21.63
Flotation Feed	100.00	96.95	27.72		97.27
Secondary Cyclone O'flo		3.05	24.75		2.73
Calculated Head		100.00	27.63		100.00

  

	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Sul.</u>	<u>Moist.</u>
Concentrate Assay	61.65	.082	9.41	.009	8.00
	(56.72) Natural				

% Moisture in Crude - 0.91



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7. PLANT: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>					
1955 Season	591,179	2652.50	1958.50	222.88	301.85
Ore in Process	1,180				
Rock for Roads	2,580				
<u>Fine Ore Bin to Mill</u>					
1955 Season	587,511	6791.83	5958.42	86.50	98.60
<u>Concentrates:</u>					
1955 Season	214,532	6791.83	5958.42	31.59	36.00

e. Monthly Hourly Operating Rates:

<u>Long Tons Per Hour - Gross</u>	<u>Feed To Primary Crusher</u>	<u>Fine Ore Bin To Concentrator</u>	<u>Concentrates</u>
January	170.08	71.73	29.69
February	144.29	52.24	22.22
March	223.70	82.06	29.20
April	230.60	81.48	27.94
May	230.80	83.14	31.73
June	238.80	89.86	32.36
July	263.26	96.06	32.94
August	246.83	94.77	32.77
September	244.62	98.84	40.03
October	231.95	111.94	36.50
Year	221.90	86.50	31.59
<u>Long Tons Per Hour - Net</u>			
January	267.74	82.79	34.27
February	291.10	80.21	34.11
March	295.08	90.15	32.06
April	300.27	94.53	32.42
May	317.75	93.13	35.55
June	313.35	100.51	36.20
July	318.42	101.13	34.68
August	306.87	104.17	36.02
September	317.44	108.04	43.75
October	289.01	123.03	40.11
Year	300.53	98.60	36.00

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7. PLANT:f. Pit - Crusher Delays:

	<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.	123.75	100.00	17.84	4.67
2. <u>Crushers</u>				
Primary Crusher	145.75	46.97	21.02	5.49
Conveyors	43.00	13.86	6.20	1.62
Secondary Crusher	41.50	13.38	5.98	1.57
Chutes, Feed Boxes, etc.	25.00	8.06	3.60	.94
Power Failure	15.50	5.00	2.24	.58
Primary Bin	9.90	2.90	1.30	.34
Tertiary Crusher	9.00	2.90	1.30	.34
Surge Bin Full	6.50	2.10	.94	.25
Surge Bin Feeder	5.50	1.77	.79	.21
Ross Feeder	4.50	1.45	.65	.17
Miscellaneous	5.00	1.61	.72	.19
Total	310.25	100.00	44.74	11.70
3. Fine Ore Bin Full	259.50		37.42	9.78
Totals	693.50		100.00	26.15

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>
January	102.50	63.59	36.41	14.78	3.86
February	116.75	49.57	50.43	16.82	4.41
March	63.50	75.81	24.19	9.16	2.39
April	57.50	77.00	23.00	8.29	2.17
May	68.00	72.64	27.36	9.81	2.56
June	61.50	76.21	23.79	8.87	2.32
July	39.50	82.68	17.32	5.70	1.49
August	54.00	80.43	19.57	7.79	2.04
September	61.25	77.06	22.94	8.83	2.31
October	69.00	80.26	19.74	9.95	2.60
Year	693.50	73.85	26.15	100.00	26.15



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7. PLANT: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>
<b>1. Operational</b>				
Feed Checks	192.34	57.87	23.08	2.83
Startup & Shutdown - Repair Sh.	54.55	16.41	6.54	.80
Power Failure	33.95	10.22	4.07	.50
Grinding Circuit Overloaded	16.71	5.03	2.01	.25
Charging #1 Rod Mill	14.46	4.35	1.74	.21
Switching to #2 Rod Mill	10.49	3.16	1.26	.15
Install Rod Mill Lifters	7.33	2.21	.88	.11
Strike	2.00	.60	.24	.03
Flotation Machines Sanded	.50	.15	.06	.01
	<u>332.33</u>	<u>100.00</u>	<u>39.88</u>	<u>4.89</u>
<b>2. Equipment</b>				
Rod Mill #1	63.04	22.82	7.57	.93
Hydroscillator	52.78	19.11	6.33	.78
Pumps	43.32	15.68	5.20	.64
Chutes, Feed Boxes, etc	32.69	11.83	3.92	.48
Thickener	28.99	10.49	3.48	.43
Ball Mill	20.31	7.35	2.44	.30
Sutorbuilt Blower	11.46	4.15	1.38	.17
General Electrical	5.38	1.95	.65	.08
Low Pressure Air Line	4.75	1.72	.57	.07
Conveyors	3.79	1.37	.45	.06
Flotation Cells	2.99	1.08	.36	.04
Rod Mill #2	2.13	.77	.25	.03
Pipe Lines	1.62	.59	.19	.02
Cyclones	.88	.32	.11	.01
Miscellaneous	2.12	.77	.25	.03
	<u>276.25</u>	<u>100.00</u>	<u>33.15</u>	<u>4.07</u>
<b>3. Out of Feed</b>	<u>224.81</u>	<u>100.00</u>	<u>26.97</u>	<u>3.31</u>
<b>Total</b>	<u>833.39</u>		<u>100.00</u>	<u>12.27</u>

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7. PLANT: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>
January	88.78	86.64	13.36	10.65	1.31
February	223.72	65.13	34.87	26.85	3.30
March	63.88	91.03	8.97	7.67	.94
April	93.92	86.19	13.81	11.27	1.38
May	73.83	89.27	10.73	8.86	1.09
June	72.08	89.40	10.60	8.65	1.06
July	31.53	94.99	5.01	3.78	.46
August	64.27	90.97	9.03	7.71	.95
September	56.53	91.49	8.51	6.78	.83
October	<u>64.85</u>	<u>90.99</u>	<u>9.01</u>	<u>7.78</u>	<u>.95</u>
Year	833.39	87.73	12.27	100.00	12.27

j. Monthly Rod, Ball, and Reagent Consumption

<u>Month</u>	<u>Rods</u>		<u>Balls</u>		<u>Reagent</u>	
	<u>Lbs.</u>	<u>Lbs. Per Ton Crude</u>	<u>Lbs.</u>	<u>Lbs. Per Ton Crude</u>	<u>Lbs.</u>	<u>Lbs. Per Ton Crude</u>
January	79,112	1.66	68,000	1.43	61,381	1.287
February	80,399	2.40	50,500	1.51	38,242	1.141
March	126,635	2.17	70,700	1.21	56,079	.960
April	87,136	1.573	64,640	1.167	48,455	.875
May	78,396	1.371	74,000	1.293	51,397	.899
June	71,628	1.172	58,582	.959	54,806	.895
July	73,320	1.213	52,520	.869	63,911	1.058
August	122,952	1.822	68,680	1.018	59,646	.884
September	98,700	1.503	62,620	.954	67,889	1.035
October	<u>102,658</u>	<u>1.274</u>	<u>69,000</u>	<u>.856</u>	<u>59,069</u>	<u>.733</u>
Year	920,936	1.568	639,242	1.088	560,875	.955



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7. PLANT:

k. Plant Testing:

A program of testing both on a laboratory and plant scale was continued throughout the year. Changes in reagent combinations and equipment, based on this testing, have been made to effect improvements.

The phosphorous depression tests were completed early in the year. The normal phosphorous content of .08% could be reduced by about .04% by adding sodium flouride, sulphuric acid and fuel oil. However, the cost of achieving this reduction was estimated to be at least \$0.46 per ton of concentrate.

A system of pH control was started to maintain a neutral circuit. The pH is held within the limits of 6.9 - 7.1, increasing the selectivity and eliminating the large circulating loads of sericitic material.

Settling tests using the six foot laboratory hydroseparator were made on the primary cyclone overflow. The purpose of these tests was to determine if a hydroseparator would do a more efficient job of producing a lower grade slime tailing than the six inch cyclones. These tests indicated that the hydroseparator would produce a lower grade slime tailing than the secondary cyclones.

Settling tests using the six foot laboratory hydroseparator were made on middling products from the flotation circuit. The purpose of these tests was to determine if a final tailing, relatively low in iron and high in silica, could be obtained from the hydroseparator overflow. The tests indicated that little separation can be expected on the middlings by using a hydroseparator.

The Arizona Chemical Company reagent, Acintal No. 2 was tested to determine the possibility of replacing the Neofat 139 as one of the principal collectors in the flotation process. The test work indicated that the Acintal No. 2 is equal to, or better than, the Neofat 139 with an estimated saving in reagent cost of \$0.02 to \$0.06 per ton of plant feed. Since the completion of this test work, Acintal No. 2 has been used as the principal collector.

Balling disc tests using Humboldt concentrates were conducted periodically throughout the year. This testing involved the use of a commercial size disc.

Five Denver mechanisms with top recirculation parts were received from Denver Equipment Company in May. A comparison study on recovery was made and it was determined that there was not a noticeable increase in recovery over that which can be obtained from the standard Denver mechanisms.

By June the entire middle row of flotation cells was converted to Fagergrens. Products from the Denver and Fagergren machines were sampled to determine the relative merits of each machine. The Denvers produced a slightly higher grade concentrate with the Fagergrens having the edge on iron unit recovery.

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7. PLANT:

k. Plant Testing:

In October an additional mechanism was added to the existing three-cell conditioner. The new mechanism that was installed is a Fagergren rotor which differs from the propeller type mechanism in the first three cells. The rotor type mechanism imparts a much more intense agitation to the pulp than the propeller type. The installation of the new conditioner mechanism was completed too late in the month to collect any operational data except to attempt to determine optimum speed. Evaluation of this type of conditioning mechanism will be made when operations resume in 1956.

8. MAINTENANCE, REPAIRS AND CHANGES:

a. Crushing Plant:

The primary crusher was completely disassembled in February. Trouble involving the motor stopping under load was experienced in January and the crusher brokedown on February 4th. It was found that the outer bushing had heated and seized, making it necessary to replace the outer and spider bushings. The eccentric bushing was sent to the Allis Chalmers factory to be re-machined and was later reinstalled. At the suggestion of Allis Chalmers a larger oil pump was installed and a new inlet was drilled to the outer side of the eccentric to insure a flow of lubricant to this part. The time required to make these repairs was one week.

In April, movement between the head nut and the mantle of the primary crusher was noticed. On May 29th, after unsatisfactory attempts to retard the movement, the mantle and shaft were removed and it was found that the middle portion of the head nut threads was burred, causing it to bind. Parts replaced were mantle, spider bushing, main shaft sleeve and head nut. Examination of the old mantle revealed that cracks in the casting makes its use as a spare doubtful.

The No. 2 buffer belt, representing the main source of conveyor trouble, was improved during the summer by remodeling the housing over the conveyor to prevent plugging.

b. Concentrator:

On July 22nd, the front trunnion bearing on No. 1 rod mill burned out, the cause being a lack of water in the micarta sleeve. The new sleeve was installed in about eight hours with two shifts of intermittent operations being required to break in the new bearing.

In May, the No. 2 rod mill was converted from a high speed (90% of critical speed) 9' x 8' mill to a slow speed (55% of critical) 9' x 12' mill. This changeover required about four days. Following the conversion, the mill was charged with balls and concentrate regrind tests were run to provide information on pelletizing. After completion of these tests the balls were removed and the mill charged with rods with the parallel rod mill system being in operation for the remainder of the year.



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8. MAINTENANCE, REPAIRS AND CHANGES:

b. Concentrator (Cont.)

Considerable trouble was experienced beginning in June with the oscillator motors on the hydros oscillator. It soon became necessary to drop the rake compartment overflow setting to remove the load on the constriction plate. During this time, the grind was naturally much finer. It was found that the bolts holding the constriction plate down had sheared, permitting water to escape into the rake compartment. The plate was reworked in September to remedy this failure, with additional larger bolts being added. After this was completed no further trouble was encountered.

The blower motor for the air cells was damaged twice by lightning. On the second occasion, serious damage was incurred to the motor and a unit was borrowed from the Cliffs Shaft Mine until repairs were effected. With two lines of mechanical cells it was possible to operate the mill at two-thirds of capacity while repairs to the motor were made.

The following difficulties with the thickener were encountered during the year:

1. Continual failure of the thickener drive mechanism occurred every three or four months. Prior to the last failure the Dorr Company detected an error in design and furnished new parts to correct the trouble. These new parts were installed shortly before the end of the season.

2. The thickener lift mechanism jammed. This was caused by a hard ridge forming on the main shaft. It was necessary to remove the entire top of the thickener mechanism and clean off the shaft to solve this problem. A water spray jetting on the shaft was installed to prevent a recurrence of this difficulty.

During October, high moistures were obtained, due in part to the type of ore treated and partly to the condition of the filters and vacuum pumps. The filter cloth and screen were checked and patched at this time. Also, the vacuum pumps were checked and it was found that the heads and cones were badly abraded. The Nash Engineering Company has made recommendations which will help prevent the abrasion caused by the entry with the filtrate water of fine concentrate into the vacuum pumps.

On three different occasions during the season, one of the fresh water pump motors was grounded by lightning, and one of the reuse pump motors burned when the current to the mine went single phase. This involved repair and replacement to the motors.

During November the remaining line of Steffensen flotation cells was replaced by a 14 cell Denver Sub-A machine. All of the flotation machines in the mill are now of the mechanical variety, eliminating the need for the Sutorbilt blower and 150 H.P. motor.

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9. E & A's:

a. Construction and Stripping E & A's:

	<u>1955</u> <u>Expenditures</u>	<u>Total</u> <u>Expenditures</u>
HM-5 Plant Changes	37,404.19	89,018.81
HM-8 Stripping	127,103.69	127,103.69
HM-9 Plant Changes	36,525.66	36,525.66
HM-10 Heating Plant Changes	2,890.55	2,890.55
HM-12 Stripping	87,092.32	87,092.32
Total	<u>\$291,016.41</u>	<u>\$342,631.03</u>

10. COST OF PRODUCTION:

a. Comparison:

	<u>1955</u>	<u>1954</u>
Pit Expense	1.915	2.046
Crushing and Screening	.676	.711
Milling Expense	2.482	2.378
Tailings Disposal	.027	.044
Stocking Expense	.070	.083
General Expense	.714	1.215
Crude Charged to Operating	.039	.806
Miscellaneous	.068	.000
Taxes	.119	.089
Other Expense & Income	.182	.240
Depletion and Depreciation	.968	.965
Shipping Expense	<u>.086</u>	<u>.067</u>
Total Cost	7.346	8.644



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10. COST OF PRODUCTION:

b. <u>Detail of 1955:</u>	<u>Jan.</u>	<u>Feb.</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Total</u>
Pit Expense	1.706	2.317	2.187	2.101	1.756	2.149	2.139	1.904	1.613	1.372			1.915
Crushing & Screening	.882	1.624	.788	.713	.473	.604	.472	.562	.427	.587			.676
Milling Expense	2.327	2.858	2.631	2.634	2.815	2.354	2.436	2.293	2.143	2.260			2.482
Tailings Disposal	.049	.031	.029	.030	.020	.032	.018	.020	.023	.020			.027
Stocking Expense	.098	.088	.097	.099	.047	.081	.045	.077	.032	.055			.070
General Expense	.750	1.402	.773	.779	.538	.589	.656	.738	.502	.342			.714
Crude Ch'gd to Oper.	.288	.026	.069	.000	.045	.000	.000	(.000)	.000	.000			.039
Miscellaneous	.133	.059	.040	.048	.108	.039	.124	(.107)	.103	.046			.068
Taxes	.108	.149	.103	.112	.098	.097	.103	.091	.080	.080			.119
Other Exp. & Income	.177	.211	.198	.157	.155	.170	.195	.178	.163	.140			.182
Depl. & Deprn.	1.229	1.160	1.178	1.190	1.155	1.179	1.176	1.187	1.152	1.156			.968
Shipping Expense	<u>.000</u>	<u>.000</u>	<u>.000</u>	<u>.008</u>	<u>.036</u>	<u>.065</u>	<u>.115</u>	<u>.054</u>	<u>.138</u>	<u>.102</u>			<u>.086</u>
Total Cost	7.747	9.925	8.093	7.871	7.246	7.359	7.479	6.997	6.376	6.160			7.346
Production	19,736	14,255	20,778	19,002	21,832	22,007	20,723	23,330	26,592	26,277			214,532

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11. TAXES:

	<u>1955</u>		<u>1954</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Humboldt Mine, including stockpile, supplies and equipment as placed by State Mine Appraiser:				
Real Estate	\$850,000	\$17,000.00	\$470,000	\$9,400.00
Personal Property	410,000	8,200.00	425,000	8,500.00
Dr. Burke Camp	400	8.00	-	-
Collection Fee		252.08		179.00
Total	<u>\$1,260,400</u>	<u>\$25,460.08</u>	<u>\$895,000</u>	<u>\$18,079.00</u>
Tax Rate		\$20.00		\$20.00

12. ACCIDENTS AND PERSONAL INJURY:

<u>Name</u>	<u>Date of Injury</u>	<u>Nature of Injury</u>	<u>Days Lost</u>	<u>Compensation Paid</u>
John Juntilla	Jan. 18th.	Torn Ligament left leg.	34	\$252.00
Bruce Cain	Feb. 28th.	Laceration Dorcum left foot	10	\$ 30.00
Joseph Archambeau	June 3rd.	Laceration 2nd, 3rd, 4th, and 5th fingers left hand	21	\$ 98.00

13. PROPOSED NEW CONSTRUCTION:

Definitely scheduled for 1956 is a new pole line from the main breaker station into the pit area. Also, the present dike system enclosing the tailings pond will be raised an average of three feet.

Under consideration is a storage building and the initial construction work on a new tailings pond. The exact plans for these latter items may be modified throughout 1956 depending on the possible future expansion of the Humboldt plant.

14. EXPLORATION:

Two small-diameter diamond drill holes were drilled to determine the grade of ore and location of the footwall in the third knob area. This work proved up a sizable tonnage of material averaging 27.63% iron. The total combined depth of these two holes (No. 2 and No. 3) amounted to 275 feet.



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15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT:

a. Equipment Received:

- 1 - Dropball Crane
- 1 - 1 Ton Pickup Truck
- 1 - 4½" Gardner Denver Drill Machine
- 1 - Steam Cleaner
- 1 - 13 Bank Denver Flotation Cells
- 1 - 18,000 Gal. Fuel Tank
- 6 - Fagergren Mechanisms for Flotation Cells
- 1 - Fagergren Rotor Conditioner
- 3 - Reagent Feeders
- 1 - 3" Sump Pump
- 1 - Merrick Weightometer

b. Proposed New Equipment:

- 1 - D-7 Tractor and Dozer
- 1 - ½ Ton Pickup Truck
- 1 - 2½ Ton Service Truck
- 1 - 500 G.P.M. Barrett Haentjens Pump
- 1 - 600 C.F.M. Air Compressor
- 1 - Bit Grinder
- 1 - Welding Machine
- 1 - Control Center for Mill
- 1 - 350 H.P. Motor
- 1 - M.G. Set for Grinding Section
- 1 - 500 G.P.M. Pit Pump
- 1 - Air-Trac Wagon Drill

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1. GENERAL:

The production, in 1955, was 125,810 tons of Lloydale ore as compared with 156,600 tons in 1954. The tons per man per day was 5.13.

Cost of production for the year was \$5.252 as compared to \$4.648 for the previous year. The cost was \$.167 under the budget estimate.

Shipments during the year totaled 170,900 tons with the inventory of ore in stock being reduced to 162,142 tons. 45,076 tons of the ore in stock is Lloydale grade and 117,066 tons is Silica grade.

Ore reserves at the end of 1955 totaled 33,581 tons with 5,701 tons being Non-Bessemer Lloydale and 27,880 tons being Sulphurous ore. Mining of this small tonnage was un-economical because it was not possible to maintain grade and production. The remaining reserves are under old mining areas, thus causing contamination of stopes below, and only a limited number of men could work the remaining reserves with the resulting sharp reduction in production.

Two diamond drill holes, U.H. #191 and U.H. #192 were drilled from the 10th Level. U.H. #191 was drilled to the southeast at  $15^{\circ}$  from the #3 East Cross-cut and the U.H. #192 was drilled north at  $-45^{\circ}$  from the #3 Cross-cut. Both holes were very discouraging and prompted the decision to close the property.

The operating schedule was increased from a four to a five day week on April 5th. In November, with the curtailing of operations due to depletion of the ore reserves, sixteen men were transferred from the property. On December 12th, mining operations were terminated and all employees except a small salvage crew were transferred. Salvage operations continued for the remainder of the year and should be completed in January, 1956. The mine will be allowed to fill with water and the Lloyd and Section 6 Shafts capped. Dams on the 4th and 7th Lloyd-Morris connecting levels were constructed by the Inland Steel Company.



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2. PRODUCTION:

a. Production by Grade and Months

<u>Month</u>	<u>Days</u>	<u>Lloyddale Tons</u>	<u>Rock Tons</u>	<u>Tons Per Man Per Day</u>
January	17	11,245	290	5.84
February	16	9,708	292	5.24
March	19	11,387	761	5.30
April	18	9,427	1,947	4.61
May	21	10,766	1,400	4.81
June	22	10,787	1,162	4.64
July	19	9,552	1,076	4.42
August	18	9,566	672	4.61
September	21	13,451	323	5.94
October	21	14,520	176	6.06
November	21	12,301	64	5.78
December	7	3,100	59	3.17
Total	220	125,810	8,222	5.13

b. Shipments

<u>Year</u>	<u>Lloyddale</u>	<u>Lloyd Silica</u>	<u>Total</u>
1955	127,085	43,815	170,900
1954	136,605	1,168	137,773

c. Ore Statement

	<u>Lloyddale Tons</u>	<u>Lloyd Silica Tons</u>	<u>Total Tons</u>	<u>Total Last Year</u>
On hand January 1, 1955	46,351	160,881	207,232	188,405
Output for Year	125,810	-	125,810	156,600
Transfers				
Overrun				
Total	172,161	160,881	333,042	345,005
Shipments	127,085	43,815	170,900	137,773
Balance on Hand	45,076	117,066	162,142	207,232
Decrease in Output			30,790	
Increase in Shipments			33,127	
Decrease in Ore on Hand			45,090	

The operating schedule for the last two years follows:

1955 - Hoisting and mining operations 3-8 hour shifts per day, 4 days per week, January 1st to April 17th. Effective April 18th, 5 days per week.

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



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2. PRODUCTION: (Continued)d. Division of Product by Levels

<u>Level</u> 10th	<u>Lloyddale</u> 125,810	<u>Total</u> 125,810
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3. COST OF DEVELOPING AND OPERATING:a. Comparative Mining Costs

	<u>1955</u>	<u>1954</u>
Product - Tons	125,810	156,600
Underground Costs	3.859	3.100
Surface Costs	.629	.514
General Mine Expenses	<u>.764</u>	<u>1.034</u>
Cost of Production	5.252	4.648
Depreciation	.822	1.185
Taxes	.069	.057
Loading and Shipping	<u>.128</u>	<u>.081</u>
Total Cost at Mine	6.271	5.971
Budget Estimated at Mine	6.737	6.017
Number of Shifts and Hours	10 2-8 hr. 210 3-8 hr.	2 1-8 hr. 3 2-8 hr. <u>205</u> 3-8 hr.
Total Operating Days	<u>220</u>	<u>210</u>
Average Daily Product	572	746

Proportion of Labor, Supplies and Expenses

Labor	\$528,597.18	67%
Supplies and Expenses	<u>260,319.87</u>	<u>33%</u>
Total	\$788,917.05	100%

b. Detailed Cost Comparison

	<u>1955</u>		<u>1954</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs</u>				
Development	\$101,766.90	.809	\$ 74,416.10	.475
Mining	159,215.81	1.266	189,147.84	1.209
Tramming	87,204.67	.693	94,144.17	.601
Auxiliary Hoisting	37,330.74	.297	41,224.33	.263
Ventilation	2,873.91	.023	3,922.89	.025
Pumping	14,603.84	.116	13,544.83	.087
Compressors and Air Lines	12,574.27	.100	11,284.19	.072
Underground Superintendence	28,395.65	.226	26,423.96	.169



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3. COST OF DEVELOPING AND OPERATING: (Continued)

b. Detailed Cost Comparison (Continued)

<u>Underground Costs</u> (Continued)	<u>1955</u>		<u>1954</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Maintenance:</u>				
Pocket & Chutes	\$ 2,292.92	.018	\$ 5,784.59	.037
Mining Equipment	19,251.54	.153	14,870.40	.095
Levels & X-Cuts	2,524.86	.020	4,784.35	.030
Shaft	4,283.25	.034	5,884.69	.037
Telephones & Safety Devices	3,638.31	.028		
Holiday Allowance	7,096.32	.056		
Vacation Pay - Current Year	2,466.45	.020		
Total Underground Costs	485,519.44	3.859	485,432.34	3.100
<u>Surface Costs</u>				
Crushing & Screening - Surface			28.15	
Hoisting	28,741.04	.227	26,088.79	.167
Stocking	14,134.30	.111	19,793.36	.127
Timber Yard	6,349.19	.052	5,505.63	.035
Dry House	6,986.60	.056	7,244.71	.046
Policing	13,540.70	.108	14,171.96	.090
General Surface	5,022.36	.040	5,101.47	.033
<u>Maintenance:</u>				
Headframe Bldg. & Equip.	524.94	.004	1,361.69	.008
Other Mine Buildings	1,142.94	.009	1,248.17	.008
Holiday Allowance	2,021.38	.016		
Vacation Pay - Current Year	715.00	.006		
Total Surface Costs	79,178.45	.629	80,543.93	.514
<u>General Mine Expenses</u>				
Geological Department	1,496.18	.012	2,024.18	.013
Mining Engineering Dept.	3,447.36	.027	5,891.11	.037
Mech. & Elect. Engr. Dept.	3,248.60	.026	4,133.28	.027
Safety Department	1,764.89	.014	1,893.40	.012
Research Laboratory	2,134.49	.017		
Analysis & Grading - Laboratory	11,023.72	.088	11,419.01	.073
" " " - Shipping	1,152.09	.009	1,749.66	.011
Telephones & Safety Devices			5,672.46	.037
Welfare - General			982.15	.006
" - District			147.07	.001
Special Expense - Pensions	26.00	.000	28.26	.000
" " - Retirements	1,272.89	.010	1,538.29	.010
" " - Legal			1,003.93	.007
" " - Hygiene Clinic	747.89	.006	2,271.88	.015
" " - Employment Off.	284.52	.002	463.73	.003
" " - Other	129.11	.001	326.55	.002
Ishpeming Office	19,363.59	.155	18,184.71	.116



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3. COST OF DEVELOPING AND OPERATING: (Continued)b. Detailed Cost Comparison (Continued)

	<u>1955</u>		<u>1954</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>General Mine Expenses</u> (Continued)				
Mine Office - Supt. & Clerks	19,313.89	.154	19,359.54	.123
Central Warehouse Overhead	2,037.67	.016	3,823.90	.025
Insurance - Property	907.31	.007	994.31	.006
" - Group, Health & Life	4,877.82	.039	5,799.41	.037
" - Group Annuity	3,451.72	.027	3,414.82	.022
" - Catastrophe	1,009.99	.008	1,167.58	.007
Personal Injury - Comp. & Drs.	6,671.67	.053	25,750.76	.164
" - Comp. Dept.			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 Insurance	1,164.06	.009	4,766.38	.030
" - Old Age Benefit	8,582.64	.069	8,436.47	.054
Employees Insurance & Comp.	1,926.20	.015		
Total General Mine Expenses	\$ 96,034.30	.764	\$161,943.89	1.034
COST OF PRODUCTION	\$660,732.19	5.252	\$727,920.16	4.648

4. ANALYSIS:a. Average Mine Analysis on Output

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Sulphur</u>
Lloyddale	125,810	56.30	.156	10.30	.324

b. Average Analysis of Shipments

<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>Loss</u>	<u>Sul.</u>	<u>Moist</u>
Lloyddale	127,085	56.85	.149	9.66	.25	2.39	1.20	.64	3.88	.368	10.21
Lloyd Silica	43,815	51.50	.112	18.68	.20	2.40	.52	.40	3.34	.025	8.91

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>Lime</u>	<u>Mag.</u>	<u>Loss</u>	<u>Sul.</u>	<u>Moist</u>
Lloyddale	45,076	50.46	.137	9.29	.22	2.15	1.08	.57	3.48	.306	10.21
Lloyd Silica	117,066	46.94	.119	17.50	.20	2.05	.45	.52	2.80	.057	8.91



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5. ESTIMATE AND ANALYSIS OF ORE RESERVES:

The estimate and analysis of ore reserves as of December 31st, 1955 is shown as follows:

	<u>Standard Ore</u>	<u>Sulphurous Ore</u>	<u>Total</u>
Total Gross as of July 31, 1955	41,520	54,612	96,132
Less Prod. July 31, to Dec. 31, 1955	<u>31,667</u>	<u>21,271</u>	<u>52,938</u>
Total Gross as of Dec. 31, 1955	9,853	33,341	43,194
Less 10% for Mining Loss and Rock	<u>4,152</u>	<u>5,461</u>	<u>9,613</u>
Net Total as of Dec. 31, 1955	5,701	27,880	33,581

6. LABOR:

Membership in the union was 99% of the eligible employees. Relations between management and the employees were excellent throughout the year.

7. SURFACE:

Stocking Grounds

The north silica pile was shipped out during the year. Shipments continued from the northeast Lloydale pile and from the east pile which contains both Lloyd Silica and Lloydale grades.

8. UNDERGROUND:

a. Mining

Mining operations were completed during the year. Operations were confined to three areas between the 9th and 10th Levels. Two of the areas were in standard ore and the third area was in sulphurous ore. The sulphurous orebody contained the bulk of the reserve tonnage remaining when mining operations were ceased. All ore above top-timber elevation was developed and mined until difficulties with grade and a drop in production forced abandonment of the stopes. One of the standard ore areas mentioned above was developed during the year by extension of the #3 Cross-cut. The area did not contain as much ore as had been anticipated. The cost of driving the #3 Cross-cut was absorbed in the operating expenditures.

b. Timber and Explosives

The following tables show comparison between 1955 and 1954 of timber and explosives consumed.

<u>Statement of Timber Used</u>	<u>Lineal Feet</u>	<u>Ave. Price Per Foot</u>	<u>Amount 1955</u>	<u>Amount 1954</u>
Cribbing	2,161	.0809	174.81	1,276.83
Stulls	7,205	.2189	1,576.83	1,870.21
H-Beams	1,215	.8771	1,065.67	2,436.43
Lagging	101,873	.0228	2,324.97	1,373.26
Poles	76,139	.0397	<u>3,024.78</u>	<u>1,914.41</u>
Total Timber Expense			8,167.06	8,871.14

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8. UNDERGROUND: (Continued)b. Timber and Explosives (Continued)Explosives

	Quantity Pounds	Average Price	Amount 1955
Gelamite 1-X	67,150	.1768	\$11,874.44
Gelatin Hi-Pressure 60% 5 x 5	<u>9,850</u>	<u>.2357</u>	<u>2,321.26</u>
Total Powder	77,000	.1844	\$14,195.70
Fuse, Caps, Etc.			<u>3,550.22</u>
Total Expense, Development & Mining			\$17,745.92
		<u>1955</u>	<u>1954</u>
Product - Tons	125,810		156,600
Pounds of Powder Per Ton of Ore	.612		.546
Cost Per Ton - Powder	.113		.102
Cost Per Ton - Fuse, Caps, Etc.	.028		.031
Cost Per Ton - All Explosives	.141		.133
Total Explosives Used in Mine	\$ 17,745.92		\$ 20,805.98
Average Price Per Pound for Powder	.1844		.1866

c. Pumping

An average of 216 gallons per minute was pumped during 1955 as compared with 214 gallons per minute in 1954.



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9. TAXES:

The following shows a comparison of the taxes paid in 1955 and 1954.

	<u>1955</u>		<u>1954</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)	\$ 70,000.00	\$1,499.95	\$ 90,000.00	\$1,926.78
N $\frac{1}{2}$ of SE $\frac{1}{4}$ of Sec. 6,47-27 80A)				
Pers., Ore in Stock, Supplies & Equip.	<u>295,000.00</u>	<u>6,321.23</u>	<u>275,000.00</u>	<u>5,887.39</u>
Total by State Tax Commission	<u>\$365,000.00</u>	<u>\$7,821.18</u>	<u>\$365,000.00</u>	<u>\$7,814.17</u>
Collection Fee		78.21		78.14
Total	<u>\$365,000.00</u>	<u>\$7,899.39</u>	<u>\$365,000.00</u>	<u>\$7,892.31</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	\$ 11.78	\$ 550.00	\$ 11.79
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6,47-27, Exc R/W41.08A	550.00	11.78	550.00	11.77
S $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6,47-27, 81.26A	900.00	19.29	900.00	19.27
SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6,47-27	550.00	11.79	550.00	11.77
SE $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6,47-27	600.00	12.86	600.00	12.84
NE $\frac{1}{4}$ of NE $\frac{1}{4}$ of Sec. 19,48-27, 40A	135.00	2.89	135.00	2.89
Total	<u>\$ 3,285.00</u>	<u>\$ 70.39</u>	<u>\$ 3,285.00</u>	<u>\$ 70.33</u>
Collection Fee		.71		.70
Total Lloyd & Misc. Lands	<u>\$368,285.00</u>	<u>\$7,970.49</u>	<u>\$368,285.00</u>	<u>\$7,963.34</u>
<u>West Ishpeming</u>				
Lot 4, Block 2	\$ 75.00	\$ 1.63	\$ 75.00	\$ 1.62
<u>North Lake Location</u>				
Store on Sec. 6, 47-27	<u>\$ 1,000.00</u>	<u>\$ 21.64</u>	<u>\$ 1,000.00</u>	<u>\$ 21.62</u>
Total Ishpeming Township	<u>\$369,360.00</u>	<u>\$7,993.76</u>	<u>\$369,360.00</u>	<u>\$7,986.58</u>
Tax Rate	21.4279		21.4087	
<u>Ely Township</u>				
Lloyd Mine-Pers. Prop.-Stockpile	\$ 20,000.00	\$ 560.00	\$ 30,000.00	\$ 840.00
Taxes Per Ton Produced	<u>1955</u>	<u>1954</u>	<u>1953</u>	<u>1952</u>
	.068	.056	.064	.117
Taxes Per Ton Shipped	.050	.064	.078	.140
			.037	.042

10. ACCIDENTS AND PERSONAL INJURY:

The safety record for the year, at the Lloyd Mine, was second in rating among the Company's underground mines as compared with eighth in 1954.

There were two compensable accidents which resulted in a total lost time of 117 days. Three non-compensable injuries brought the total number of injuries to five and the total amount of lost time to 123 days.

<u>Year</u>	<u>Frequency Rate</u>	<u>Severity Rate</u>
1955	26.54	653
1954	63.90	
Average all UG properties in 1955	37.00	5,249

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10. ACCIDENTS AND PERSONAL INJURY: (Continued)

The accidents are listed as follows:

Accident No. 925, April 25, 1955, Gordon Vercoe, Miner. Rupture of biceps muscle, right arm. Time lost - 48 days.

Accident No. 926, July 26, 1955, William Wood, Pocketman. Fracture of left heel. Time lost - 69 days.

11. POWER:

A total of 3,056,684 kilowatt hours of electric power was consumed during 1955. This was approximately a 50% increase over the previous year, and was a direct result of the longer work week.

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>Year</u>	<u>K.W. Hours</u>	<u>Cost</u>	<u>Rate</u>
1955	3,056,684	\$28,354.32	.00928
1954	2,111,339	\$19,670.44	.00932



MATHER MINE "A" SHAFT  
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1. GENERAL:

Production for the Mather Mine, "A" Shaft for the year was 1,045,409 tons. The million ton mark was exceeded in spite of the reduced operating schedule during the first half of the year. Operations to April 18th were on a two shift, four day per week schedule. A two shift, five day per week schedule was in effect between April 18th and July 31st. Beginning August 1st the schedule was expanded to a three shift, five and one-third day per week operation and this work week continued throughout the remainder of 1955. Shipments from the pocket were commenced on April 5th and continued through November 26th and shipments from the stockpile commenced on April 15th and continued through November 8th. A total of 1,472,005 tons were loaded out during that period; a new record for the Mather Mine, "A" Shaft. By grades 999,939 tons of Standard grade were mined and 45,470 tons were of the Special grade.

The analysis of the Mather Mine, "A" Shaft product for the year was 57.95 Fe., 9.26 Si., and .021 Sul. in the Standard grade and 58.07 Fe., 10.21 Si., and .613 Sul. in the Special grade. The analysis of the shipments for the year was 51.45 Fe. Natural in the Standard grade and 52.41 Fe. Natural in the Special grade. This analysis compares most favorably with the analysis in 1954 when the Standard grade shipments were 50.64 Fe. Natural and the Special grade shipments were 50.43 Fe. Natural.

In spite of increases in the cost of labor and supplies the cost of production decreased \$.472 per ton as compared with 1954, and the total cost at the mine including depreciation, taxes, and loading and shipping costs showed a decrease of \$.054 per ton. The increased efficiency that was attained by improved methods and equipment paid off by increasing the tons per man per day from 8.04 tons in 1954 to a Mather Mine, "A" Shaft record of 9.17 tons for 1955.

Physical inventories were reduced considerably during 1955. The supply balance was decreased from \$328,101.37 as of January 1, 1955 to \$222,808.78 as of December 31, 1955. The steel shortage that developed during the last half of the year put such items as steel sets for underground support, structural steel, as well as some machine parts and other steel products, in critical supply and necessitated substitutions and revisions in structural fabrication at the mine and General Shops in order to keep development and mining underway.

The underground drilling program for outlining new ore reserves continued throughout 1955, and diamond drills operated from the 6th, 7th, 8th and 9th Levels during the year. The gross ore reserves were increased by 3,282,952 tons.

Labor relations for the year were satisfactory as indicated by the fact that again in 1955, as in 1954, there were no formal grievances presented.

Mining operations were conducted principally on the 7th and 8th Levels, with 5th, 6th and 9th Levels contributing a minor percentage of the production. By levels, production was as follows: 5th Level - 39,844 tons or 3.8% of the total product; 6th Level - 800 tons or .08% of the total product; 7th Level - 730,726 tons or 70.4% of the total product; 8th Level - 265,608 tons or 25.6% of the total product; and 9th Level - 710 tons or .07% of the total product.

Main level development was continued on the 8th and 9th Levels throughout the year. All cross-cut development was completed on the 8th Level, and the 9th Level footwall drift

MATHER MINE "A" SHAFT  
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1. GENERAL: (Continued)

was advanced to within 400' of the "A" and "B" Shaft boundary. At the end of the year cross-cut development on the 9th Level was underway in two headings. The use of rock bolts for ground support was continued wherever possible.

The conveyor belt drift on the 9th Level was bolted along its entire length and needed no steel support except at the load and discharge points. Ground conditions encountered in the cross-cut development on the 8th and 9th Levels, as well as in a portion of the footwall drift on the 9th Level, were of such a nature as to require steel sets for support, thus, resulting in a higher development cost per foot of drift than in those areas where rock bolts were used. The comparative costs are \$59.46 per foot of drift where rock bolts are used for support as against \$95.50 per foot of drift where steel sets are used for ground support.

With the use of three sub-level conveyors, a fairly large portion of 8th and 9th Level reserves will be handled without the use of regular tramping equipment. Planning was completed and development was well along for two sub level conveyors above the 8th Level and one above the 9th Level to transfer ore by raises and scraping drifts to the inside trench and crushing station on the 9th Level.

Equipment used on the original 7th Level sub conveyor will be used for the #1 sub conveyor on the 8th Level. Additional belting, idlers and supports will extend its length from 240' to 400'. Experimentation on belt loading will be tried in conjunction with the #1 belt to determine whether feeder belts, reciprocating feeders, or inclined grizzly chutes would be most effective and economical for use with the #2 and #3 conveyors.

The #2 and #3 conveyors will be a wire rope supported conveyor system in which two parallel wire ropes are strung on 4' centers along the conveyor drift and fastened down at 160' intervals to provide tension, and supported every 15' by fabricated pipe stands. Special three roll idlers are then suspended between the wire ropes by a clamping device which is an integral part of the idler.

This type of conveyor has advantages over conventional conveyors in that installation time is greatly reduced, misalignment of idlers does not affect belt training, and heavy channel supporting structurals are not required for idler stands.

All ore carried by these three conveyors, along with ore trammed to the inside storage trench on the 9th Level, will be scraped into a crushing station and then conveyed 3100' to the shaft by a 30" belt conveyor system. Development and excavation work for this conveyor system on the 9th Level was nearing completion at the end of the year.

Installation work on this project is already underway and when completed will incorporate the following flow sheet: Ore discharged into the storage trench at the load end will be scraped over a scalping screen, with the oversize material discharging into a 36" x 42" jaw crusher. All undersize material will then be loaded onto a 48" buffer belt, then to the 30" main conveyor belt, and finally discharged at the shaft plat through a raise to the 9½ Level skip loading station.

A new "Whaley Automat" loader was purchased during the year for drifting on the 8th and 9th Levels.

Two remote controlled single drum hoists with 125 H.P. and 75 H.P. motors on the pull



MATHER MINE "A" SHAFT  
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1. GENERAL: (Continued)

and pull back respectively, were purchased and preparations made for their installation on the 9½ Level. With the large diameter 42" grooved drum on these new hoists high rope costs should be greatly reduced and down time held to a minimum.

Installation of a magnet over the head pulley on the 7th Level conveyor was made during the year to remove any tramp iron from the ore conveyed. The operation was very effective and, although not its intended purpose, a considerable quantity of reusable bits, bolts, and assorted machine parts were salvaged during the year.

A new track cleaner was purchased near the year's end for cleaning track on the new levels. Several new improvements were incorporated over the original design including a fluid coupling and complete hydraulic controls for operating the digging plows.

Two basic systems comprise the new mine communications system; the mine radio-phone system and the audio-phone system.

The mine radio-phone is a short wave system with three separate frequency channels with one frequency providing communication between the dispatcher and underground locomotives, another frequency providing communication between the hoisting engineer, cage rider, and dispatcher, and a third frequency providing for communication between a portable receiver-transmitter, used in shaft work, and the hoisting engineer.

The audio-phone system is a system with all speakers and microphones connected in parallel by a four wire cable and provides sound at all stations when any microphone is being operated. This saves time in contacting personnel in the vicinity of any of the stations. Sound intensity of the speakers can be varied, permitting adjustments for large areas or for confined quarters as desired. One of the audio-phone systems provides communication between the various level plats and surface locations. A second audio-phone system is presently being extended within the mine. Both systems include the dispatchers' control station in their network.

The entire system is well integrated by the dispatchers' control station and provides very close control of the flow of ore from the various points in the mine to surface, of supplies to various points in the mine from surface, and permits close contact with supervisory and maintenance personnel. The use of the standard mine telephone is being discontinued where the audio-phones are being installed.

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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>1954 Total</u>
Mather	997,817	2,122	999,939	
Mather Special	39,863	5,607	45,470	
Total	1,037,680	7,729	1,045,409	915,405
Rock			67,705	70,521

<u>Months:</u>	<u>Ore</u>	<u>Rock</u>
January	63,368	5,137
February	64,551	6,226
March	78,911	6,556
April	79,195	5,764
May	90,448	4,928
June	98,222	4,884
July	78,633	4,609
August	91,000	3,751
September	116,955	6,182
October	115,568	5,566
November	84,905	6,303
December	83,653	7,799
Total	1,045,409*	67,705

\* Total includes 7,729 tons, current year stockpile overrun pro-rated monthly.

b. Shipments:

	<u>Pocket</u>	<u>Stockpile</u>	<u>Total</u>	<u>1954 Total</u>	<u>Increase</u>
Mather	658,455	756,831	1,415,286	662,870	
Mather Special	-	56,719	56,719	11,933	
	658,455	813,550	1,472,005	674,803	797,202

All ore in stock was loaded out by the end of the shipping season. An overrun of 7,729 tons was developed with 2,122 tons in the Mather grade and 5,607 tons in the Mather Special grade.

GILBERT BOND  
25% COTTON FIBRE  
USA



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2. PRODUCTION: (Continued)

c. Ore Statement:

	<u>Mather</u>	<u>Mather</u> <u>Special</u>	<u>Total</u>	1954 <u>Total</u>
On Hand January 1, 1955	512,174	11,249	523,423	282,821
Output for Year	997,817	39,863	1,037,680	902,862
Transfers	-	-	-	-
Overruns	2,122	5,607	7,729	12,543
Total	<u>1,512,113</u>	<u>56,719</u>	<u>1,568,832</u>	<u>1,198,226</u>
Shipments	<u>1,415,286</u>	<u>56,719</u>	<u>1,472,005</u>	<u>674,803</u>
Balance on Hand	96,827	-	96,827	523,423
Decrease in Output				254,873
Increase in Output			130,004	
Decrease in Ore on Hand			426,596	
Increase in Ore on Hand				240,602

Working Schedule:

- 1955 - 2-8 hr. shifts, 4 days per week, Jan. 1st to April 18th.  
         2-8 hr. shifts, 5 days per week, April 18th to August 1st.  
         3-8 hr. shifts, 5-1/3 days per week, August 1st to December 31st.
  
- 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.



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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>Eighth (2590') Level</u>	<u>Ninth (2810') Level</u>	<u>Total</u>	<u>Rock</u>
January	6,188		56,650			62,838	5,137
February	6,913		57,124			64,037	6,226
March	4,587	800	69,825	3,088		78,300	6,556
April	4,850		67,079	6,688		78,617	5,764
May	7,300		71,002	11,471		89,773	4,928
June	5,850		76,279	15,386		97,515	4,884
July	2,750		49,539	25,733		78,022	4,609
August	625		52,333	37,431		90,389	3,751
September			66,713	49,524		116,237	6,182
October			64,292	50,548		114,840	5,566
November	281		51,456	32,115	335	84,187	6,303
December	500		48,434	33,616	375	82,925	7,799
	<u>39,844</u>	<u>800</u>	<u>730,726</u>	<u>265,600</u>	<u>710</u>	<u>1,037,680</u>	<u>67,705</u>

Current Year Stockpile Overrun

7,729  
1,045,409

e. Production Delays:

The mine operated throughout 1955 with only minor interruptions including the strike beginning at midnight on June 30th and extending through the following day. The normal schedule was resumed on Tuesday, July 5th.

The vacation period of one week during the third week in August was utilized to perform necessary main level repair work underground and for repair of the pan feeder in the shaft headframe.



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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	57.95	.103	9.26	.021
Mather Special	58.07	.045	10.21	.613

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	57.70	.105	9.66	.30	3.05	.045	.54	.89	1.91	10.84
Mather Special	57.85	.066	9.90	.27	2.22	.590	1.33	.22	1.91	9.41

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

<u>Grade</u>	<u>Tons</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	96,827	51.51	.094	8.20	.27	2.81	.028	.48	.79	2.15	10.82

ERT BOND  
COTTON FIBRE  
U.S.A.

GILB  
25%

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

Capital account expenditures amounted to \$912,851.98, which brought the total at the end of the year to \$10,415,979.48. 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 \$10,734,202.59. 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 1955</u>
Main Level Development	54.1
Underground Conveyor Belt and Crusher Systems	36.9
Underground Exploration	5.4
Underground Equipment	2.0
Surface Projects	1.6
Total Charge-Offs	\$822,543.89 ✓
Total Capital Account Charges as Above	<u>912,851.98</u> ✓
Actual Net Increase in Capital Account	\$ 90,308.09

GILBERT BOND  
25% COTTON FIBRE  
USA



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

Comparative Mining Costs:

The Cost of Production decreased \$.472 per ton as compared with the previous year. Underground Costs decreased \$.102 per ton, while Surface Costs per ton and General Mine Expense Costs per ton decreased \$.066 and \$.304 respectively. It should be pointed out that the Telephones and Safety Devices account, Vacation Pay account, and Holiday Allowance account were formerly under General Mine Expenses, whereas in 1955, they were absorbed in the Underground Costs and Surface Costs. The sum of these three accounts amounted to \$.215 per ton.

The decrease in the Cost of Production was a reflection of the increase in the unit production from 8.04 tons per man per day in 1954 to 9.17 tons per man per day in 1955.

The Total Cost at Mine was \$.054 less than the previous year. Depreciation charges were greater in 1955 than in 1954 with the major item being a charge of \$.494 in 1955 under "Allowance Under Section 309" as against a credit of \$.014 to this account in 1954.

	<u>1955</u>	<u>1954</u>
Product	1,045,409	915,405
Underground Costs	2.862	2.964
Surface Costs	.347	.413
General Mine Expense	.498	.802
Cost of Production	<u>3.707</u>	<u>4.179</u>
Depreciation: Pre-Production Development	.013	.013
Plant & Equipment	.162	.171
Movable Equipment	.007	.008
Development	.104	.104
Miscellaneous Equipment	.001	.001
Amort. of Defense Facilities	.096	.103
Allowance Under Section 309	.494	.014
Adjustment Prior Year's Charges	.090	
Taxes	.283	.300
Administration	.050	.050
Loading and Shipping	<u>.075</u>	<u>.041</u>
Total Cost at Mine	4.902	4.956
Budget - Cost of Production	3.969	4.403
Budget - Total Cost at Mine	4.655	5.136
Number of Shifts and Hours	22 1-8 hr. 136 2-8 hr. 97 3-8 hr.	12 1-8 hr. 123 2-8 hr. 83 3-8 hr.
Total 8 Hour Operating Shifts	585	507
Number of Operating Days	240-2/3	209
Average Daily Product	4,344	4,380

Mather "A" 1955



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

	<u>Proportion of Labor and Supplies</u>		
Labor	\$2,719,873.66	2.602/ton	59%
Supplies	<u>1,882,413.81</u>	<u>1.800/ton</u>	<u>41%</u>
Total Cost at Mine	\$4,602,287.47	*4.402/ton	100%

\*Does not include Amortization of Defense Facilities, Allowance Under Section 309, and Adjustment of Prior Year's Charges.



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

Detailed Cost Comparison:

	<u>1955</u>		<u>1954</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs:</u>				
Development	635,272.64	.608	777,721.90	.850
Mining	1,142,013.01	1.094	948,921.16	1.037
Tramming	504,120.48	.482	402,749.41	.440
Ventilation	20,096.70	.019	17,530.76	.019
Pumping	56,857.06	.055	61,456.46	.067
Compressors and Air Lines	45,250.84	.043	69,421.44	.076
Crushing and Screening - UG	23,319.10	.022	15,354.75	.016
Underground Superintendence	195,057.01	.186	208,201.95	.227
Maintenance:				
Pockets and Chutes	6,994.78	.006	9,973.70	.011
Mining Equipment	119,299.94	.115	137,055.95	.150
Levels and X-Cuts	42,687.95	.041	20,034.79	.022
Shaft	8,990.44	.008	44,849.81	.049
Telephones and Safety Devices	42,407.24	.040		
Vacation Pay	101,514.35	.097		
Holiday Allowance	48,106.79	.046		
Total Underground Cost	2,991,988.33	2.862	2,713,272.08	2.964
<u>Surface Costs:</u>				
Hoisting	112,987.64	.110	149,297.05	.163
Crushing and Screening - Surface	12,991.34	.012	15,290.18	.017
Stocking	43,730.66	.042	61,347.00	.066
Timber Yard	47,948.17	.045	49,648.32	.054
Dry House	42,665.52	.041	43,730.42	.048
Policing	19,106.55	.018	20,355.39	.023
General Surface	24,171.89	.023	15,188.75	.017
Maintenance:				
Headframe Bldg. and Equipment	7,936.35	.007	7,803.56	.008
Other Mine Buildings	17,504.08	.017	15,506.51	.017
Telephones and Safety Devices	1,018.47	.001		
Vacation Pay	25,378.59	.024		
Holiday Allowance	7,303.07	.007		
Total Surface Cost	362,742.33	.347	378,167.18	.413
<u>General Mine Expenses:</u>				
Geological Department	10,119.26	.009	11,428.27	.012
Mining Engineering Department	37,424.47	.036	42,883.38	.047
Mech. Engineerint Department	8,354.45	.008	29,717.11	.032
Safety Department	8,995.65	.009	8,821.30	.009
Research Laboratory	16,120.87	.015	3,115.53	.003

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

Detailed Cost Comparison: (Continued)

	1955		1954	
	Amount	Per Ton	Amount	Per Ton
<u>General Mine Expenses:</u> (Continued)				
Analysis and Grading - Laboratory	40,498.50	.039	45,633.17	.050
"      "      "      - Shipping	6,489.31	.006	9,135.73	.010
Telephones and Safety Devices			60,993.28	.067
Welfare - General			4,911.01	.006
"      - District			735.26	.001
Special Expense - Pensions	146.42	.000	141.29	.000
"      "      - Retirements	7,169.75	.007	7,691.81	.009
"      "      - Legal			5,019.92	.006
"      "      - Hygiene Clinic	8,856.51	.008	11,843.52	.013
"      "      - Employment Office	1,602.60	.001	2,318.74	.002
"      "      - Other			3.64	
Ishpeming Office	107,519.48	.103	96,015.63	.105
Mine Office - Supt. and Clerks	63,540.16	.061	65,858.03	.072
Central Warehouse Overhead	24,001.48	.023	25,548.10	.028
Insurance - Property	4,309.51	.004	5,455.24	.006
"      - Group, Health and Life	27,148.83	.026	29,380.25	.032
"      - Group Annuity	12,224.42	.012	20,206.08	.022
"      - Catastrophe	4,749.00	.005	5,620.45	.006
Personal Injury - Comp. & Doctors	52,605.24	.050	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	18,078.75	.017	23,784.87	.026
"      - Old Age Benefit	47,023.36	.045	42,187.60	.046
Electrical Engineering Department	2,948.84	.003		
Employees Insurance & Compensation	10,849.67	.011		
 Total General Mine Expenses	 520,776.53	 .498	 733,699.36	 .802
 COST OF PRODUCTION	 3,875,507.19	 3.707	 3,825,138.62	 4.179



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5. ESTIMATE AND  
ANALYSIS OF  
ORE RESERVES:

The net ore reserves reported to the Michigan Tax Commission on December 31, 1955 were 10,077,875 tons. This is an increase of 2,237,543 net tons over the 1954 estimate. Included in the 1955 estimate are 1,589,170 net tons in Section 1, 47-27, to be mined by Mather Mine, "A" Shaft. Between the 7th and 8th Levels there has been proven to date 6,321,067 gross tons by underground development and 41,233 gross tons by surface diamond drilling. Ore reserves below the 8th Level total 2,137,666 gross tons by underground development and 572,031 gross tons by surface diamond drilling.

The 1955 estimate indicates a gross gain in reserves of 3,282,952 tons as compared to a gross gain of 4,979,885 tons in 1954.

Net Total December 31, 1954	7,840,332
Net Total December 31, 1955	<u>10,077,875</u>
Net Gain in Reserves	2,237,543
1955 Production	<u>1,045,409</u>
Gross Gain in Reserves	3,282,952

Expected Average Natural Analysis of Ore Reserves as of December 31, 1955

<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.....	551,938	53.15	.122	5.08	0.25	2.62	.58	.60	.014	1.97	12.50
Mather - Underground											
Development.....	<u>9,525,937</u>	51.50	.100	8.75	0.20	2.45	1.00	.50	.050	2.25	12.00
	10,077,875										

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 602 with a net gain of 64 men during the year.

Number of Men 1/1/55.....	538
Added to Roll During the Year.....	88
Total.....	<u>626</u>
Separations.....	<u>24</u>
Total on Payroll 12/31/55.....	602
Average Number of Men as per December Labor Statement.....	503

Of the separations, 6 retired, 5 were transferred to the Mather Mine, "B" Shaft, 1 died, 8 quit, 1 had a leave of absence, 2 were fatal accidents, and 1 entered the service. Of the additions, 6 were returned servicemen, 77 were transferred from the Mather Mine, "B" Shaft, 3 were rehired and 2 were transferred from the Spies Mine.

b. Statement of Wages:

	<u>1955</u>	<u>1954</u>
<u>Average Wages Per Day</u>		
Surface	\$18.15	\$17.51
Underground	<u>22.79</u>	<u>21.08</u>
Total	\$21.83	\$20.32
 <u>Average Wages Per Month</u>		
	(20 Days)	(17½ Days)
Surface	\$363.00	\$306.43
Underground	<u>455.80</u>	<u>368.90</u>
Total	\$436.60	\$355.60
 <u>Tons Per Man Per Day</u>		
Surface	44.40	38.05
Underground	<u>11.56</u>	<u>10.20</u>
Total	9.17	8.04
 <u>Labor Cost Per Ton</u>		
Surface	\$ .410	\$ .460
Underground	<u>1.971</u>	<u>2.067</u>
Total	\$2.381	\$2.527



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6. LABOR AND WAGES: (Continued)

c. Labor Relations:

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

In conjunction with the demand for more iron ore during the past year, the working force was increased by 64 men. The majority of the men added to the payroll were transfers from Mather Mine, "B" Shaft.

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.

ART BOND  
COTTON FIBRE  
U.S.A.

GILBI  
25%



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7. SURFACE:

Buildings:

Maintenance of buildings was of a routine nature throughout the year, and consisted mainly of painting the interior of the engine house.

Headframe and Trestles:

The headframe equipment operated throughout the year with only minor delays. The Kennedy Van Saun pan feeder was repaired with twenty-eight new shafts, seven rebuilt pads, and fourteen new wheels being installed. The scalping screen deck was built up with hard surface welding material.

Stocking:

Both old and new style cars operated successfully with no delays during the year. Bulldozing was necessary on the ends of the north and center piles to provide sufficient stocking capacity.

Engine House:

Operation of hoisting equipment continued with no serious delays.

Skips:

The north skip was removed on September 18th, and the south skip was removed on December 18th for repairs. Both skips operated without any delays throughout the year.

Underground Cars:

Thirty-one underground tram cars were completely overhauled at the mine shops during the year, thus making a total of sixty-one cars repaired since the rebuilding program began.

Heating System:

The two steam boilers were converted from coal to automatic oil fired operation during the year. The conversion job should pay for itself within a short period as no boiler-men are now required.

Batching Plant:

The batching plant was completed during the year and operated successfully in conjunction with blowing concrete by pneumatic placer through a 6" pipeline to the lower levels. The structure was completely enclosed and insulated and heat was provided for winter operation.

Steam Cleaning Shed:

A small (12' x 16') corrugated steel shed was constructed opposite from the mine shops to provide protection for the steam jenny machine and operator during winter weather.

Mather "A" 1955



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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. Daily recordings of the microseismic activity were made and the low level of activity apparently indicates no serious failures occurred in the capping. The hole continued to take its approximate average of 70 c.f.m. of air, but the flow of water into the hole at the greenstone-iron formation contact (520' elevation) decreased to a negligible amount in June.

A Bureau of Mines field crew conducted a camera and caliper logging of the hole in September. A useful caliper log was obtained, but water conditions clouded the camera lens, resulting in an uninterpretable photographic record.

At the conclusion of the year plans were being made to re-enter the hole in an attempt to drill to the present void. In conjunction with this, a tentative underground drilling program has been proposed, consisting of two diamond drill holes from the 3rd Level and one from the 1st Level.

A flat hole and a 30 degree hole are proposed from 3rd Level cross-cuts in an attempt to intersect the present location of caved ground. A flat hole planned due east from the 1st Level is intended either to locate present caving and fracturing activities, or to provide an additional site from which to observe future ground movements.

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8. UNDERGROUND:

5th Level:

Production from the 5th Level was 39,844 tons, or 3.8% of the total mine production. All of the tonnage was of the Special grade and came from over the #7 Cross-cut.

Mining was completed in the main block development in this area, and two additional undercutting drifts presently being driven on the -160 and -185 sub-levels will complete the development for all ore above the -360' elevation. Mining of the pillar remaining above the -360 sub-level will be the final phase of the mining above #7 Cross-cut.

6th Level:

Eight hundred tons were produced from the #7 Cross-cut but operations were suspended when the grade fell below present requirements. A small reserve tonnage in a different area will be mined after work on the 5th Level is completed.

One diamond drill hole, #285, was drilled from the 6700 Cross-cut to test for up-dip extensions of the orebody west of a minor fault as indicated by U.H. #77 and #83. No enrichment was encountered west of the fault.

7th Level:

The 7th Level continued as the main producer with a total of 730,726 tons or 70.4% of the mine output. Production came from eight caving areas in Section 2 and three caving areas in Section 1. During the year mining operations were completed over the North Block Center, which is located north of the footwall drift and west of the loading end of the 7th Level conveyor belt. Areas still active are over the #1, #5 North, #5 South, #6, and #7 South Cross-cuts. The 780 top-timber area is still active and mining was resumed in the North Block East which is located immediately to the north of the loading end of the 7th Level conveyor belt. Four out of the six areas being mined in Section 2 are above the main footwall drift in the level pillar. This pillar contains the bulk of the tonnage remaining above the 7th Level in Section 2. In Section 1 caving was carried on over the #7, #8 and #9 Cross-cuts. The 2500' 7th Level conveyor belt operated with very little maintenance throughout the year. The belt carried all of the 7th Level production and brought the total tonnage carried to date to 2,745,589 tons.

The operations in the mining areas in Section 2 are summarized in the following paragraph.

Operations were completed in the North Block Center early in the year with the production for 1955 totaling 3,894 tons. 82,993 tons were produced from over #1 Cross-cut. Some development is still required to mine the remaining reserves which will likely be depleted during the coming year. The #5 North Cross-cut produced 119,323 tons and operations will continue throughout 1956. Preparation for mining of the pillar over the footwall drift required development over the #5 and #6 Cross-cuts with 2,116 tons and 1,522 tons being produced from the respective areas. 83,010 tons were produced from the #7 South Cross-cut. Development of the level pillar will also proceed from this cross-cut. The 780 top-timber transfer area produced 99,162 tons during the year and production is expected to continue for the first quarter of 1956. Production in the North Block East was resumed in August and for the year a total of 17,403 tons was mined.

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8. UNDERGROUND: (Continued)

7th Level: (Continued)

Operations in this area should continue for most of the coming year.

In Section 1, the three areas over the #7, #8 and #9 Cross-cuts continued to produce and it is anticipated that operations will continue well into 1956 in the #7 and #8 Cross-cuts and into 1957 in the #9 Cross-cut. Production from the individual areas was 103,762 tons over the #7 Cross-cut, 104,138 tons over the #8 Cross-cut and 80,956 tons over the #9 Cross-cut.

Three diamond drill holes were drilled above 7th Level to detail ore outlines prior to mining development. U.H.'s #283 and #287, drilled from the end of the 7912 incline above the #9 Cross-cut in Section 1, resulted in no change in the expected ore outlines. U.H. #284 was drilled from the -800' sub-level over the #1 Cross-cut, and indicated a structural complex which tended to limit reserves in this area.

8th Level:

Total production from the 8th Level was 265,600 tons or 25.6% of the mine production. Practically all of the tonnage came from the #7, #8 and #9 Cross-cuts with a small tonnage coming from development of the #3, #4, and #5 Cross-cuts and from development of sub-level conveyor belt drifts over these cross-cuts.

Production from the cross-cuts was as follows: #7 Cross-cut, 67,262 tons; #8 Cross-cut, 82,265 tons and #9 Cross-cut, 97,163 tons. A considerable reserve tonnage is still available above all three cross-cuts. Due to heavy ground conditions, development and actual mining must, of necessity, be carried out with as little delay as possible between the two operations.

All the main level development including the footwall drift and cross-cuts has been completed. The #4 and #5 Cross-cuts were driven in only a short distance with #4 Cross-cut to be used as a supply and ventilation opening for mining both above and below the 8th Level. The #5 Cross-cut is designed to serve the same purpose, in addition to providing the main transfer point for all 8th Level ore being passed to the 9th Level for crushing and conveying to the shaft. During the year development of two sub-level conveyor belt drifts was begun in the area between #3 and #7 Cross-cuts. Both of the above mentioned conveyor belt drifts are being driven in the interbedded ore. One conveyor belt will extend 400' east of the #5 Cross-cut and a second belt will extend approximately 480' west of this cross-cut with both belts discharging into an ore-pass raise to the 9th Level. Development of the #6 Cross-cut was eliminated as this area can be served by a conveyor belt.

A total of fifteen diamond drill holes were drilled from 8th Level during the year. Underground Holes #293, #296, #299, #302, #304, and #307 were drilled from 8th Level cross-cuts to locate the footwall below 8th Level in order to facilitate the planning of 9th Level development. Underground Holes #274, #278, #279, #280, #281, #288, #291, and #295 were drilled east of the Mather Fault to outline the footwall position and the thickness of the large orebody which extends into Section 1, 47-27.

Underground Hole #315 was drilled from a top-timber cutout in the 8300 Cross-cut to lo-

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8. UNDERGROUND: (Continued)

8th Level: (Continued)

cate the footwall contact for positioning of mining development west of the Mather Fault.

9th Level:

Work on the 9th Level was restricted to main level drift and cross-cut development, excavation work on the main conveyor belt system, and development of a drift for a sub-level conveyor which will discharge into the trench at the loading end of the main conveyor belt.

The footwall drift was advanced to a distance of 3,960' east of "A" Shaft. In addition, the #6 Cross-cut was driven in 300' and the #7 Cross-cut 100'. Due to the ground conditions about 80% of the development on the main level during 1955 required steel set support.

Development of the sub-level conveyor belt drift as mentioned above was half completed by the end of the year. This belt will be approximately 360' long and will service an area for which two cross-cuts would normally be required.

Eight underground diamond drill holes; #290, #290-A, #298, #303, #308, #309, #310, and #314, were drilled from 9th Level during the year to investigate the ore sections east of the Mather Fault. The drilling indicated a continuation of enrichment below 8th Level with a flattening and reversal of dip occurring between the 8th and 9th Levels. The orebody was also indicated to be displaced 40' upward south of an east-west trending intrusive dike.

The 9600 Cross-cut is being advanced to the south to provide drilling stations for exploring above and below the 9th Level in the vicinity of a major east-west trending fault. This structure will have extreme importance on the future development plans for levels below the 9th.

The following table of main level development includes drifting on the 8th and 9th Levels.

	<u>Timbered Ore Drift</u>	<u>Timbered Rock Drift</u>	<u>Naked Rock Drift</u>	<u>Total</u>
NM 101 - 8th Level	270'	1,516'	-	1,786'
NM 101 - 9th Level	-	2,002	555'*	2,557
	<u>270'</u>	<u>3,518'</u>	<u>555'</u>	<u>4,343'</u>

\* Rock bolted.

Changes and Developments in Mining Methods:

Steel sets continued as the means of support with some new types of sets being introduced during the year. Some variations were tried successfully with rigid arched steel sets. The shortage of steel required modifications of some of the sets on hand which could not be utilized for their original purpose. Two types of yielding sets were tried; circular and arched. The circular set consists of four identical pieces having an installed in-



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8. UNDERGROUND: (Continued)

Changes and Developments in Mining Methods: (Continued)

side diameter of eight feet. The arched set consists of a cap, two legs, and a straight sill with an inside cross-sectional working area of approximately 6'6" in width by 7'0" in height.

Three sub-level conveyors are planned with development of the drifts well on the way toward completion. One of the belts will have standard rigid supports while the other two will be rope belts with the idlers being carried by 3/4" wire ropes suspended between stands approximately 15' apart and anchored at every 160' interval. The belts will be 36" in width.

Work is progressing on a main level conveyor belt system on the 9th Level. Excavation work is almost complete and installation of equipment has been started. The belt will be 30" in width and approximately 3100' long. At the loading end ore will be passed to a storage trench from 8th and 9th Level mining areas. A portion of the ore will be transferred to the trench by sub-level conveyor belt and the remainder by the conventional tramming method. From the trench the ore will be scraped over a scalping screen with the oversize passing through a 36" x 42" jaw crusher. Then the product will travel over a short buffer belt to the main conveyor belt which in turn will discharge the ore to a skip loading point on the 9 1/2 Level. A tramp iron magnet and an automatic weight recording meter are incorporated in the design of the conveyor system.

A brief summary is shown below in tabular form for the various conveyor projects that are being developed or installed.

	<u>Conveyor Length</u>	<u>Belt Width</u>	<u>Belt Speed</u>	<u>Number of Loading Points</u>
#1 Sub conveyor - 8th Level	400'	36"	250'/min.	2
#2 Sub conveyor - 8th Level	480'	36"	535'/min.	3
#3 Sub conveyor - 9th Level	360'	36"	535'/min.	4
Main conveyor - 9th Level	3100'	30"	500'/min.	1

Mining Engineering:

Each month a thorough inspection was made of all contracts and working places in the mine.

All development contracts had to be provided with lines and grades and these had to be frequently re-checked during the progress of the work. The development of the various conveyor belt drifts required very close control. Planning the development of the conveyor belt systems has required considerable time and effort because of the problems which arise with a new method of mining and the installation of new equipment. In addition, ventilation surveys and the posting of fire maps, together with shaft gauging, tax estimates, stope and stockpile analysis of iron, silica, and sulphur were projects of importance during 1955.





A sub-level conveyor belt drift development using arched legs, which were modified from their original form at the mine shops and straight caps, which also were fabricated at the mine.





An undercutting drift in a block caving development area utilizing the new yielding arch steel sets as the means of support.





Albert Prin, shift boss, shown at a control dispatcher station on 8th Level.



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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	\$ 5,017.47	\$.0048
Stulls	1,269.52	.0012
Lagging	21,573.47	.0206
Poles	12,442.27	.0119
Steel	251,235.33	.2404
Minecrete Supplies	<u>209.35</u>	<u>.0002</u>
Total 1955	\$291,747.41	\$.2791
Total 1954	\$312,140.31	\$.3410

Explosives:

The following tables show the cost of explosives used in mining 1,045,409 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>1955</u>	<u>1954</u>
Powder - All Kinds	\$ 93,865.71	\$ 90,073.20
Miscellaneous Blasting Supplies (Fuse, Caps, Bags, etc.)	<u>43,711.95</u>	<u>39,378.60</u>
Total	\$137,577.66	\$129,451.80

TABLE II

Unit Costs and Consumptions of Explosives

	<u>1955</u>	<u>1954</u>
Pounds of Powder per Ton of Ore	0.500	0.575
Tons of Ore per Pound of Powder	2.000	1.738
Cost per Ton for Powder	\$0.090	\$0.098
Cost per Ton for Fuse, Caps, etc.	\$0.041	\$0.043
Cost per Ton for all Explosives	\$0.131	\$0.141

TABLE III

	<u>1955</u>	<u>1954</u>
Cost per Ton in Development for Mining	\$ .040	\$ .037
Cost per Ton in Mining	<u>.091</u>	<u>.104</u>
Total	\$ .131	\$ .141

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8. UNDERGROUND: (Continued)

Pumping:

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

Diversion of water below the Cambria-Jackson 7th Level, to be pumped from the Mather Mine, "A" Shaft, 3rd Level, ceased on July 1st, 1955, when the Cambria-Jackson Mine pumps on the 8th Level went into operation. Thus, pumping decreased on the 3rd Level from an average of 94 gallons per minute in 1954 to 84 gallons per minute in 1955, a decrease of 10.6%.

The amount of water pumped on the 6th Level increased only slightly from an average of 347 gallons per minute in 1954 to an average of 348 gallons per minute in 1955, an increase of 0.3%. All Mather Mine, "B" Shaft water is diverted on the 6th Level by ditch to Mather Mine, "A" Shaft 6th Level sumps.

	<u>Mather Mine,</u> <u>"A" Shaft Water</u> <u>G.P.M. Av.</u>	<u>Mather Mine,</u> <u>"B" Shaft Water</u> <u>G.P.M. Av.</u>	<u>Cambria-Jackson</u> <u>Water</u> <u>G.P.M. Av.</u>	<u>Total Water</u> <u>Pumped</u> <u>G.P.M. Av.</u>
<u>1954</u>				
3rd Level	57	-	37	94
6th Level	191	156	-	<u>347</u>
Total				<u>441</u>
<u>1955</u>				
3rd Level	64	-	20	84
6th Level	182	166	-	<u>348</u>
Total				<u>432</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.



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9. TAXES:

Taxes for the year at the Mather Mine, "A" Shaft totaled \$295,636.65. The assessed valuation set for Section 2, 47-27, by Mr. Hardenberg, the state mine appraiser, was \$155,000 higher than 1954. The real estate valuation decreased by \$840,000 but the personal property valuation increased by \$995,000. The tax rate of \$41.00 per thousand of valuation was increased \$2.05 over the 1954 rate.

	1955			1954		
	VALUATION	RATE	TAXES	VALUATION	RATE	TAXES
Section 2, 47-27 Except the N 600' NE of NE and the Rights of Way						
Real	\$3,795,000		\$155,595.00	\$4,635,000		\$180,533.25
Personal	3,415,000		140,015.00	2,420,000		94,259.00
Total	\$7,210,000	\$41.0000	\$295,610.00	\$7,055,000	\$38.9500	\$274,792.25
Mather Mine Pipe Line, parcel in Section 3, 47-27	\$ 650	\$41.0000	\$ 26.65	\$ 650	\$38.9500	\$ 25.32
Total Mather Mine "A" Shaft (Sec. 2, City of Ishpeming)	\$7,210,650	\$41.0000	\$295,636.65	\$7,055,650	\$38.9500	\$274,817.57

	1955		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total Operating	\$295,636.65	\$0.283	\$0.201
	1954		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total Operating	\$274,817.57	\$0.300	\$0.407

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10. ACCIDENTS  
AND  
PERSONAL  
INJURY

There were 21 compensable injuries during the year which occasioned a lost time of 727 days, and two fatalities which added 12,000 days lost time, for a total of 12,727 days. There were also 18 non-compensable accidents, which added 42 days lost time for a grand total of 12,769. The severity was 12,392 and the frequency was 39.79 compared with company averages for underground mines of 5,249 on severity and 37.00 on frequency. The total hours worked were 1,030,395 as compared with 993,998 in 1954.

The two fatal accidents occurred on October 10th. Henry E. Anderson and Rupert M. Frederickson, the two miners involved, were killed instantly by an explosion of dynamite in the drift in which they were working. The dynamite was set off by a charge that was exploded in an adjacent drift. Anderson and Frederickson obviously had assumed that they were in a safe place and would not in any way be affected by the blast in the adjacent drift. They had been warned twice prior to the blast by the man who was planning to blast in the adjacent transfer. The charge placed by the scraperman detonated, by propagation, the dynamite in the hole which was charged, or being charged, by Anderson and Frederickson. The length of primacord in the charged hole had not as yet been cut from the spool, and when this detonated it in turn detonated the dynamite on the floor of the drift causing the fatalities.

<u>DATE</u>	<u>NAME</u>	<u>NATURE OF INJURY</u>	<u>NUMBER OF DAYS LOST</u>
1/ 4/55	Albert Herman	Contusion upper right chest with injury to costacartilaginous margins. No fracture noted.	14
1/ 4/55	Robert Miljour	Laceration over medial malleolus and swelling but no fracture, right leg.	8
2/14/55	Adolph Niemi	Abrasion above ankle on inside, swelling, severe contusion. Fracture lower third left fibula.	49
3/22/55	Milburn Fowler	Sore back.	13
3/23/55	George Emanuelson	Bruised back of neck and cut backs of both hands.	12
3/30/55	John Latola	Fracture - 2nd, 3rd, 4th metatarsal.	72
4/ 7/55	Calvin Korpi	Avulsion of nail and fracture of distal phalanx, right index finger.	20
4/14/55	Nick Donato	Broken bone in right forearm, cut on back of right wrist.	123
5/ 6/55	Dante Rovedo	Bruised instep.	10
5/12/55	Arnold Helander	Contusion of dorsum of right foot with resulting deep infection and abscess formation. Incised and drained.	7
5/25/55	Carl Larson	Fracture left fibula.	62
5/26/55	Lauri Kantola	Puncture in bottom of left foot.	18
6/24/55	Ralph Maki	Low back pain with sciatic neuritis - left leg.	44
9/ 1/55	Thomas Lawer	Bruises on upper parts of left and right arms.	80
9/13/55	Donald Lahtela	Bruised and swollen left foot.	34

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10. ACCIDENTS  
AND  
PERSONAL  
INJURY (Continued)

<u>DATE</u>	<u>NAME</u>	<u>NATURE OF INJURY</u>	<u>NUMBER OF DAYS LOST</u>
10/10/55	Henry Anderson	Fatality.	6,000
10/10/55	Rupert Frederickson	Fatality.	6,000
10/10/55	James Dowrick	Shock. Fracture, ankle, tibula, fibula.	75
10/13/55	Raymond Duhamé	Contusion - right chest.	9
10/17/55	Charles Anderson	Severe contusion, swelling - discoloration of entire foot, left. X-ray negative.	35
11/10/55	Clayton Hollon	Muscle strain - right shoulder. Hospitalized.	21
12/10/55	Frank Hiissala	Contusion, lower left lateral chest. No fracture seen.	10
12/28/55	Frank Hiissala	Small piece of ore or rock in right heel.	<u>11</u>
		Total Days Lost	12,727

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11. POWER:

A total of 16,245,161 kilowatt hours of electric power was consumed during 1955. This was approximately 2,000,000 kilowatt hours greater than the preceding year, and is a direct result of the longer work week.

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>
1955	16,245,161	3620 K.W.	52%	\$150,266.76	\$.0092
1954	14,249,248	3550	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

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I. GENERAL:

The production for the year was 340,601 tons compared with 324,269 tons in 1954. Production from Fee Lands was 49,339 tons or 14.5% of the total production. The smaller production from Fee Lands is due to mining approaching the 9th level elevation at the east end of the ore body. This necessitated a transfer of contracts to other areas until development from the new 10th level is driven into the Fee Land. A larger proportion of the mine production will be realized from Fee Lands in the latter part of 1956 after the development from the 10th level is completed to this area.

The working schedule has been continued on the basis of 2-8 hour shifts per day for 5 days per week. Some improvement in efficiency over the previous year is reflected in the increase in the tons per man per day from 6.9 in 1954 to 7.0 in 1955. Total shipments were slightly less than production and amounted to 335,939 tons. The stockpile carry-over at the end of the year was 31,886 tons compared with 36,788 tons at the end of 1954.

There was no exploration drilling done in 1955 but development and mining has proven a substantial tonnage of new ore. The engineer's estimate of 3,248,393 tons shows a net gain of 140,491 tons in reserves after deducting the year's production from the 1954 estimate. The additional reserves have again been proven chiefly in Chase Lease #9 and a slightly 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 an average of 1299 g.p.m. was pumped compared with 1312 g.p.m. in the previous year. Seven wells have been in nearly continuous operation and one of these was down for repairs at the end of the year. The downward trend in the underground water has continued as indicated by the average of 1535 g.p.m. in 1955 compared with 1574 g.p.m. in 1954.

Development of the 10th level has been underway throughout the year. A large sump was excavated near the shaft and also a storage trench for skip loading. The main-level haulage drift to the south was advanced about 350' further to cross cut the ore body and enter the south footwall slate. The first cross cut, branching to the southeast, was being advanced at the close of the year.

2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Production

<u>Year</u>	<u>Grade</u>	<u>Tons</u>
1955	Morris	340,601
1954	"	324,269

The 1955 production came from Fee and Leased Lands in the following proportions:

	<u>Fee</u>	<u>Leased</u>	<u>Total</u>
Production - Tons	49,339	291,262	340,601
Percentage	14.5%	85.5%	100.0%
Percentage - 1954	26.1%	73.9%	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 1933-1955	5,208,545	75.1
Fee Ore Production 1933-1955	1,726,087	24.9
Total	6,934,632	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	209,462	126,477	335,939
<u>Grade</u>	<u>Fee</u>	<u>Lease</u>	<u>Total</u>
Morris	43,950	291,989	335,939

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

<u>Year</u>	<u>Total</u>
1955	335,939
1954	326,001
1953	324,150
1952	294,569
1951	353,704

Total shipments since Inland acquired lease in 1933 - 6,893,181 tons.

c. Ore in Stock December 31, 1955

<u>Grade</u>	<u>Tons</u>
Morris	31,886

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	21	195	6.28	25,860
February	20	206	6.87	26,332
March	23	195	7.47	31,512
April	21	195	6.93	27,462
May	21	197	6.95	28,735
June	22	196	7.61	30,161
July	19	194	7.51	25,036
August	23	197	7.41	31,008
September	21	195	7.09	27,377
October	21	198	6.61	25,550
November	21	195	6.61	25,939
December	21	196	6.68	26,064
Total	254	197	7.00	331,036
Stockpile Overrun				9,565
Total				340,601

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>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sulphur</u>	<u>Moisture</u>
Morris	335,939							
Dried		55.70	.083	12.89	.47	2.57	.084	-
Natural		49.35	.074	11.42	.42	2.28	.074	11.39

b. Ore in Stock December 31, 1955 (Natural)

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sulphur</u>	<u>Moisture</u>
Morris	31,886	49.21	.074	11.28	.39	2.12	-	11.75

c. Ore Reserves - Expected Natural Analysis

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Sulphur</u>	<u>Moisture</u>
Morris	2,855,635	49.06	.071	12.00	.44	2.25	.015	12.00
Hi-Sul	392,758	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 1955, shows 140,491 tons of new ore developed. The bulk of the newly developed ore has again been proven between 8th and 9th levels in Chase Lease #9. This area has continued to be the principle source of production and as mining progressed to lower elevations, an ore outline was proven exceeding that used for estimating purposes. In Chase Lease #24, a substantial increase in reserves was also proven due to revisions in the ore outline. The 10th level development has added some tonnage due to the ore encountered in the main-level haulage drift. As level development expands and the downward extensions of the ore body proven, substantial additions to the reserves will naturally result.

	<u>Estimate</u> <u>10- 1-54</u>	<u>Production</u> <u>10- 1-54 to</u> <u>10-1-55</u>	<u>Estimated</u> <u>Deducting</u> <u>Product</u>	<u>Actual</u> <u>Estimate</u> <u>10- 1-55</u>	<u>Incr. or Decr.</u> <u>from</u> <u>1954 Estimate</u>
Chase Lease #24	103,069	3,902	99,167	95,853	3,314
Chase Lease #24 Hi-Sul	394,215	111,908	282,307	359,699	77,392
Chase Lease #9	2,057,249	173,496	1,883,753	1,972,471	88,718
Chase Lease #9 Hi-Sul	-	1,908	1,908	5,090	6,998
Total Chase Leases	2,554,533	291,214	2,263,319	2,433,113	169,794
CCI Lands	862,480	45,919	816,561	787,311	29,250
CCI Lands Hi-Sul.	31,490	3,468	28,022	27,969	53
Total CCI Lands	893,970	49,387	844,583	815,280	29,303
GRAND TOTAL	3,448,503	340,601	3,107,902	3,248,393	140,491

5. LABOR AND WAGES

The labor force has remained nearly constant as indicated by the average of 197 men in 1955 compared with 198 in 1954. The industry-wide wage increase of 1/2 cent on the increment between job classes and \$.11½ to base, became effective July 1st, 1955.



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6. SURFACE

The mine water, which has been supplied from #8 surface well, was causing trouble due to sludge in the water and the main source of water was changed to Carp River. Water, for drinking purposes around the plant, is obtained from the Township.

The loading pocket on the north side of the headframe was rebuilt. The coal storage hopper at the air shaft heating plant, was also rebuilt. The ladder-road in the air shaft was also repaired.

Repairs in the main hoisting shaft consisted of installing 12 sets of steel near the 2nd level elevation.

On the 4th and 6th levels, which connect to the Lloyd Mine workings, heavy dams were built after operations in the Lloyd Mine were abandoned late in the year.

Surface Pumping

<u>Well No.</u>	<u>G.P.M.</u> <u>Dec. 1955</u>	<u>G.P.M.</u> <u>Dec. 1954</u>
1	190	69
2	75	75
3	105	183
3A	306	289
5	-	90
8	275	275
9	83	91
10	<u>318</u>	<u>359</u>
	1352	1431

The average drop in the water level in the surface material above ledge, since pumping started in 1937, to December 30, 1955 is shown in the table below:

<u>Test Hole</u>	<u>Drop 8-25-37 to</u> <u>12-30-55</u>	<u>Depth Remaining</u> <u>To Ledge</u>
501	79.1	14.4
506	62.5	24.7
510	36.2	87.4
511	39.7	114.4
514	28.4	98.5
515	17.8	110.8
517	26.2	85.9
522	28.8	82.9
524	18.4	64.4
527	51.5	23.5
528	11.4	88.1
531	5.1	71.6
534	<u>1.6</u>	<u>95.6</u>
Total	345.9	962.2
Average	26.6	74.0

Operating Expense for surface drainage amounted to \$24,014.00 compared with \$27,241.00 in 1954. The cost per ton was \$0.07 compared with \$0.08 in 1954.



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7. UNDERGROUND

a. Pumping

The bulk of the underground water is being handled by the two automatically operated 1200 g.p.m. centrifugal pumps located on the 9th and 4th levels.

The following table shows a comparison of the mine water pumped over a 5-year period:

<u>Year</u>	<u>4th</u>	<u>6th</u>	<u>7th</u>	<u>8th</u>	<u>9th</u>	<u>Total</u>
1955	57.2	52.0	108.0	509.3	791.0	1534.6
1954	71.9	43.5	96.8	553.9	797.0	1574.2
1953	76.1	37.1	77.0	546.2	882.4	1620.9
1952	94.6	27.1	69.2	495.8	971.4	1658.1
1951	107.8	36.3	67.4	431.5	945.8	1588.8

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

<u>Year</u>	<u>Cost Per Ton</u>
1955	\$.51
1954	.46
1953	.55
1952	.65
1951	.49
1950	.42

b. Development

The major development consisted of work on the 10th level. A large sump was excavated near the shaft on the west side of the plat and also a storage trench for skip loading, south of the shaft. The main-level haulage drift to the south towards the ore body was advanced 350' further to cross cut the ore body and enter the south footwall slate. About 40' of first class ore was encountered in the drift. The first cross cut, branching to the southeast, was being driven late in the year and ore was encountered in this heading in December. This development has been continued on a two-shift basis during the year.

Chase Lease #24

An average of five contracts have mined in this Lease during the year. One contract continued stoping in Deposit #79 above the 8th level and also advanced stope development to the east along the strike. In the latter part of the year, mining entered Chase Lease #9 in this area. A small area was mined by stoping along the south side of the deposit and at the west end, a caving operation has been continued. Mining and development has proven a larger ore outline and increased the reserves in this deposit. A stope operation has continued in Deposit #82 throughout the year and to the east, a small amount of mining was done near the boundary of the Lease in Deposit #33.

Fee Lands

An average of four contracts have continued mining on Fee Lands and all the operations have been between the 8th and 9th levels. Near the west boundary of the Lease a small area was mined by caving on the -170' sub and above, in Deposit #87. Mining in this deposit was chiefly in Chase Lease #9 with some of the mining extending east into Fee Lands.

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7. UNDERGROUND (Cont'd)

b. Development (Cont'd)

Fee Lands (Cont'd)

Three contracts conducted caving operations for a part of the year at the east end above the 9th level. Small areas were mined in Deposit #88 and Deposit #84-A, to complete the mining above the 9th level. Late in the year a caving operation was being developed in a small pillar near the 9th level elevation in Deposit #84-B and another caving operation that has been underway all year in the same deposit was nearing the 9th level elevation. The mineable reserves above the 9th level are nearly depleted in Fee Lands and mining on a larger scale must await 10th level development into this area.

Near the west boundary of the Fee Lands, a sub-level stope was developed in a narrow extension of Deposit #87. Mining at the close of the year was approaching the 9th level in this area also.

Chase Lease #9

There was an average of nine contracts mining in this Lease throughout the year and the bulk of the production was from this area. Mining has again been concentrated in Deposits #33, #75-C and #76, between the 8th and 9th levels. Seven of the contracts continued sub-level caving operations in these deposits with occasional small scam stopes being developed for mining where conditions permitted. Mining and development has proven additional reserves in these deposits.

One contract mined in Deposit #86 where a sub-level stope was developed. Sub-level stoping has been continued by one contract in Deposit #86 and a caving operation has been continued in Deposit #87 near the west boundary of the Lease on the -170' Sub.

Sub-level caving has continued to be used in most areas and sub-level stoping to a smaller extent.