

**THE CLEVELAND-CLIFFS IRON COMPANY**

**Ore Mining Department**

**ANNUAL REPORT OF GENERAL MANAGER**

**For Year Ending December 31, 1951**

MS 86-100  
2022

# 2022

THE CLEVELAND-CLIFFS IRON COMPANY  
ORE MINING DEPARTMENT

Manager's Annual Report Year 1951

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	Athens	Cambria- Jackson	Cliffs- Shaft	Lloyd	Maas	
<u>Ishpeming, Negaunee, and Iron</u>						
<u>River Districts:</u>						
General	127-128	160	15-16	37	187	
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Taxes	154	181	33	55	209	
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Power	157-158	185-186	36	58		
Nationality of employes	159	186				
Water supply				58		
Condition of premises	158	186		59		
<hr/>						
	<u>Mather</u>					
	<u>"A"</u>	<u>"B"</u>	<u>Morris</u>	<u>Negaunee</u>	<u>Spies</u>	<u>Tilden</u>
<u>Ishpeming, Negaunee and Iron</u>						
<u>River Districts:</u>						
General	60-61	213-214	106	253	266-267	114
Production, shipments & inventories	62-64	215-217	106-108		268-269	114-115
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Power	104	251		264	286	
Condition of premises					286	
Nationality of employes	105	252		264-265	287	
Water supply	104	251			286	

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	Agnew	Alworth	Atkins	Canisteo	Hawkins
<u>Mesaba District:</u>					
General	288	295	299	305	318-320
Production, shipments and inventories	288-289	295	299-300	305-306	320
Analysis	289-290	295-296	300	306-307	320-321
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Labor and wages	290-291	296	301	309	323
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Accidents and personal injuries	293-294	298	304	316	329-331
New construction or equipment	294	298	304	316-317	331-332
Maintenance and repairs	292	297	302	313-314	327
Beneficiation	292	297	302	312-313	326-327
<hr/>					
	Hill- Trumbull	Holman- Cliffs	Sally	Sargent	Wanless
<u>Mesaba District:</u>					
General	333-334	349	362	364	371
Production, shipments and inventories	334-335	349-350	362	364	371-372
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Explorations	344-345	359	363	369	376
Taxes	345	359-360	363	369	377
Accidents and personal injuries	345-346	360	363	369-370	377
New construction or equipment	346-348	360-361	363	370	377
Maintenance and repairs	342-343	358	363	369	375
Beneficiation	340-342	357	363	367-368	

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RECEIVED  
THE CLIFFS IRON CO.  
CLEVELAND, OHIO

1952 APR 15 AM 9:21

Mr. Walter A. Sterling, Vice President,  
1460 Union Commerce Bld.  
Cleveland, Ohio

Dear Sir:-

Expansion of operations of the Ore Mining Department continued in 1951 with attainment of new production and shipment peaks in line with the needs of the national defense program. This acceleration is expected to continue in 1952 through increasing production at Mather Mine B Shaft and the addition of Michigan's first small scale low grade beneficiation plant at the Ohio Mine open pits near the west end of the Marquette Range. The Company's unique position with respect to favorable possibilities of economic treatment of low grade ores, however, was established in October with announcement of the new partnership with the Ford Motor Company to develop the Humboldt deposit and construct a flotation plant for the production of 400,000 tons of concentrates annually at this property 12 miles west of Ishpeming. As in Minnesota, this entry into low grade ore beneficiation is expected to be of far reaching importance in future mining operations in Michigan, and with impetus assured by the research staff and facilities now wisely provided.

Increased production was accompanied by additional employment and supervisory responsibilities, the latter particularly with respect to the job evaluation program underway throughout the year following signing of the supplementary agreement with the union December 12th, 1950. The job rate study, for an agreed further  $8\frac{1}{2}\%$  per hour average wage increase, was marked by apparently different objectives between the iron ore companies and negotiations moved along sporadically with our operations marred in June by a five day strike to enforce the union's choice of the steel mill job manual for iron ore mines. This was soon followed by a second walkout of nine days duration at the Michigan mines, when grievance procedure was discarded and the no-strike provision violated over an employee discharge and supervisor appointment disagreement at the Athens Mine. The outcome was not favorable to the union and appreciation is here expressed for the policy guidance and support of the official staff during these intervals. The unfinished job evaluation program was further complicated when the union on December 12th presented 22 demands for a new contract to replace the one in existence since May 28, 1947 and extended to December 31st, 1951.

Other highlights in 1951 were the Company's entry, through its subsidiary the Cliffs Realty Company, into a contract for the building of 100 homes in North Ishpeming to assist in providing for expanding employment housing needs, and the departure in December from operation of the Ishpeming Hospital through donation and assistance with other companies to a new non-profit organization of responsible representatives from Ishpeming and Negaunee for future guidance of this institution.

PRODUCTION

Production for the five year period beginning with 1947 follows:

<u>Year</u>	<u>Michigan Mines</u>	<u>Minnesota Tons</u>	<u>Total Tons</u>
1947	4,162,545	3,767,682	7,930,227
1948	4,112,679	4,595,354	8,708,033
1949	3,675,240	3,461,590	7,136,830
1950	4,246,613	4,005,229	8,251,842
1951	4,634,764	4,379,327	9,014,091

The 1951 production by grades and districts was as follows:

MICHIGAN

Non-Bessemer Standard	3,520,341 Tons
" " Special	877,955 "
Silicious	236,468 "
Total	<u>4,634,764</u>

This is the highest annual production recorded for all Michigan mines.

MINNESOTA

Non-Bessemer	3,313,561 Tons
Bessemer	<u>1,065,766 "</u>
Total	4,379,327 tons

SHIPMENTS

Shipments from the underground mines and open pits in Michigan and Minnesota in 1951 were:

Michigan Mines	4,695,311 tons
Minnesota Mines	<u>4,375,623 "</u>
Total	9,070,934 tons
Shipments in 1950	7,887,723 tons

The 1951 shipment figure in excess of 9,000,000 tons also represents the establishment of a new high, which barring interference, is likely to again be exceeded in 1952.



ANALYSIS

The expected and actual analyses of 2,151,138 tons of Cliffs Group ore shipped in 1951, on which upper and lower lake comparative analyses were available, are as follows:

	<u>Tons</u>	<u>Dried</u> <u>Iron</u>	<u>Silica</u>	<u>Moist.</u>	<u>Natl.</u> <u>Iron</u>
Expected		57.43	10.62	11.95	50.57
Average mine analysis	2,151,138	57.40	10.35	12.09	50.458
Average lower lake		57.29		11.18	50.885
Guarantee		57.69	9.95	11.60	51.00

The iron natural content of Cliffs Group shipped in 1951 was somewhat lower than normal expectations, mainly by reason of the 1% lower iron allowed at Mather Mine A Shaft to maintain production at this property in the face of a shortage of working places. Because total production at this property was so much higher than at any of the other underground mines, the effect was proportionate in the total mixture. A comparison by mines of the ores going into Cliffs Group is listed below and shows the mines other than Mather Mine A Shaft were very close to their expected analysis:

<u>Cliffs Group</u>	<u>Expected Fe.</u>	<u>Actual Fe.</u>
Cliffs Shaft Crushed	51.00	52.02
Lloyddale	58.00	58.08
Lloyd Silica	52.50	51.60
Maas Standard	58.80	58.77
Maas Special	58.80	59.03
Mather Mine A Shaft	58.50	57.41
Mather Mine B Shaft	58.50	59.03
Athens	58.50	58.60
Cambria	58.75	57.99
Spies	56.50	56.03

The mine analysis record of the larger shipments by grades from Minnesota was as follows:

	<u>Tons</u>	<u>Iron</u> <u>Dried</u>	<u>Phos.</u>	<u>Moist.</u>	<u>Iron</u> <u>Natl.</u>
Newberry Bessemer	793,110	56.456	.037	7.880	52.007
Williamson	1,885,894	56.012		8.869	51.049
St. Paul	922,956	55.472		11.941	48.848

The iron content of lower lake analyses exceeded the above in all cases.

COSTS:

Mining costs in 1951 were unfavorable compared to the average that had been so well maintained the year previous. This was due largely, of course, to the 21¢ per hour wage increase granted December 1, 1950, 8½¢ of which was still being negotiated but which was charged to operations, and an additional set-back that affected the average of the Michigan mines through the shortage of working places and consequent tonnage loss at Mather Mine A Shaft, the largest producer. Cost increases were in a moderate range for the Minnesota open pits and the average well below the undergrounds with their lower productivity.

The comparison least distorted by charges other than those mentioned above is the record of the Michigan underground mines for the first 11 months of 1950 and 1951 showing the unusually large increase of 72¢ per ton as against 9¢ in the comparable period the year before:

	Tons	Total Cost Per Ton
11 months 1950	3,703,038	\$ 3.624
11 months 1951	4,193,575	4.345
Increase per ton		\$ .721

Following the December 1, 1950 wage boost was an increase in the price of iron ore which assisted in maintaining earnings on a level not too far under the high attained in 1950. Negotiations now in progress with the union on a new contract and hinging economically on a recommendation of the appointed Wage Stabilization Panel hearing do not augur well costwise for 1952, although prospects are better for increased production from the Mather Mine which is expected to supply nearly one half of the Michigan underground production.

ORE RESERVES:

Exploration and development at active mines a little more than replaced the 9,014,091 tons mined by stepping up reserves as follows:

	12-31-50	12-31-51	Incr. or Decr.
Michigan	29,819,400	30,406,678	587,278
Minnesota	33,495,875	35,209,131	1,713,256

Ore concentration advances assisted in maintaining and in fact supplementing the reserves in Minnesota, where a new find of ore mineable by open pit methods north of the Sargent shaft was of particular importance in extending the life of this small producer. The statement may be repeated from last year that new discoveries in Michigan and Minnesota, except for low grade formation, were spotty in nature and served only to emphasize the importance of continuing our present expanded exploratory program so vitally needed because of the much greater period of time (and expense) required to bring a mine into production than formerly. This is true of the deepening undergrounds as well as of open pit-concentration processes replacing the simpler washing plants of several years ago.



ORE RESERVES (Cont.)

The reserves listed for Michigan do not take into account immediate possibilities in connection with the above last statement for the Humboldt, Republic and probably Michigamme properties, where the explored tonnages representing concentrated material at least equals the 30,406,678 developed reserves reported to the Tax Commission. The opening of these deposits is of prime significance to future operations of the Company, and further correlation of this intended program was assured by appointment of S. W. Sundeen as Assistant Manager in charge of exploration, development and research, which in 1951 was extending to foreign as well as important local holdings.

SAFETY PROGRESS:

The slow but seemingly certain improvement in safety continued, although marred by two fatalities, one underground at the Lloyd Mine and the other on surface at Mather Mine B Shaft. The record is perhaps best shown by the accident frequency and severity comparison for the five year period from 1946 to 1950 inclusive, and for 1951:

	<u>Frequency</u>	<u>Severity</u>
5 year average 1946-1950	42.21	3.315
Year 1951	36.96	2.140

Frequency in the above table represents the number of lost time accidents per million man hours worked and severity the number of days lost per thousand hours worked. The charge for the two fatalities was 12,000 days or about one half the total lost time.

The 1951 record compares favorably with latest available figures of national rating for metal mining, and the 2.14 severity was next best for major mining companies in the Lake Superior region.

LABOR

The labor force for the second straight year increased rapidly in Michigan due mainly to expanding needs at Mather Mine B Shaft and opening of the Ohio Mine. The reverse was true at the end of the year in Minnesota whermost crews were being reduced preparatory to a mid-winter shutdown of stripping operations. The total number of mine department employees in the Lake Superior region nevertheless reached a new peak not far short of 5,000, as shown in the three year comparison:

	<u>Michigan</u>	<u>Minnesota</u>	<u>Total</u>
December 1949	3,062	1,206	4,268
1950	3,466	1,316	4,782
1951	3,752	1,187	4,939

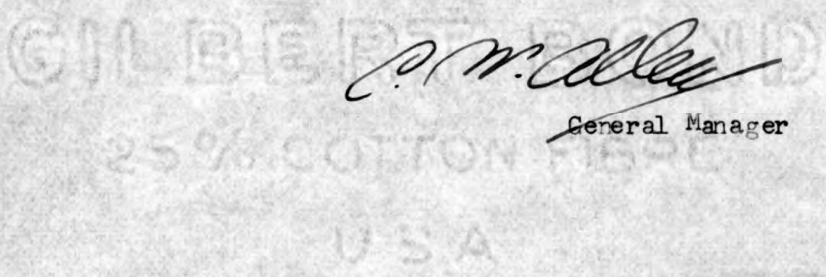
LABOR (CONT)

The usual statements for the comparative record showing statistics on labor, wages, supplies and taxes are appended hereto.

Yours very truly

*J. M. Allen*  
General Manager

CWA:DP





THE CLEVELAND-CLIFFS IRON COMPANY  
MINING DEPARTMENT

A COMPARISON OF MINING DEPARTMENT MICHIGAN ASSESSED VALUATION AND  
TOTAL TAXES PAID FROM YEAR 1929 THROUGH 1951

YEAR	The C. C. I. Co.	The Negaunee Mine Co.	The Athens Ir. Mng Co.	The C. P. & L. Co.	Total Four Companies	Changes from Previous Year
	<u>Assessed Valuation</u>					
1929	\$ 13,291,521	5,284,600	2,586,500	1,318,198	22,480,819	
1930	14,169,590	4,884,400	2,436,500	1,370,445	22,860,935	I 380,116
1931	13,867,696	4,635,700	2,536,500	1,539,428	22,579,324	I 218,389
1932	12,815,645	4,185,700	2,226,500	1,447,936	20,715,781	D 1,863,543
1933	9,850,359	3,554,400	2,036,500	1,419,565	16,860,824	D 3,654,957
1934	10,002,373	3,196,400	2,077,800	1,418,837	16,695,460	D 165,364
1935	10,062,288	3,057,770	1,929,520	1,424,711	16,474,289	D 221,171
1936	10,263,100	3,107,500	1,929,520	1,424,281	16,724,401	I 250,112
1937	11,589,306	3,350,000	2,242,900	1,442,555	18,624,761	I 1,900,360
1938	12,959,542	3,124,100	2,532,900	1,447,843	20,064,385	I 1,439,624
1939	13,090,541	3,267,300	2,683,400	1,981,982	21,023,223	I 958,838
1940	12,185,132	3,692,700	2,683,400	2,003,335	20,564,567	D 458,656
1941	11,202,237	4,644,430	2,683,400	2,004,379	20,534,446	D 30,121
1942	10,628,886	5,461,800	2,759,000	2,016,245	20,865,931	I 331,485
1943	11,936,427	5,418,800	2,785,300	2,134,715	22,275,242	I 1,409,311
1944	12,326,490	5,022,010	2,868,550	2,134,755	22,351,805	I 76,563
1945	11,949,265	4,809,060	2,446,740	2,135,750	21,340,815	D 1,010,990
1946	11,423,395	4,170,610	2,327,690	2,136,050	20,957,745	D 383,070
1947	11,826,910	4,524,225	2,197,815	2,148,105	20,697,055	D 260,690
1948	11,744,905	4,710,145	2,082,815	2,157,405	20,695,270	D 1,785
1949	11,884,480	5,608,650	2,048,715	3,385,014	22,926,859	I 2,231,589
1950	12,222,610	6,767,390	2,116,750	3,401,977	24,508,727	I 1,581,868
1951	13,296,480	8,124,100	2,276,750	3,419,775	27,117,105	I 2,603,378

	<u>Taxes - Paid</u>					
1929	\$476,740.79	199,695.33	97,749.13	55,233.01	829,398.26	
1930	522,901.50	190,689.79	95,122.50	51,352.11	870,064.90	I 40,666.64
1931	507,175.34	183,218.38	100,251.06	65,344.18	855,988.96	D 14,075.95
1932	377,700.32	120,527.71	65,264.22	46,897.77	610,390.02	D 245,598.94
1933	261,765.08	99,599.60	57,065.71	36,067.26	454,067.26	D 155,892.37
1934	267,327.80	86,527.53	56,246.84	31,256.06	441,358.23	D 13,139.42
1935	279,734.41	95,226.14	60,089.81	29,817.75	464,868.11	I 23,509.88
1936	302,207.99	107,861.43	66,447.06	30,066.37	505,782.85	I 40,914.74
1937	345,790.20	120,097.50	80,366.44	30,024.80	576,278.94	I 70,496.09
1938	415,719.34	118,534.83	96,103.47	30,227.17	660,584.81	I 84,305.87
1939	415,979.65	120,806.75	99,217.45	37,997.17	674,997.17	I 13,416.21
1940	376,744.89	130,696.88	95,075.43	39,698.46	642,215.63	D 31,785.39
1941	340,282.83	156,845.98	90,003.76	39,846.19	626,978.76	D 15,236.87
1942	321,091.31	182,845.08	91,057.97	37,686.66	632,681.02	I 5,702.26
1943	380,652.40	202,371.63	107,251.69	40,623.07	730,898.79	I 98,217.77
1944	436,214.77	200,703.60	121,015.20	40,577.13	797,510.70	I 67,611.91
1945	425,599.58	191,565.47	104,255.07	40,964.14	762,384.26	D 36,126.44
1946	417,575.92	168,599.05	103,799.44	43,785.56	733,739.97	D 28,644.29
1947	438,298.87	178,769.39	98,262.27	47,743.90	763,074.43	I 29,334.46
1948	470,710.79	194,238.19	93,223.59	52,220.35	810,392.92	I 47,318.49
1949	496,219.03	229,597.68	108,352.31	92,041.23	926,204.25	I 115,811.33
1950	492,851.32	270,829.15	101,440.20	87,917.79	953,038.46	I 26,834.21
1951	526,996.81	322,304.11	104,513.09	87,884.60	1,041,698.61	I 88,660.15

Notes: The 15-Mill Tax Amendment went into effect in 1933.  
 The Michigan State Sales Tax became effective in July 1933, practically replacing the State Ad Valorem Taxes.  
 The drop in C.C.I.Co. 1933 valuation is due to the Inland Steel Co. taking over the Morris Mine.  
 The State Tax Commission revalued Marquette County in 1949.

STATEMENT SHOWING COMPARATIVE COST FOR ALL EXPLOSIVES  
USED AT MICHIGAN HARD ORE MINES

	1948	1949	1950	1951
PRODUCT - Tons .....	602,453	492,405	641,562	700,346
<u>POWDER</u>				
Pounds - 60% Gelamite .....	350	200	58,950	29,700
Gelamite #1 .....	80,500	80,050	106,100	172,250
Hercomite 2X .....	520,600	391,300	475,400	484,800
Total Pounds Powder .....	601,450	471,550	640,450	686,750
Total Cost .....	\$ 84,605.78	\$ 68,984.15	\$ 97,335.14	\$112,185.28
Fuse - Feet .....	838,775	742,670	899,500	599,800
Caps, Number .....	131,261	114,495	134,934	96,460
Electric Caps .....	19,830	23,943	51,276	102,905
Fuse Lighters .....	56,320	42,500	40,000	40,000
Connecting Wire - Lbs. ....	727	747	2,238	2,814
Tamping Bags .....	11,224	4,870	2,578	22,880
Powder Bags .....	12		6	34
No. 18 Shot Wire .....	13,628	6,755	5,869	16,430
Total Cost - Fuse, Caps, etc..	\$ 13,760.42	\$ 12,986.35	\$ 22,892.15	\$ 33,560.09
Total Cost - All Explosives ..	98,366.20	81,970.50	120,227.29	145,745.37
Average Price per Pound - Powder .	\$ .1406	\$ .1463	\$ .1520	\$ .1634
Cost per Ton - Powder .....	.1404	.1401	.1517	.1602
Cost per Ton - Fuse, etc. ....	.0228	.0264	.0357	.0479
Cost per Ton - All Explosives ....	\$ .1632	\$ .1665	\$ .1874	\$ .2081
Pounds of Powder per ton of Ore ..	.9980	.9576	.9983	.9806

The production increased 58,784 tons, or 9.2% in 1951 compared with 1950.

The average price per pound for powder increased \$.0114, or 7.5% over 1950, and \$.0171, or 11.7% over 1949. The cost per ton for all explosives increased \$.0207, or 11% over 1950, and \$.0416, or 25% over 1949.



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STATEMENT SHOWING COMPARATIVE COST OF ALL EXPLOSIVES

USED AT MICHIGAN SOFT ORE MINES

	1948	1949	1950	1951
PRODUCT - Tons .....	3,152,904	2,944,310	3,212,232	3,590,206
<u>POWDER</u>				
Pounds - 60% .....	51,758	125,272	29,575	177,095
80% .....	568	---	---	8,750
Hercomite .....	1,144,255	783,041	879,619	823,776
Gelamite .....	199,990	315,521	531,442	896,944
Herculite .....	850	600	---	---
<u>Total Pounds - Powder .....</u>	<u>1,397,421</u>	<u>1,224,434</u>	<u>1,440,636</u>	<u>1,906,565</u>
<u>Total Cost - Powder .....</u>	<u>\$199,294.38</u>	<u>\$186,034.08</u>	<u>\$226,692.90</u>	<u>\$322,570.05</u>
Fuse - Feet .....	4,121,214	3,311,772	4,170,639	4,449,311
Caps - Number .....	528,234	432,647	477,223	570,324
Leading Wire - Feet .....	17,785	13,730	26,375	125,220
Connecting Wire - Pounds .....	128	70	118	74
Tamping Bags - Number .....	2,000	---	---	---
Tamptite Shells .....	34,420	11,280	16,900	35,907
Powder Bags .....	190	125	172	313
Fuse Lighters .....	112,350	97,500	12,500	142,300
Electric Exploders .....	18,306	9,017	15,359	108,463
Master Fuse Lighters .....	1,000	500	112,550	500
Primacord - Feet .....	277,286	616,900	771,200	1,094,050
<u>Total Cost, Fuse, Caps, etc. ...</u>	<u>\$ 55,113.19</u>	<u>\$ 57,794.56</u>	<u>\$ 73,017.00</u>	<u>\$ 119,136.58</u>
<u>Total Cost, All Explosives .....</u>	<u>\$254,407.57</u>	<u>\$243,828.64</u>	<u>\$299,709.90</u>	<u>\$ 441,706.63</u>
<u>Average Price per Pound - Powder ..</u>	<u>\$ .1426</u>	<u>\$ .1519</u>	<u>\$ .1574</u>	<u>\$ .1692</u>
<u>Cost per Ton - Powder .....</u>	<u>\$ .0632</u>	<u>\$ .0632</u>	<u>\$ .0706</u>	<u>\$ .0898</u>
<u>Cost per Ton - Fuse, Caps, etc. ...</u>	<u>\$ .0175</u>	<u>\$ .0196</u>	<u>\$ .0227</u>	<u>\$ .0332</u>
<u>Cost per Ton - All Explosives .....</u>	<u>\$ .0807</u>	<u>\$ .0828</u>	<u>\$ .0933</u>	<u>\$ .1230</u>
<u>Pounds of Powder per ton of Ore ...</u>	<u>.4432</u>	<u>.4159</u>	<u>.4485</u>	<u>.5310</u>

The mines included in 1951 figures are the Athens, Cambria-Jackson, Lloyd, Maas, and Mather Mine "A" and "B" Shafts.

1951 Production increased 377,974 tons, or 11.8% as compared with 1950.

Average price per pound for powder increased \$.0118, or 7.5% over 1950, and \$.0173 or 11.4% over 1949.

The cost per ton for all explosives increased \$.0297, or 31.8% over 1950, and \$.0402, or 48.5% over 1949.

CJB:ls

7/9/52

STATEMENT SHOWING COMPARATIVE COST FOR ALL MINE TIMBER  
USED IN MICHIGAN SOFT ORE MINES

	1948	1949	1950	1951
PRODUCT - Tons .....	3,152,904	2,944,310	3,212,232	3,590,206
<u>TIMBER</u>				
Lineal Feet - 6-8" .....	555,404	351,908	284,906	482,086
8-10" .....	193,679	87,661	137,850	151,597
10-12" .....	343,987	162,846	309,154	262,993
12-14" .....	125,630	192,785	124,053	95,774
14-16" .....	22,036	65,914	16,525	24,382
Treated Timber .	2,595	---	3,450	---
<u>Total Feet .....</u>	<u>1,243,331</u>	<u>861,114</u>	<u>875,938</u>	<u>1,016,832</u>
<u>Total Cost .....</u>	<u>\$177,526.83</u>	<u>\$154,177.77</u>	<u>\$144,398.74</u>	<u>\$176,790.76</u>
<u>LAGGING</u>				
Lineal Feet - 7' .....	6,262,127	4,855,632	4,851,344	6,782,257
<u>Total Feet .....</u>	<u>6,262,127</u>	<u>4,855,632</u>	<u>4,851,344</u>	<u>6,782,257</u>
<u>Cost .....</u>	<u>\$100,798.92</u>	<u>\$ 79,114.43</u>	<u>\$ 73,168.42</u>	<u>\$119,789.79</u>
Poles - Feet .....	2,971,360	1,932,207	2,293,741	2,505,193
Poles - Cost .....	\$ 88,446.08	\$ 58,737.97	\$ 68,649.38	\$ 80,192.74
Wire Fencing - Rods .....	60	60	55	254
Wire Fencing - Cost .....	\$63.12	\$98.64	\$90.42	\$468.22
Steel Sets .....	\$ 44,013.04	\$ 50,778.52	\$ 57,230.01	\$343,525.92
Concrete Sets .....	11,185.08	20,850.78	5,220.34	17,169.12
<u>GRAND TOTAL COST .....</u>	<u>\$422,033.07</u>	<u>\$363,758.11</u>	<u>\$348,757.31</u>	<u>\$737,936.55</u>
Average Cost per foot - Timber .	\$ .1428	\$ .1790	\$ .1650	\$ .1739
" " " 100' - Lagging.	1.6096	1.6293	1.5082	1.7662
" " " 100' - Poles ..	2.9766	3.0399	2.9929	3.2011
" " " Rod - Fencing .	1.0520	1.6440	1.6440	1.8433
Feet of Timber per ton of Ore ..	.3943	.2925	.2727	.2832
Feet of Lagging " " " "	1.9861	1.6491	1.5103	1.8891
" " Poles " " " "	.9424	.6563	.7141	.6978
" " Fencing " " " "	.0003	.0003	.0003	.0117
Cost per ton for Timber .....	\$ .0563	\$ .0524	\$ .0450	\$ .0492
" " " " Lagging .....	.0320	.0269	.0228	.0334
" " " " Poles .....	.0281	.0199	.0214	.0223
" " " " Structural Steel	.0140	.0172	.0178	.0957
" " " " Concrete Sets .	.0035	.0071	.0016	.0048
<u>Total Cost per ton ....</u>	<u>.1339</u>	<u>.1235</u>	<u>.1086</u>	<u>.2054</u>

The mines included in the 1950 figures are the Athens, Cambria-Jackson, Lloyd, Maas, and Mather Mine "A" and "B" Shafts.

1951 Production increased 377,974 tons, or 11.8% as compared with 1950.

Total Cost per ton for all timber increased \$.0968 or 89.1%, practically all in steel and concrete sets at Mather Mine "A" and "B" Shafts.



STATEMENT SHOWING TOTAL COST OF SUPPLIES CHARGED TO "COST OF ORE AT MINE"

MICHIGAN MINES ONLY

	1948		1949		1950		1951	
PRODUCT - Tons .....	3,755,357		3,436,715		4,059,413		4,527,647	
<u>CLASSIFICATION</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>
General Supplies .....	\$ 405,754.43	\$ .108	\$ 364,110.00	\$ .106	\$ 485,743.00	\$ .120	\$ 703,129.00	\$ .155
Iron & Steel .....	250,279.83	.067	293,723.00	.085	360,813.00	.088	509,776.00	.113
Machinery .....	388,917.25	.104	328,758.00	.096	372,657.00	.092	556,466.00	.123
Explosives .....	366,211.73	.098	359,163.00	.105	472,169.00	.116	601,218.00	.133
Lumber and Timber .....	482,010.71	.128	403,698.00	.117	389,104.00	.096	465,831.00	.103
Fuel .....	57,880.76	.015	61,004.00	.018	70,853.00	.017	79,132.00	.017
Electric Power .....	678,573.82	.180	629,182.00	.183	850,552.00	.210	1,000,237.00	.221
Miscellaneous .....	104,611.66	.028	76,727.00	.022	104,669.00	.026	201,057.00	.044
Total .....	\$2,734,240.19	\$ .728	\$2,516,365.00	\$ .732	\$3,106,560.00	\$ .765	\$4,116,846.00	\$ .909

SUMMARY OF PRODUCTION, DAYS WORKED,  
LABOR COST, AND AVERAGE UNIT RATES

	MICHIGAN		MINNESOTA	
	1951	1950	1951	1950
<u>Production: (Tons)</u>				
1. Underground Mines	4,527,647	4,059,413	527,316	538,612
2. Open Pit Mines	103,022	107,465	3,730,874	3,456,574
3. Total	4,630,669	4,166,878	4,258,190	3,995,186
<u>Days Operated:</u>				
4. Underground Mines	737,114	656,074 $\frac{1}{4}$	60,272 $\frac{1}{4}$	62,666 $\frac{3}{4}$
5. Open Pit Mines	4,216	4,433 $\frac{3}{8}$	134,141 $\frac{3}{4}$	136,335 $\frac{1}{4}$
6. Total Direct	741,330	660,508	194,414	199,002
7. Indirect	252,313 $\frac{1}{4}$	190,793	150,555	93,815 $\frac{1}{2}$
8. Grand Total Days	993,643 $\frac{1}{4}$	851,301	344,969	292,817 $\frac{1}{2}$
<u>Labor Cost:</u>				
9. Underground	\$ 11,065,471.71	\$ 8,367,474.68	\$ 980,399.77	\$ 870,586.20
10. Open Pit	60,977.83	54,530.60	2,001,014.92	1,674,314.55
11. Total Direct Cost	11,126,449.54	8,422,005.28	2,981,414.69	2,544,900.75
12. Indirect	3,594,363.19	2,373,020.70	2,244,824.73	1,288,452.06
13. Grand Total Cost	\$ 14,720,812.73	\$ 10,795,025.98	\$ 5,226,239.42	\$ 3,833,352.81
<u>Statistical Information</u>				
<u>Tons per man per day:</u>				
Underground (1+4)	6.142	6.187	8.749	8.595
Open Pit (2+5)	24.436	24.239	27.813	25.353
Combined (3+6)	6.246	6.308	21.903	20.076
Grand Total (3+8)	4.660	4.895	12.344	13.644
<u>Labor Cost per ton:</u>				
Underground (9+1)	\$ 2.444	\$ 2.061	\$ 1.859	\$ 1.616
Open Pit (10+2)	.592	.507	.536	.484
Combined (11+3)	2.403	2.021	.700	.637
Grand Total (13+3)	3.241	2.591	1.227	.959
<u>Average Rate per day:</u>				
Underground (9+4)	15.012	12.754	16.266	13.892
Open Pit (10+5)	14.463	12.300	14.917	12.281
Combined (11+6)	15.008	12.751	15.335	12.788
Grand Total (13+8)	\$ 14.793	\$ 12.681	\$ 15.150	\$ 13.091

Cliffs Power and Light has been excluded from above on lines 8 and 13, as follows:

Days	21,051	21,043
Amount	\$ 289,487.93	\$ 258,482.30

Increase in cost per ton and average rate per day 1951 over 1950 due to wage increase granted December 1, 1950 amounting to 12 $\frac{1}{2}$ ¢ per hour plus a deferred adjustment to be negotiated estimated to equal 8 $\frac{1}{2}$ ¢ per hour.



THE CLEVELAND-CLIFFS IRON COMPANY  
ORE MINING DEPARTMENT  
LABOR SUMMARY -- ALL COMPANIES

PRODUCTION - TONS	<u>1948</u>		<u>1949</u>		<u>1950</u>		<u>1951</u>	
	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT
		8,605,471		7,134,528		8,162,064		8,888,859
Surface .....	524,388	\$ 5,977,241.26	451,917 $\frac{1}{4}$	\$ 5,357,595.59	528,437 $\frac{1}{2}$	\$ 6,325,168.62	648,805	\$ 9,276,256.10
Cost Per Ton .....		\$ .695		\$ .751		\$ .775		\$ 1.044
Underground .....	573,482 $\frac{1}{4}$	\$ 7,198,264.61	493,990	\$ 6,495,934.84	563,058 $\frac{1}{4}$	\$ 7,423,649.17	625,503- $\frac{3}{4}$	\$ 9,536,944.27
Cost Per Ton .....		.836		.911		.910		1.073
Superintendence & General Roll ...	63,604 $\frac{1}{2}$	\$ 925,453.99	67,265	\$ 1,001,379.19	73,665	\$ 1,138,043.30	85,354 $\frac{1}{2}$	\$ 1,423,339.71
Cost Per Ton .....		.108		.140		.139		.160
GRAND TOTAL .....	1,161,474- $\frac{3}{4}$	\$ 14,100,959.86	1,013,172 $\frac{1}{4}$	\$ 12,854,909.62	1,165,161 $\frac{1}{4}$	\$ 14,886,861.09	1,359,663 $\frac{1}{4}$	\$ 20,236,540.08
COST PER TON .....		\$ 1.639		\$ 1.802		\$ 1.824		\$ 2.277
Average Rate Per Day .....		\$ 12.14		\$ 12.69		\$ 12.78		\$ 14.88
Tons Per Man Per Day .....		7.19		7.04		7.01		6.54

NOTES: The above is the total of all wages and salaries for employees of the Mining Department, including The Cliffs Power & Light Company. The mines were idle in 1951 from June 11th to June 14th, incl. - Michigan; June 9th to June 15th - Mesaba; July 3rd to July 12, incl. due to Union strike.

WAGES:

Deferred wage adjustment granted in 1950 still in processive stage.

1951 WORKING SCHEDULE:

MICHIGAN

Athens, Cambria-Jackson, Cliffs Shaft and Maas mines operated 2 shifts 6 days per week for entire year.  
 Lloyd, Mather "A" Shaft and Mather "B" Shaft operated same schedule, but 3 shifts per day until April 1st, when schedule was changed to 5- $\frac{2}{3}$  days.  
 Spies operated 2 shifts 6 days per week to February 1st, 5 $\frac{1}{2}$  days per week thereafter.  
 Tilden operated 1 shift 6 days per week from August 16th to October 31st.

MINNESOTA

Agnew and Sargent, underground mines, worked 2-8 hr. shifts 6 days per week.  
 Atkins commenced ore operations January 1st, working 2-8 hr. shifts 6 days per week to March 5th - thereafter contracted to Range Improvement Co.  
 Canisteo commenced ore operations April 30th, working 2-8 hr. shifts 6 days per week to October 20th.  
 Hawkins " " " April 25th, " 3-8 " " 6 " " " " August 11th (Apr.25, 1-8-5 days, Apr.26, 2-8-5 days, May 16, 3-8-6 days)  
 Hill-Trumbull " " " April 30th, " 3-8 " " 6 " " " " " October 19th.  
 Holman-Cliffs " " " April 16th, " 3-8 " " 6 " " " " " November 3rd.  
 Wanless " " " April 25th, " 1-8 " " 6 " " " " " November 17th.

THE CLEVELAND-CLIFFS IRON COMPANY

STATEMENT SHOWING PENALTY COST OF OVERTIME WORKED

AND EFFECT ON PRODUCTION COST FOR YEAR 1951

	MICHIGAN PROPERTIES	MINNESOTA PROPERTIES	TOTAL
<u>Year 1951</u>			
January .....	\$ 80,641.78	\$ 17,367.75	
February .....	70,799.83	14,855.82	
March .....	84,514.25	12,164.65	
April .....	74,691.68	15,572.97	
May .....	76,829.83	35,442.77	
June .....	69,498.10	26,848.13	
July .....	45,912.23	38,461.39	
August .....	72,447.07	35,952.59	
September .....	95,113.94	40,891.73	
October .....	73,981.03	31,986.02	
November .....	65,159.85	17,650.91	
December .....	75,259.27	21,372.28	
Total - Year 1951 .....	\$ 884,346.86	\$ 308,311.13	\$ 1,192,657.99
Total - Year 1950 .....	465,892.02	144,917.15	610,809.17
<u>PRODUCTION</u>			
Tons - Year 1951 .....	4,630,669	4,258,190	8,888,859
Tons - Year 1950 .....	4,166,878	3,995,186	8,162,064
<u>EFFECT THE PENALTY COST HAD ON YEAR'S PRODUCTION COST</u>			
Increased 1951 by .....	\$ .1910	\$ .0724	\$ .1342
Increased 1950 by .....	.1118	.0363	.0748



CLIFFS SHAFT MINE  
ANNUAL REPORT  
YEAR 1951

1. GENERAL

For the year 1951, production from the Cliffs Shaft Mine totalled 700,346 tons. The budget estimated production was 686,297 tons. On May 15, 1951 the 20,000,000th ton of ore was hoisted from the Cliffs Shaft Mine. Both shafts operated during the year for a total of 292 days. The mine operated on straight 8-hour overlapping shifts, both day and night, six days per week through the whole year. The mine was idle 4 days during June and 9 days during July because of general strikes called by the United Steelworkers of America (C.I.O.) Union.

Cost of production increased from \$4.041 in 1950 to \$4.380 in 1951 while the total cost increased from \$4.415 in 1950 to \$4.774 in 1951. The mine operated on a slightly more efficient basis during the year as indicated by the tons per man per day which rose from 4.75 in 1950 to 5.04 in 1951 or an increase of 0.29 tons per man per day over the previous year. The wage increase granted the employees on December 1, 1950 together with the relative increase in supply costs were sufficient to overcome the increased operating efficiency and result in the operating cost increasing \$.339 over 1950.

In 1951 there was an average of 86.3 gangs working in the mine compared to 91.3 gangs in 1950. On the average, 61 of these were double crews employing two miners instead of a miner and a helper. This is an increase in this type of contract of 13 gangs compared to the previous year. The miner-helper type contract is now being used primarily as a training aid in preparing men, eligible for mining, for the work they will be doing as miners. It is also used to a limited extent in areas where the ore body is too small in size to permit a two-man contract from operating within the incentive system. All of the mining contracts used tungsten-carbide bits and jackleg-sinker machines for drilling during 1951. Of the total contracts, 9.5 gangs or 11% spent their time on raising or drifting and 40 gangs or 46.4% were engaged in so-called development work which includes the raising or drifting as well as breast and raise stoping.

Shipments from the mine, both pocket and stockpile, totalled 729,991 tons. The current year overrun from stockpile was 8,579 tons and pocket overrun was 13,689 tons. Total overrun of 22,267 tons divided by the mine tally production of 677,079 tons equals 3.29%. This is an increase in overrun of 1.43% compared to the preceding year. The skip weight factor remained at 5.10 tons per skip throughout 1951.

All of the production mined during the year was screened to -2" which produced 73.2% lump ore and 26.8% crushed ore.

Major improvements to the surface plant during 1951 consisted of widening and paving the driveway and a small parking lot in the vicinity of the mine office, also enlarging the main parking lot by extending the shoreline of Lake Bancroft, northward, with material removed from the rockpile. This project will be completed in 1952. The remodelling of the main underground dryhouse was completed early in the year.

The major improvement underground was the reopening and timbering of the Moro Mine "K" Shaft. Connections with the Moro Mine on the 6th, 8th and 10th levels together with the reopened Moro "K" Shaft have vastly improved ventilation in the south-east portion of the mine. The Moro Mine has been cleared of water to the 10th level (Moro 12th level) elevation.

CLIFFS SHAFT MINE  
ANNUAL REPORT  
YEAR 1951

1. GENERAL: (Cont'd)

A number of purchases were made of underground equipment during 1951 which might be classified as major improvements. The important items are listed below:

- 12 - J50 Ingersoll-Rand Drills
- 8 - CP59 Drills
- 4 - R38 Ingersoll-Rand stopers
- 12 - Thor-75 Drills
- 10 - 76 cu. ft. underground dump cars

Labor relations have been quite satisfactory during the year. A number of minor complaints were presented in verbal form but these were resolved to the satisfaction of both management and the Union. There were no formal grievances submitted in 1951. Operations were interrupted, however, for short periods in June and again in July by district-wide "wild cat" strikes called by the Union.



CLIFFS SHAFT MINE  
ANNUAL REPORT  
YEAR 1951

2. PRODUCTION,  
SHIPMENTS, &  
INVENTORIES:

a. Production by Grades:

<u>Grades</u>	<u>Tons</u>	<u>% of Total</u>
Cliffs Shaft Lump	389,529	
Cliffs Shaft Crushed	<u>142,642</u>	
Total	532,171	76.0
Bancroft Lump	45,741	
Bancroft Crushed	<u>16,527</u>	
Total	62,268	8.9
Section 10 Lump	77,591	
Section 10 Crushed	<u>28,316</u>	
Total	105,907	<u>15.1</u>
GRAND TOTAL FEE & LEASE ORE	700,346	100.0

Production by grades and percentages of Lumps and Fines for the past five years follows:

<u>Year</u>	<u>Lump Ore</u>		<u>Crushed Ore</u>		<u>Total Tons</u>
	<u>Tons</u>	<u>%</u>	<u>Tons</u>	<u>%</u>	
1947	<u>396,561</u>	72.50	<u>150,235</u>	27.50	<u>546,796</u>
1948	427,903	71.00	174,550	29.00	602,453
1949	351,318	71.36	141,087	28.64	492,405
1950	472,740	73.70	168,822	26.30	641,562
1951	512,861	73.20	187,485	26.80	700,346

The revolving trommel was equipped during 1951 as follows:

- Bottom section - 2" Screen
- Center " - 2" "
- Top " - 1½" "

The ratio of separation of product for the year 1951 was 74% Lump and 26% Crushed.

All of the ore produced to date from the Bancroft Lease and Section 10 Lease since they were acquired by the Company is shown in the table below:

	<u>Bancroft Ore</u>	<u>Sec. 10 Ore</u>
	<u>Tons</u>	<u>Tons</u>
1925 to 1946, inclusive	1,157,601	56,414
1947	45,030	36,611
1948	53,919	41,920
1949	33,941	48,100
1950	41,317	95,160
1951	<u>62,268</u>	<u>105,907</u>
Total	1,394,076	384,112

CLIFFS SHAFT MINE  
ANNUAL REPORT  
YEAR 1951

2. PRODUCTION, ETC.:

b. Shipments

<u>Grade</u>	<u>Pocket Tons</u>	<u>Stockpile Tons</u>	<u>Total Tons</u>	<u>Total Last Year</u>
Cliffs Shaft Lump	248,315	174,111	422,426	329,060
Cliffs Shaft Crushed	86,580	57,069	143,649	129,484
Bancroft Lump	31,274	13,763	45,037	27,697
Bancroft Crushed	10,306	5,818	16,124	10,206
Section 10 Lump	56,902	18,327	75,229	66,750
Section 10 Crushed	18,947	8,716	27,663	24,459
Total 1951	452,324	277,804	730,128	587,656
Total 1950	442,777	144,879	587,656	
Increase	9,547	132,925	142,472	

c. Stockpile Balances:

Ore in stock as of December 31, 1951:

Cliffs Shaft Lump	35,597 tons
Cliffs Shaft Crushed	14,711
Bancroft Lump	3,818
Bancroft Crushed	1,638
Section 10 Lump	6,623
Section 10 Crushed	2,776
Total	65,163 tons

d. Division of Product by Levels:

<u>Level</u>	<u>"A" Shaft Tons</u>	<u>"B" Shaft Tons</u>	<u>Total Tons</u>
1st	882	45,821	46,703
2nd	28,222	23,175	51,397
3rd	2,754	-	2,754
4th	50,549	47,688	98,237
5th	39,454	892	40,346
6th	66,705	47,494	114,199
7th	38,927	20,259	59,186
8th	27,911	-	27,911
9th	80,696	22,266	102,962
10th	47,849	-	47,849
11th	39,850	15,776	55,626
12th	29,717	-	29,717
13th	-	-	-
14th	-	23,459	23,459
15th	-	-	-
Total	453,516	246,830	700,346
Rock			37,236
Total Ore & Rock			737,582



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2. PRODUCTION, ETC.: (Cont'd)

f. Production by Months:

Month	Oprg. Days	CLIFFS SHAFT		BANCROFT		SECTION 10		Total
		Lump	Crushed	Lump	Crushed	Lump	Crushed	
Jan.	26	34,993	12,101	3,561	1,230	5,533	1,915	59,333
Feb.	24	31,575	11,079	4,248	1,453	4,621	1,594	54,570
March	27	34,149	12,038	4,103	1,418	6,815	2,394	60,917
April	25	36,580	13,399	4,432	1,718	6,509	2,525	65,163
May	26	35,063	12,377	3,636	1,383	7,380	2,776	62,615
June	22	28,910	10,440	3,360	1,146	7,981	2,767	54,604
July	17	25,534	9,865	2,663	968	4,145	1,520	44,695
Aug.	27	35,866	13,846	3,787	1,437	7,724	2,946	65,606
Sept.	24	32,820	11,414	2,957	1,055	6,165	2,223	56,634
Oct.	27	34,123	11,319	5,432	1,689	7,920	2,486	62,969
Nov.	25	29,374	10,484	3,068	1,065	6,359	2,239	52,580
Dec.	22	26,913	9,358	3,677	1,241	5,353	1,855	48,397
Current Years								
Stkpl. Overrun		3,629	4,922	817	724	1,186	1,076	11,348
Total	292	389,529	142,642	45,741	16,527	77,591	28,316	700,346

g. Ore Statement:

	Cliffs Shaft		Bancroft		Section 10		Total	Total Last Year
	Lump	Crushed	Lump	Crushed	Lump	Crushed		
On Hand Jan. 1, 1951	68,355	15,719	3,115	1,235	4,261	2,123	94,808	40,902
Output for Year	389,529	142,642	45,741	16,527	77,591	28,316	700,346	641,562
Total	457,884	158,361	48,856	17,762	81,852	30,439	795,154	682,464
Shipments	422,287	143,650	45,038	16,124	75,229	27,663	729,991	587,656
Balance on Hand	35,597	14,711	3,818	1,638	6,623	2,776	65,163	94,808
Increase in Output							58,784	

The major delays during 1951 occurred on January 28th when the airline to the crusher froze; on February 13th when the stocking car jumped the track and damaged the trestle; on March 22nd when the compressors broke down; on May 14th when crusher bearings overheated; on November 13th when a runner broke in "B" Shaft and on December 16th when the pockets on surface were jammed by frozen dirt. Several other delays of shorter duration occurred during the period. The total of all delays resulted in a loss of 114 $\frac{3}{4}$  hours of production time and 11,875 tons in production.



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3. ANALYSIS:a. Average Analysis of 1951 Output:

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
Cliffs Shaft Mine	60.04	.099	9.46
Cliffs Shaft Crushed	51.62	.104	19.84
Bancroft Lump	61.34	.104	7.62
Bancroft Crushed	53.61	.108	16.81
Section 10 Lump	60.29	.102	9.11
Section 10 Crushed	52.52	.107	18.26

The output analyses remained very nearly the same in 1951 as in 1950.

b. Complete Analysis of 1951 Ores as Shipped from Mine:

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Lump Ore (°)	60.10	.102	9.36	.21	1.91	.63	.63	.010	.75	.33
Crushed Ore (°)	52.00	.100	19.78	.28	2.36	.62	.78	.014	1.08	2.25

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

c. Analysis of Ore in Stock Dec. 31, 1951:

		<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>
C. S. Lump	Dried	58.29	.096	11.85	.21	1.91	.63	.63	.011	.75	.33
	Natural	58.10	.096	11.81	.21	1.90	.63	.63	.011	.75	.33
C. S. Crushed	Dried	51.26	.097	20.95	.28	2.36	.62	.78	.014	1.08	
	Natural	50.11	.095	20.48	.27	2.31	.61	.76	.014	1.06	2.25
Banc. & Sec. 10 Lump	Dried	59.88	.092	9.88	.21	1.91	.63	.63	.012	.75	
	Natural	59.68	.092	9.85	.21	1.90	.63	.63	.012	.75	.33
Ban. & Sec. 10 Crushed	Dried	51.50	.106	20.53	.28	2.36	.62	.78	.013	1.08	2.25
	Natural	50.34	.104	20.07	.27	2.31	.61	.76	.013	1.06	

d. Analysis of Ore Reserves: (Run-of-Mine Ore)

	<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>
Dried	56.52	.108	10.89	.49	2.42	.97	.81	.018	1.21	.85
Natural	56.04	.107	10.80	.49	2.40	.96	.80	.018	1.20	

The above analysis is expected for the Cliffs Shaft, Bancroft and Section 10 ore.



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4. ESTIMATE  
OF ORE  
RESERVES:

Assumption: Factor used is 8, 9 and 10 cu. ft. per ton of ore in place. The factor 9 is most commonly used.  
10% deduction for rock and loss in mining.

Ore in Sight December 31, 1951:

Bancroft Area - "A" Shaft

Summary:

	<u>Tons</u>
Bancroft Ore Available Aug. 31, 1951	328,626
Less Production Aug. 31, 1951 to Dec. 31, 1951	<u>20,184</u>
Gross Tonnage as of Dec. 31, 1951	308,442
Less 10% for Mining and Rock	<u>32,863</u>
Net Total Bancroft Ore Available	275,579

Section 10 Lease

Summary:

Section 10 Ore Available Aug. 31, 1951	541,710
Less Production Aug. 31, 1951 to Dec. 31, 1951	<u>34,591</u>
Gross Tonnage as of December 31, 1951	507,119
Less 10% for Mining and Rock	<u>54,171</u>
Net Total Section 10 Ore Available	452,948

Net Total Bancroft & Section 10 Leases	728,527
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Cliffs Shaft Fee Ore Areas

Summary:

Cliffs Shaft Ore Available Aug. 31, 1951	1,440,953
Cliffs Shaft Ore Available Aug. 31, 1951 from Section 9 Exploration	<u>29,800</u>
Total Ore Available Aug. 31, 1951	1,470,753
Less Production Aug. 31, 1951 to Dec. 31, 1951	<u>165,805</u>
Gross Tonnage as of December 31, 1951	1,304,948
Less 10% for Mining and Rock	<u>147,075</u>
Net Total Fee Ore Available	1,157,873

Recapitulation

Net Cliffs Shaft Ore Available	1,157,873
Net Bancroft Ore Available	275,579
Net Section 10 Lease Ore Available	<u>452,948</u>

Grand Total	1,886,400
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4. ESTIMATE  
OF ORE  
RESERVES:

(Cont'd)

Ore Reserves for the past two years are shown for comparison:

	<u>Dec. 31, 1951</u>	<u>Dec. 31, 1950</u>
Cliffs Shaft Ore Available	1,157,873	1,121,717
Ban. & Sec. 10 Ore Available	728,527	815,214
TOTAL	<u>1,886,400</u>	<u>1,936,931</u>
Decrease in 1951	50,531	

New Ore Developed in 1951 - 700,346 minus 50,531 equals 649,815 tons.

The following table shows the variations in ore reserves in the Cliffs Shaft Mine since 1947:

Net Available Ore in Sight

<u>Year</u>	<u>Sec. 10 Ore</u> <u>Tons</u>	<u>Bancroft Ore</u> <u>Tons</u>	<u>Cliffs Shaft Ore</u> <u>Tons</u>
1947	401,249	254,305	1,134,472
1948	364,941	271,298	1,162,651
1949	389,679	283,376	1,169,491
1950	542,454	272,760	1,121,717
1951	452,948	275,579	1,157,873

The estimated reserves in the Bancroft Lease and Cliffs Shaft Fee Ores increased slightly over 1950 but a sharp drop in Section 10 Lease Ore caused ore reserves to drop 50,531 tons under 1950.

The table below shows that the 1951 reserves, while slightly lower than the 1950 reserves, remain higher than the previous several years estimates. This increase is due to the development of the Section 10 Lease reserves and the intensive drilling program being conducted in the old workings on the upper levels of the mine which have proven the existence of ore in several abandoned mining areas.

Total Ore Available in Mine at End of Each Year

1951	1,886,400 tons
1950	1,936,931 "
1949	1,842,546 "
1948	1,798,890 "
1947	1,816,756 "



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5. LABOR AND WAGES:

a. General

Comparing 1951 and 1950, the record shows four less men in the surface crew with the same number of men in the underground crew during 1951.

A general wage increase of 12½¢ per hour was granted, effective December 1st, 1950. This was accompanied by an agreement with the Union providing for the evaluation of all jobs and elimination of so-called "job inequities". The total average cost of this program was not to exceed 8½¢ per hour average. The evaluation cost of this program was not completed during 1951 and a sum of money equivalent to 8½¢ per hour for the total man hours worked at the property was set aside to be paid out when the program is completed.

b. Comparative Statement of Wages and Product:

	<u>1951</u>	<u>1950</u>
Product (tons)	700,346	641,562
No. of Shifts and Hours	2-8 Hr.	2-8 Hr.
No. of Days Operated	292	283
 <u>Average Number of Men Employed</u>		
Surface	95	99
Underground	<u>368</u>	<u>368</u>
Total	463	467
 <u>Average Wages Per Day</u>		
Surface	\$13.26	\$11.21
Underground	<u>14.90</u>	<u>12.75</u>
Total	\$14.57	\$12.43
 <u>Product Per Man Per Day</u>		
Surface (tons)	22.31	20.91
Underground	<u>6.50</u>	<u>6.15</u>
Total	5.04	4.75
 <u>Labor Cost Per Ton</u>		
Surface	\$ .607	\$ .549
Underground	<u>2.295</u>	<u>2.078</u>
Total	\$2.902	\$2.627

The conversion of all contracts to tungsten carbide drilling and the improved incentive morale all contributed to the higher efficiency during the year. However, in spite of increased efficiency, the wage increase paid for the full year together with the 8½¢ per hour "inequity" adjustment held back for future payment were sufficient to increase both surface and underground labor costs at the mine in 1951.

Penalty earnings increased as shown below as a result of the longer period of 6-day operation in 1951 as compared to 1950. In 1950, we worked a 6-day schedule for 8 months while in 1951 we worked 6 days for the full year.

1951	\$136,546.90
1950	<u>95,578.17</u>
Increase in 1951	\$ 40,968.73

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5. LABOR AND  
WAGES:

(Cont'd)

Surface and underground labor costs per ton for the past five years are as follows:

<u>Year</u>	<u>Surface Labor</u>	<u>Underground Labor</u>	<u>Total Labor</u>
1951	.607	2.295	2.902
1950	.549	2.078	2.627
1949	.629	2.126	2.755 (x)
1948	.585	2.010	2.595
1947	.615	1.958	2.573

(x) Costs for operating 10½ months.

	<u>Shifts</u>	<u>Earnings</u>	<u>Avg. Wages 1951</u>	<u>Avg. Wages 1950</u>
Contract Miners				
Dev. in Rock	3,577	64,638.44	18.07	15.02
Dev. in Ore & Stopping	47,815	697,550.15	14.59	13.30
Total Contract Miners	51,392	762,188.59	14.83	13.57
Contract Trammers	550	11,176.98	20.32	17.83
Total Contract Labor	51,942	773,365.57	14.89	13.61

The increase in average wages paid to contract miners is up because of increased output on the part of the mining crews and also because of the December 1, 1950 wage increase granted all employees.

Total Number of Days

	<u>1951</u>	<u>1950</u>
Surface	31,392	30,682
Underground	107,707	104,283
Total	139,099	134,965

Amount for Labor

Surface	424,885.51	352,253.32
Underground	1,607,507.24	1,333,026.64
Total	2,032,392.75	1,685,279.96

Proportion of Surface to Underground Men

1951	1 to 3.45
1950	1 to 3.37
1949	1 to 3.09
1948	1 to 3.33
1947	1 to 3.40



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6. SURFACE:

a. Buildings and Repairs:

The table below shows cost of repairs to mine buildings for the years 1949, 1950 and 1951:

	<u>1951</u>	<u>1950</u>	<u>1949</u>
Office & Warehouse	494.06	653.37	426.05
Shops	1,672.01	2,903.39	4,036.17
Shaft Houses	2,255.21	23,791.39	26,403.77
Engine House	375.45	713.03	717.64
Dry House	4,955.66	1,935.96	1,587.80
Coal Dock & Trestle	810.00	103.98	1,508.49
Crusher Building	2,850.91	963.23	820.73
Miscellaneous	1,001.57	802.68	753.74
Old Boiler House	<u>2,156.80</u>	-	-
Total	16,571.65	31,867.03	36,254.39

During 1951 a new rock chute was constructed in the crusher building and this together with a rather extensive strengthening program carried on in the structure materially increased maintenance costs on the structure. A large doorway was cut into the south wall of the Old Boiler House to permit storage of the new 3/4-yard crane and Caterpillar D-8 tractor. This together with new storage platforms erected in the building account for the expense under this heading.

7. UNDERGROUND:

a. Development:

1. Section 10 Lease

Production from the Section 10 Lease totalled 105,907 tons or 15.0% of the total product from the Cliffs Shaft Mine, an increase of 11.3% in production from this area over the previous year. The number of gangsworking in the Lease has remained at 10. The major developments carried on in the Section 10 Lease were concentrated on the 8th and 10th levels.

The Section 10 Lease ore body at the 8th level elevation was developed for mining under an experimental program wherein stoping was to be conducted using air-driven loaders operating on double track to load ore. This system was soon abandoned as being too slow and expensive in competition with present scraping methods and since the system would be limited to the removal of ores lying on and above the level elevation. The area was then connected with the 10th level by raises and normal mining resumed. Contract No. 81 began stoping in a new ore vein at the 7th level elevation with most satisfactory results. The coordinates were 1790 S - 2080 E. A second new vein, discovered immediately south of Contract No. 78 at the 6th level elevation, proved to be too small to warrant mining.

On the 10th level, Contract No. 44 extended a drift southeast to hole into the 12th level, Moro Mine. Access to the mine was denied at this point because of water lying at this elevation and because the bottoms in the area had been removed. However, access to the mine was later effected from the Cliffs Shaft 6th level elevation to the Moro 8th level. An exploration program will be conducted to outline mineable ore reserves in the Moro Mine.

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7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

2. Cliffs Shaft and Bancroft Lease

The total average number of gangs working in the mine decreased by five under 1950. The number of crews engaged in development mining decreased from 50.3 in 1950 to 46.4 crews in 1951. A rule of thumb at the Cliffs Shaft Mine is that approximately half of the crews must be engaged in so-called development mining to maintain adequate reserves at the property. The number of crews engaged in development drifting and raising decreased from 13.3 in 1950 to 9.5 gangs in 1951. Double crews (i.e. two miners instead of the miner-helper combination) increased from 48 in 1950 to 61 during 1951. Excessive absenteeism amongst employees during the year forced a reduction in the development program since it became necessary to fill production contracts with men normally employed in development raising and drifting.

"A" SHAFT

In the "A" Shaft territory on 5th level immediately south of shaft, a new drift was driven as part of a program enabling reentry of several old stopes on the 2nd, 3rd and 4th level elevations. This drift cut across the top of a new ore body of very sizeable dimensions which will be outlined by diamond drilling. New raises were also extended to other old stopes on the 2nd and 3rd level elevations from the 5th level as part of a program wherein mining will be resumed in old stopes where available ore has been discovered by the drilling program.

While extending a new raise from the 15th level to an 11th level stope in the northeast section of the mine, Contract No. 90 cut a new ore vein at the 12th level elevation. This vein was later developed for mining and, while the ore limits have not yet been established, it appears to be quite extensive in size. Contract No. 41 extended an 8th level crosscut 300' southeast in ore into the Moro Mine to coordinates 2960 E - 1800 S. This ore body was later explored by diamond drilling and plans were completed to develop the area for mining.

The most significant development on the Bancroft Lease was on the 10th level elevation where the area between 100 N to 400 N and 1600 E to 1800 E was explored and found to contain a large quantity of first class ore. This area lies under No. 16 stope which has followed down from above the 8th level as a narrow, steeply pitching ore vein.

"B" SHAFT

The new ore vein discovered in 1949 by diamond drilling on the 1220' elevation was mined this year by Contract No. 63. The 1230' back elevation established for stopes in this area will prevent the removal of a sizeable portion of the reserves in this vein. This maximum back elevation was established because of the proximity of surface and the possibility of a stope back collapsing and holing through to surface. Contract No. 11 developed a vein of ore lying just above the 1st level, "A" Shaft which had been discovered earlier in the year by diamond drilling. This vein is small in size and the ore will be mined by the one contract. On the 5th level a drift was driven southerly from the shaft and a raise extended northwest to a stope on the 2nd level. This stope had been filled with rock from the 1st level but drilling proved a layer of ore lying beneath the hanging in the back of the stope.



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7. UNDERGROUND:

a. Development:

2. Cliffs Shaft and Bancroft Lease (Cont'd)

"B" SHAFT (Cont'd)

The rock dump was levelled off and covered with 2-inch hardwood plank and then mining in the area began. The practice of covering over rock dumps to permit removal of ore backs will be common in the older, abandoned areas of the mine where drilling has proven sufficient quantities of ore to warrant the practice. Most of the remaining development in the "B" Shaft territory was associated with the advance of stopes in the regular stoping process.

Excepting the above-mentioned ore reserve areas of recent development, particularly those in the Section 10 Lease, there has been no new virgin territory opened up in the Cliffs Shaft Mine for several years. The structure is fairly well outlined and we know with fair certainty where to go and look in this structure pattern for additional ore reserves. Therefore, we can to some extent anticipate how much might be developed through future drilling along this known structure and concomitantly this lets us do some guessing as to the ultimate life of the mine. As in the past several annual reports, it is well to emphasize that the only virgin large area which we have not explored for hard ore reserves lies in Section 9 as a westward extension of the so-called hard ore formation. Some exploratory work should be carried on regularly in Section 9 to determine whether or not lump ore reserves exist in that area which can be mined from the Cliffs Shaft Mine.

c. Drifting and Raising:

<u>Year</u>	<u>Rock Drifts and Raises</u>	<u>Ore Drifts and Raises</u>	<u>Total</u>
1947	3,221'	2,952'	6,173'
1948	3,068'	4,213'	7,281'
1949	2,498'	2,047'	4,545'
1950	5,548'	2,870'	8,418'
1951	3,968'	2,799'	6,767'

d. Explosives, Drilling and Blasting:

Powder consumption per ton of ore increased .046 lbs. per ton compared to 1950 usage. The average price for Gelamite increased from \$15.60 to \$16.70. The average price of Hercomite 2X increased from \$14.94 to \$15.98. The cost per ton for powder increased .0175 over the 1950 cost.

The powder consumption per foot of rock development increased 4.7 per foot of development compared to 1950 practice, as shown in the table below:

<u>Year</u>	<u>Pounds of Powder Per Foot of Rock Development</u>		
1947	17.8	Hercomite	2X
1948	16.5	"	2X
1949	17.1	"	2X
1950	12.0	"	2X and 60% H.P. Gelatin
1951	16.7	"	2X and 60% H.P. Gelatin

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7. UNDERGROUND: (Cont'd)

d. Explosives, Drilling and Blasting: (Cont'd)

Statement of Explosives Used:

<u>STOPING AND DEVELOPMENT IN ORE</u>	<u>Quantity</u>	<u>Average Price</u>	<u>Amount 1951</u>	<u>Amount 1950</u>
Gelamite No. 1 - Cwt.	171,000	16.70	\$28,894.14	\$16,286.98
Hercomite No. 2X - Cwt.	433,100	15.98	69,240.00	61,054.85
Gelatin 60%	16,550	18.72	3,097.89	4,339.42
60% H.P. 5 x 5 Powder - Total	620,650	16.31	\$101,232.03	\$81,761.25
<u>Blasting Supplies</u>				
Fuse - Per M Ft.	592,100	9.27 M	5,487.69	7,267.53
No. 6 Caps	95,315	15.47 M	1,474.55	1,937.95
No. 6 Electric Caps	81,807	20.91 C	17,108.18	5,325.07
Fuse Lighters - 7"	32,500	9.00 M	292.50	369.12
No. 18 Shot Firing Cord	12,830	18.68 M	239.69	75.20
Tamping Bags	16,480	6.34 M	104.50	169.07
Powder Bags	28	5.25	140.72	32.10
Connecting Wire - lbs.	2,183	.976	2,132.28	1,150.11
Miscellaneous			890.35	439.93
<u>Total Blasting Supplies</u>			27,870.46	16,766.08
<u>TOTAL STOPING &amp; DEVELOPING IN ORE</u>			\$129,102.49	\$98,527.33
<u>PRODUCT, Tons</u>			700,346	641,562
Lbs. Powder Per Ton Ore			.886	.840
Cost Per Ton For Powder			.145	.1275
Cost Per Ton For Fuse, etc.			.039	.0261
Cost Per Ton, All Explosives			.184	.1536
 <u>DEVELOPMENT IN ROCK</u>				
Hercomite 2X - Cwt.	51,700	16.00	8,272.00	9,595.40
60% Gelatin	13,150	18.79	2,470.87	5,719.70
Gelatin No. 1 - Cwt.	1,250	16.83	210.38	258.79
Total Powder	66,100	16.57	\$10,953.25	\$15,573.89
<u>Blasting Supplies</u>				
Fuse - Ft.	7,700	9.52 M	73.38	334.97
No. 6 Caps	1,145	15.52 M	177.67	72.54
No. 6 Electric Caps	21,098	21.28 C	4,491.61	4,980.95
Fuse Lighters - 7"	7,500	9.00 M	67.50	42.84
No. 18 Shot Firing Cord-Ft.	3,600	14.84 M	63.42	83.32
Tamping Bags	6,400	6.52 M	41.74	47.66
Connecting Wire - lbs.	631	.982	620.03	711.29
Powder Bags	6	5.62	33.72	-
Miscellaneous			120.56	163.50
<u>Total Blasting Supplies</u>			5,689.63	6,126.07
<u>TOTAL ROCK DEVELOPMENT</u>			\$16,642.88	\$21,699.96
Feet Rock Development			3.968	5.548
Cost Per Foot, Rock Development			4.194	3.911
 GRAND TOTAL ALL EXPLOSIVES			\$145,745.37	\$120,227.29
AVERAGE COST PER POUND FOR POWDER			.1633	.1463



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8. COST OF  
OPERATING:

a. Comparative Mining Costs:

	<u>1951</u>	<u>1950</u>
Product - Tons	700,346	641,562
Underground Costs	3.282	2.981
Surface Costs	.460	.487
General Mine Expense	<u>.638</u>	<u>.573</u>
Cost of Production	4.380	4.041
Taxes	.263	.281
Depreciation	.040	.028
Loading & Shipping	<u>.091</u>	<u>.065</u>
Total Cost at Mine	4.774	4.415
Budget Estimate at Mine	4.800	4.428
No. of Days Operating	292	283
No. of Shifts and Hours	2-8 hr.	2-8 hr.
Average Daily Product	2,398	2,268

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8. COST OF OPERATING: (Cont'd)

b. Detailed Cost Comparison  
Details of Accounts

	<u>Total 1951</u>		<u>Total 1950</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs</u>				
Exploring in Mine	33,506.61	.048	25,426.88	.039
Wage Adjustment	88,475.49	.126	7,529.25	.012
Development in Rock	125,047.42	.179	148,541.76	.232
Stoping & Dev. in Ore	1,216,669.89	1.737	1,107,396.53	1.725
Timbering	63,555.43	.091	40,371.90	.063
Tramming	273,313.75	.390	192,630.51	.300
Ventilation	15,830.40	.023	2,533.81	.004
Pumping	42,186.12	.060	36,613.20	.057
Compressors & Air Pipes	84,978.46	.121	78,890.99	.123
Back Filling	-	-	1,164.28	.002
Underground Superintendence	89,502.80	.128	73,125.72	.114
Compressors & Power Drills	22,632.88	.032	27,199.50	.042
Scrapers & Mechanical Loaders	137,164.75	.196	103,325.28	.160
Tramming Equipment	101,086.18	.144	68,845.92	.109
Pumping Machinery	4,714.45	.007	6,792.17	.011
Total Underground Costs	2,298,664.63	3.282	1,920,387.70	2.993
<u>Surface Costs</u>				
Hoisting	57,591.02	.082	54,292.24	.085
Stocking Ore	41,058.60	.059	40,360.31	.063
Screening-Crushing at Mine	84,578.75	.121	72,753.45	.113
Dry House	20,507.78	.029	18,456.40	.029
General Surface Expense	37,135.65	.053	31,882.88	.050
Maint. Hoisting Equipment	21,183.47	.030	20,571.45	.032
Shaft	12,194.52	.017	6,026.86	.009
Top Tram Equipment	11,571.93	.017	19,738.04	.031
Docks, Trestles & Pockets	19,822.43	.028	16,154.44	.025
Mine Buildings	16,571.65	.024	31,867.03	.050
Total Surface Costs	322,215.80	.460	312,103.10	.487
<u>General Mine Expense</u>				
Geological	7,196.47	.010	4,837.98	.007
Mining Engineering	16,811.57	.024	12,955.77	.020
Mechanical & Elect. Engineering	7,823.14	.011	5,381.32	.008
Analysis & Grading	58,931.95	.084	34,294.53	.054
Safety Department	5,509.68	.008	7,363.87	.012
Telephones & Safety Devices	16,484.14	.024	13,459.70	.021
Local & General Welfare	6,426.54	.009	6,310.20	.010
Special Exp.-Pensions & Allow.	10,804.76	.015	13,220.78	.020
Ishpeming Office	52,406.80	.075	41,840.37	.065
Mine Office	52,702.90	.075	43,400.75	.068
Insurance	35,796.91	.051	36,922.48	.058
Personal Injury	42,495.24	.061	30,960.33	.048
Social Security Taxes	44,266.98	.063	41,085.47	.064
Employees Vacation Pay	79,490.60	.115	65,640.00	.102
Research Laboratory	9,177.69	.013	2,650.56	.004
Total General Mine Expense	446,325.37	.638	360,054.11	.561
COST OF PRODUCTION	3,067,205.80	4.380	2,592,544.91	4.041



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8. COST OF OPERATING: (Cont'd)

a. Comparative Mining Costs: (Cont'd)

The Cost of Production increased \$.339 per ton compared to 1950. The wage increase of 12½¢ per hour effective December 1, 1950 and the 8½¢ per hour retro-active allowance included in the cost of production as of that date are primarily responsible for the higher costs. Increases in the cost of supplies is also reflected in the higher costs.

Exploring in Mine

A total of 81 holes were drilled in 1951 for a combined total footage of 7,247'. Most of these were short holes drilled on the upper levels of the mine. To speed up the drilling program another drill and crew was added late in the year making a total of three on underground exploration.

The table below gives the footage and percentage of each type of material drilled during 1951 and 1950:

<u>Type of Material</u>	<u>1951</u>		<u>1950</u>	
	<u>Footage</u>	<u>%</u>	<u>Footage</u>	<u>%</u>
Ore	1293	17.8	900	15.9
Lean Ore & 2nd Class Ore	1003	13.8	675	11.9
Conglomerate	10	.1	42	.7
Hard Hematite Cherty-Iron Formation	2323	32.1	1426	25.2
Intrusive	1644	22.7	1699	30.1
Argillite & Graywacke	868	12.0	776	13.8
Quartzite	<u>106</u>	<u>1.5</u>	<u>134</u>	<u>2.4</u>
Total	7247	100.0	5652	100.0

Timbering

The increase in cost in this account is due to renewal of numerous chutes using steel in place of timber for supports and lining.

Tramming

The higher cost is due to the increase in wages and better distribution of labor charges which previously were partly absorbed in stoping charges.

Ventilation

The reopening of the Moro Mine "K" Shaft for ventilation purposes accounts for the increase in this expenditure.

Scrapers & Mechanical Loaders

The increase in this expense is due to purchasing some new equipment together with the increase in the cost of equipment and supplies.

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8. COST OF OPERATING: (Cont'd)

a. Comparative Mining Costs: (Cont'd)

Scrapers & Mechanical Loaders (Cont'd)

The following is a list of the larger items of equipment in this category:

- 7 - 48" Pacific Slush Master Scrapers
  - 1 - 3-Drum experimental scraper hoist, Lake Shore Engr. Co.
  - 3 - 30 H.P. scraper hoist motors
- A large increase in use and purchase of 10" ball-bearing type sheaves

The tonnage and unit cost for the past five years for 5/8 wire rope are compared below:

<u>Year</u>	<u>Product</u>	<u>Type of 5/8" Rope Used</u>	<u>Purchased</u>	<u>Cost</u>	<u>Cost Per Ton</u>	<u>Feet per Ton Ore</u>
1947	546,796	"Trulay"	81,212'	\$14,969.85	.0274	.149
1948	602,453	"	99,297'	21,563.67	.0358	.165
1949	492,405	"	95,715'	19,256.67	.0391	.194
1950	641,562	"	93,460'	22,193.41	.0358	.146
1951	700,346	"	99,950'	24,087.95	.0344	.143

Shaft Repairs

The increase in this expense is due to moving of power lines and engineering costs incurred in planning the proposed shaft location.

Analyses & Grading

The large increase in this account is due to employing additional samplers and obtaining check samples on the lump ores placed on stockpile. The increase in wages is also reflected in the higher costs.

Mine Buildings

This expenditure decreased because the repairing of the shafthouses by the Intrusion-Prepakt Corporation was completed in 1950. The construction of an addition and remodelling of the dry house was the major improvement to buildings in 1951.

9. EXPLORATIONS:

Two diamond drills were employed continuously in 1951 with a third rig being added in December. A total of 7,247' was drilled of which 17.8% or 1,293' was first class ore and 13.8% or 1,003' was 2nd class ore. Locations of the holes, which range from #666 to #746 inclusive, are on file with the Geological Department and are also posted on the operating maps.



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9. EXPLORATIONS: (Cont'd)

Underground drilling during the year has been confined to "A" and "B" Shafts above 5th level, the Section 10 and Bancroft Leases and the "A" East area. The most significant tonnage additions have been in the Bancroft and "A" East areas. From the workings available at the present time, drilling can be considered largely complete above 5th level "A" and "B" Shafts and in the Section 10 Lease.

Limits of the Cliffs Shaft hard-ore horizon have been established to the north and south with greater precision. Nearly E.-W. faults bordering the Bancroft and Section 10 Leases on the north and south respectively and bounding the "B" Shaft workings on the north and south have removed the ore horizon above the surface of erosion.

The ore horizon, dipping south, rolls back and intersects ledge about 800' south of the south limiting fault mentioned above. It is in this area, where the ore horizon is back below ledge, that a short range surface drilling program was initiated to explore for ore which could be expected above present workings. At the end of the year the three holes that had been drilled in this area, near the Robbins flooring mill, had proven up largely lean and 2nd class conglomerate ore.

10. TAXES:

Comparative data for 1951 and 1950 is shown below:

	<u>1 9 5 1</u>		<u>1 9 5 0</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Realty	2,285,000	85,928.80	2,410,000	91,176.08
Minerals under NW $\frac{1}{4}$ of Sec. 9, 47-27 (with Cliffs Shaft)			(with Cliffs Shaft)	
Personal	801,100	30,125.85	336,100	12,715.47
Lot 2, Sec. 3, 47-27 (Bancroft)	775,000	29,144.34	815,000	30,833.41
Lot 174, Nelson's Addition	100	3.76	100	3.78
S. 35.91 feet of Lot 179	50	1.88	50	1.89
S $\frac{1}{2}$ of NW $\frac{1}{4}$ of Sec. 10, 47-27	<u>1,200,000</u>	<u>45,126.72</u>	<u>1,200,000</u>	<u>45,398.88</u>
Total Cliffs Shaft Mine	5,061,250	190,331.35 <sup>o</sup>	4,761,250	180,129.51
Taxes per ton produced-Less Idle Exp.		.263		.281
Taxes per ton shipped " " "		.253		.307

(<sup>o</sup>) Taxes charged to Idle Expense \$5,760.00 included above

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11. ACCIDENTS AND  
PERSONAL INJURY:

The accident record for the year is shown below:

	<u>Cliffs Shaft</u> <u>Mine</u>	<u>C. C. I. Co.</u> <u>Undg. Mines</u>	<u>C. C. I. Co.</u> <u>All Operations</u>
Tons of Ore Mines	700,346	5,104,814	8,924,843
Hours of Labor	1,096,918 $\frac{3}{4}$	7,126,086 $\frac{1}{4}$	10,875,837 $\frac{3}{4}$
Number of Fatalities	0	2	2
No. of Compensable Accidents	24	111	136
No. of Non- " "	28	228	264
Total Lost Time Accidents	52	341	402
Days Lost, Compensable Injuries	1657	8670	10657
Days Lost, Non-Compensable "	70	530	621
Total Days Lost	1727	21200	21278
Frequency Rate	47.40	47.85	36.96
Severity Rate	1.574	2.975	2.140

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

Fatalities 6,000 days.

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

12. NEW CONSTRUCTION  
OR EQUIPMENT:

The following E. & A.'s were carried over or approved in 1951:

E. & A. No. CC-93 - Exploration drilling has been continued under this account in Section 9, 47-27 for hard ore reserves.

E. & A. No. CC-335 - Repairing the upper portion of "A" Shaft was completed in 1951 and this account was closed. Spent in 1951, \$977.69 - Total expenditure, \$22,379.52

E. & A. No. CC-370 - A JB-D6 Bit Grinder was purchased for the Drill Shop at a cost of \$1,110.00 and this account was closed in 1951.

E. & A. No. CC-376 - Twenty sinker drill machines and jacklegs were purchased at a cost of \$10,215.48 and this account was closed in 1951.

E. & A. No. CC-409 - Remodelling the Dry Building was completed late in the year at a cost of \$36,919.38 and the account was closed in 1951.

E. & A. No. CC-416 - Converting hoist motors to D.C. drive has been suspended pending decision on new shaft. Amount expended to end of year for 2 - D.C. Motors and 2 - D.C. Generators and controls, \$21,187.83. This equipment is usable with proposed hoists for new shaft.

E. & A. No. CC-424 - Ten 76 cu. ft. rocker dump cars were purchased at a cost of \$17,170.18 and this account was closed in 1951.

E. & A. No. CC-427 - Twenty sinker drill machines and jacklegs were purchased at a cost of \$10,602.52 and the account was closed in 1951.

E. & A. No. CC-431 - A new top tram hoist was purchased at a cost of \$15,037.97. New controls and installation cost will complete the expenditure under this account in 1952.



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12. NEW CONSTRUCTION  
OR EQUIPMENT: (Cont'd)

E. & A. No. CC-445 - A 1951 model, 3 cu. yd. Ford Dump truck, was purchased at a cost of \$3,362.95 and this account was closed in 1951.

E. & A. No. CC-446 - Two Chicago-Pneumatic Gopher Drills were purchased at a cost of \$2,740.00 and the account was closed in 1951.

E. & A. No. CC-448 - A 60" Pan Feeder Conveyor was ordered to replace badly worn conveyor in Crusher house. The amount authorized was \$9,500.00.

E. & A. No. CC-455 - A 18" x 16" Oliver Planer was purchased at a cost of \$1,332.30 and a circular power saw will also be purchased under this account for delivery in 1952. The total amount authorized under this account is \$3,500.00.

E. & A. No. CC-459 - A Northwest Crawler Crane, Model 25, was purchased at a cost of \$17,517.49 and the account was closed in 1951.

E. & A. No. CC-464 - A IR-54 Drill Sharpener, a Toledo Threader and a Pneumatic Forging Hammer were order for delivery in 1952. The amount authorized is \$9,200.00

E. & A. No. CC-481 - A D-8 Caterpillar tractor-bulldozer was ordered for delivery early in 1952. The amount authorized was \$20,524.75.

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15. POWER:

The following five year comparison shows power consumption, cost and rate per K.W.H.:

<u>Year</u>	<u>K. W. H.</u>	<u>Cost</u>	<u>Rate per K.W.H.</u>
1951	9,486,529	150,759.93	.015892
1950	8,966,456	145,557.13	.016251
1949	6,890,166	107,479.26	.015375
1948	8,422,715	117,605.65	.013964
1947	8,119,492	113,591.74	.013988

The detail of distribution of power at the mine follows:

	<u>K. W. H.</u>	<u>Cost</u>
Scraping Ore & Rock	1,330,738	\$21,148.10
Pumping	1,279,089	20,327.29
Hoisting	1,574,298	25,018.69
Stocking Ore	37,155	590.47
Crushing Expense	249,658	3,967.57
Dry House "	95,731	1,521.36
Surface "	39,358	625.48
Telephone & Safety Expense	105,337	1,674.01
Mine Office Expense	12,619	200.55
Machine & Carpenter Shop	18,764	298.19
Drill & Bit Shop	45,960	730.40
Heating Plant	10,354	164.56
Compressors	3,903,579	62,035.68
Electric Haulage	748,854	11,900.80
Ventilation	35,035	556.78
<b>Total</b>	<b>9,486,529</b>	<b>\$150,759.93</b>

Comparative data for 1951 and 1950 follows:

	<u>1951</u>	<u>1950</u>	<u>Difference</u>	<u>Increase</u>	<u>Decrease</u>
	<u>K.W.H.</u>	<u>K.W.H.</u>		<u>%</u>	<u>%</u>
Production - Tons	700,346	641,562	58,784	9.16	
Scraping Ore & Rock	1,330,738	1,183,793	146,945	12.41	
Pumping	1,279,298	1,305,970	26,672		2.08
Hoisting	1,574,298	1,451,536	122,762	8.46	
Stocking Ore	37,155	27,000	10,155	37.61	
Crushing Ore	249,658	231,750	17,908	7.72	
Dry House Expense	95,731	78,478	17,253	2.20	
Surface	39,358	45,760	6,402		16.26
Telephone & Safety Exp.	105,337	105,890	553		.52
Mine Office	12,619	11,016	1,603	14.56	
Machine & Carpenter Shop	18,764	3,350	15,414	460.11	
Drill & Bit Shop	45,960	59,358	13,398		29.15
Heating Plant Expense	10,354	11,044	690		.67
Compressors	3,903,579	3,634,800	268,779	7.39	
Electric Haulage	748,854	734,900	13,954	1.89	
Ventilation	35,035	41,821	6,786		19.36
<b>Totals</b>	<b>9,486,529</b>	<b>8,966,466</b>	<b>560,272</b>	<b>6.25</b>	



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1. GENERAL

The production was 259,082 tons compared with 221,636 tons in 1950. The bulk of the tonnage was obtained from ore areas above the 9th Level and the balance or approximately 23% was mined from the small deposit above the 8th Level. There has been practically no change in the size of the labor force during the year, and a working schedule of three eight-hour shifts, six days per week was in effect until April 1. The schedule was then decreased to 5-2/3 days per week.

There was a substantial increase in the total shipments compared to the previous year and the bulk of the tonnage was Lloydale grade. Shipments of Silica grade more than doubled the tonnage last year and accounts for the large increase in the total shipments. All the Lloydale grade in stockpile was loaded out before the end of the shipping season and a small stockpile overrun was realized. The inventory of ore in stock at the close of the year showed 18,666 tons of Lloydale grade and 131,240 tons of Silica grade.

A drilling program has been continued during the year, exploring several deep fault structures to the south and below the present levels. Exploration was also conducted to explore the extent of the sulphurous deposit, and the main orebody below the 9th Level. The results of the drilling program that was conducted from the exploration drift that was driven south on the 8th Level was very disappointing and this program was stopped on the completion of two additional deep holes. Four holes were drilled from the 9th Level to explore the extent of the ore below this elevation in both the sulphurous and main orebodies. The tonnage proven by this drilling, though relatively small, indicated sufficient reserves to justify the cost of sinking the winze and developing the 10th Level. It is estimated the operating life of the mine has been extended about three years by the reserves, but the productive capacity during this period is limited severely by the small size of the orebodies.

Operations were interrupted on two occasions when the Union called wild cat strikes of all company employees. The first strike occurred in June when employees were on strike for 3-2/3 days from June 11th to 14th due to the Union enforcing its demands for a speed-up in the job classification program. In July the Union called a second strike in sympathy with the Athens Mine smoking incident, and 7-2/3 days were lost on this account from July 3rd to 13th. There was no shutdown for vacation purposes in August as has been customary because of the time lost by employees by the strikes.

2. PRODUCTION, SHIPMENTS AND INVENTORIES

a. Production by Grades

<u>Grade</u>	<u>Tons</u>	<u>Percent</u>
Lloydale	125,636	48.5
Lloyd Silica	133,446	51.5
Total	259,082	100.0

The proportion of Silica grade was increased in order to maintain an economical operation as standard grade ore areas were depleted.

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

b. Shipments

Total shipments increased over last year due to the larger proportion of Silica grade mixed in the Cliffs Group cargoes. An overrun of 2,128 tons of Lloyddale grade was realized when the stockpile of this grade was loaded out.

The following table shows the shipments during the past six years:

<u>Year</u>	<u>Lloydale</u>	<u>Lloyd Silica</u>	<u>Lloyd Special</u>	<u>Total</u>
1951	131,954	101,190	-	233,144
1950	142,929	38,153	3,736	184,818
1949	127,384	21,586	-	148,970
1948	55,767	108,388	-	164,155
1947	145,480	272,632	-	418,112
1946	182,664	17,711	-	200,375

c. Stockpile Inventories

<u>Grade</u>	<u>Tons</u>
Lloydale	18,666
Lloyd Silica	131,240
Total	149,906

There was a larger tonnage on hand at the end of the year compared with a year ago and the Silica grade again represents the bulk of the inventory.

d. Division of Product by Levels

<u>Level</u>	<u>Lloydale</u>	<u>Lloyd Silica</u>	<u>Total</u>
8th	52,140	7,457	59,597
9th	73,496	125,989	199,485
Total	125,636	133,446	259,082

The reserves in the small deposit above the 8th Level were practically depleted at the close of the year.

e. Production by Months

<u>Month</u>	<u>Days</u>	<u>Lloydale</u> <u>Tons</u>	<u>Lloyd Silica</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>	<u>Rock</u> <u>Tons</u>	<u>Tons Per</u> <u>Man Per</u> <u>Day</u>
January	26	13,544	14,323	27,867	228	6.95
February	24	9,898	12,251	22,149	135	5.80
March	26-2/3	13,624	11,142	24,766	701	5.99
April	23-2/3	12,312	9,982	22,294	428	5.68
May	24-2/3	11,068	11,252	22,320	118	5.52
June	20	8,388	9,553	17,941	617	5.23
July	16	2,828	11,125	13,953	1,093	5.32
August	25	8,217	14,060	22,277	377	5.66
September	22-1/3	12,157	10,309	22,466	272	6.06
October	25-2/3	12,880	9,034	21,914	30	5.23
November	23	9,643	9,981	19,624	104	5.35
December	21	8,677	10,706	19,383	20	5.53
Total	278	123,236	133,718	256,954	4,123	5.69
Transfers		272	272			
Cur. Yr. Stkpile Overrun		2,128		2,128		
Grand Total		125,636	133,446	259,082	4,123	5.69



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

f. Ore Statement

	<u>Lloydale</u> <u>Tons</u>	<u>Lloyd Silica</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>	<u>Total</u> <u>Last</u> <u>Year</u>
On Hand January 1, 1951	24,984	98,984	123,968	87,150
Output for Year	123,236	133,718	256,954	218,123
Transfers	272	272		
Overruns	2,128		2,128	3,513
Total	150,620	232,430	383,050	308,786
Shipments	131,954	101,190	233,144	184,818
Balance on Hand	18,666	131,240	149,906	123,968
Increase in Output			38,831	
Increase in Shipments			48,326	
Increase in Ore on Hand			25,938	

The operating schedule for the past five years follows:

- 1951 - Hoisting and mining operations three eight-hour shifts per day, six days per week, Jan. 1 to April 1. Effective April 1 hoisting and mining operations three eight-hour shifts per day, five and two thirds days per week.
- 1950 - Hoisting and mining operations three eight-hour shifts per day, five days per week, Jan. 1 to Aug. 21. Effective Aug. 21 hoisting and mining operations three eight-hour shifts per day, six days per week.
- 1949 - Hoisting and mining operations three eight-hour shifts per day, six days per week, Jan. 1 to June 27. Effective June 27 hoisting and mining three eight-hour shifts, five days per week.
- 1948 - Hoisting operations two eight-hour shifts and mining three eight-hour shifts, six days per week, Jan. 1 to Nov. 29. Effective Nov. 29, hoisting and mining operations three eight-hour shifts, six days per week.
- 1947 - Hoisting operations two eight-hour shifts and mining three eight-hour shifts, six days per week Jan. 1 to March 1. Effective March 1, hoisting and mining operations two eight-hour shifts, six days per week.

g. Delays

There were two delays of significance excluding the time lost because of the strikes and they are listed below in the order of their occurrence.

On the day shift June 19th the drive shaft for the pinion gear on the winze hoist broke causing a thirty hour delay to hoisting before a new shaft could be machined and repairs completed. Hoisting was resumed on the afternoon shift June 20th and the estimated loss in tonnage because of the delay was 1,000 tons.



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

g. Delays (Cont'd.)

During the midnight shift August 30 all the power was cut off from the mine when lightning struck the sub station at the Morris Mine and the resulting fire cut off the power to both mines. It was necessary to dam the 9th Level haulage drift for storage of water because no pumping could be done until the power was restored. Hoisting was delayed sixteen hours on this account and the estimated loss in production was 1,600 tons.

3. ANALYSIS

a. Average Mine Analysis on Output

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sul.</u>	<u>Sil.</u>
Lloyddale	125,636	58.10	.138	.077	9.61
Lloyd Silica	133,446	51.51	.123	.039	18.88

b. Analysis of Ore in Stock December 31, 1951

<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>
Lloyddale Dried	18,666	58.11	.132	9.53	.29	2.43	.68	.47	.065	3.07	
Lloyddale Nat'l.		50.46	.115	8.28	.26	2.11	.59	.41	.056	2.67	13.16
Lloyd Sil. Dried	131,240	52.32	.127	17.76	.25	2.58	.57	.48	.040	3.07	
Lloyd Sil. Nat'l.		45.40	.110	15.41	.22	2.24	.49	.42	.035	2.66	13.22

c. Complete Analysis of Ores Shipped

<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>
Lloyddale	131,954	58.30	.145	9.00	.30	2.43	.68	.47	.081	3.07
Lloyd Silica	101,190	51.60	.119	18.90	.25	2.58	.57	.48	.040	3.07

d. Complete Analysis of Straight Cargoes

There were no straight cargo shipments.

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

The following is an estimate of ore reserves as of December 31, 1951 using a factor of 12 cubic feet per ton:

	<u>Standard Ore</u> <u>No. 1 Deposit</u>	<u>Sulphurous Ore</u> <u>No. 2 Deposit</u>	<u>Total Tons</u>
Total Gross as of August 31, 1951	112,581	40,500	153,081
Tonnage Increase as Proven By Drilling August 31, 1951 - December 31, 1951	84,152	262,712	346,864
Total as of December 31, 1951	196,733	303,212	499,945
Less Production Aug. 31 to Dec. 31, 1951	21,679	21,678	43,357
Total Gross as of December 31, 1951	175,054	281,534	456,588
Less 10% for Mining Loss and Rock	19,673	30,321	49,994
Net Total as of December 31, 1951	155,381	251,213	406,594



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4. ESTIMATE OF ORE RESERVES (Cont'd.)

a. Developed Ore (Cont'd.)

The following table shows a comparison of developed ore during the past three years:

	1949	1950	1951
Reserves on January 1	533,848	352,559	197,318
Production	143,512	133,515	125,636
Balance	390,336	219,044	71,682
Reserves on December 31	352,559	197,318	406,594
New Ore Developed	37,777	21,726	334,912

The estimated reserves includes the new ore proven by drilling below the 9th Level and which were excluded from the estimate in the previous year. The bulk of the tonnage below the 9th Level is high-sulphur ore averaging about .700% sulphur. The reserves have been estimated to the proposed 10th Level elevation 150' below the 9th Level.

A small tonnage is estimated in the deposit above the 8th Level and this will be depleted early in 1952. The small reserves above the 9th Level will also be depleted in 1952 but the new ore proven below this elevation has extended the operating life approximately 3 years.

b. Estimated Analysis of Ore Reserves

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Lloyddale Dried	58.00	.140	9.71	.23	2.60	.75	.55	.090	2.45	
Lloyddale Nat'l.	50.46	.122	8.45	.20	2.26	.65	.48	.078	2.13	13.00

5. LABOR AND WAGES

a. General

Membership in the Union at the close of the year was 91.2% of the eligible employees and this is nearly the same ratio as last year. The turnover in labor was quite large and represented 21% of the force. Employee relations have been quite satisfactory and evidence of this is reflected in the very few complaints that have been submitted and the fact that no formal grievances were received during the year. The few complaints were minor in nature and in each case were settled in Step 1 of the grievance procedure.

There were 162 men on the payroll at the end of the year compared with 159 a year ago. There were 20 men who quit, 5 transferred to other mines, 4 died, 2 were retired, 2 enlisted in the military service, 1 was discharged and 1 laid off. There were 37 men hired and 1 transferred from another mine making a net increase of 3 men on the labor force.

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GILBERT BOND



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5. LABOR AND WAGES (Cont'd.)

b. Comparative Statement of Wages and Product

Product	<u>1 9 5 1</u>	<u>1 9 5 0</u>	<u>Incr.</u>	<u>Decr.</u>
	259,082	221,636	37,446	
<u>No. of Shifts and Hours</u>				
Jan. 1 to April 1		3 8-Hr. Hoisting (6 Days Per Week)		
		3 8-Hr. Mining (6 Days Per Week)		
April 1 through Dec. 31		3 8-Hr. Hoisting (5-2/3 Days Per Week)		
		3 8-Hr. Mining (5-2/3 Days Per Week)		
<u>Average Number of Men Working</u>				
Surface	41 $\frac{1}{2}$	43 $\frac{1}{2}$		1 $\frac{1}{2}$
Underground	120 $\frac{1}{2}$	112	8 $\frac{1}{2}$	
Total	161 $\frac{3}{4}$	155 $\frac{1}{4}$	6 $\frac{1}{2}$	
<u>Average Wages Per Day</u>				
Surface	13.66	11.67	1.99	
Underground	14.97	12.93	2.04	
Total	14.64	12.58	2.06	

The following table shows a comparison of the average wages per day for surface and underground for the past five years:

<u>Year</u>	<u>Surface</u>	<u>Underground</u>
1951	13.66	14.97
1950	11.67	12.93
1949	11.62	12.79
1948	11.09	13.02
1947	10.32	11.86

<u>Wages Per Month of 24 Days</u>	<u>1 9 5 1</u>	<u>1 9 5 0</u>	<u>Incr.</u>	<u>Decr.</u>
Surface	327.84	280.08	47.76	
Underground	359.28	310.32	48.96	
Total	351.36	301.92	49.44	

<u>Wages Per Month of 22 Days</u>	<u>1 9 5 1</u>	<u>1 9 5 0</u>	<u>Incr.</u>	<u>Decr.</u>
Surface	300.52	256.74	43.78	
Underground	329.34	284.46	44.88	
Total	322.08	276.76	45.32	

<u>Product Per Man Per Day</u>	<u>1 9 5 1</u>	<u>1 9 5 0</u>	<u>Incr.</u>	<u>Decr.</u>
Surface	22.50	19.29	3.21	
Underground	7.74	7.45	.29	
Total	5.76	5.37	.39	

<u>Labor Cost Per Ton</u>	<u>1 9 5 1</u>	<u>1 9 5 0</u>	<u>Incr.</u>	<u>Decr.</u>
Surface	.610	.605	.005	
Underground	1.932	1.736	.196	
Total	2.542	2.341	.201	



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5. LABOR AND WAGES (Cont'd.)

b. Comparative Statement of Wages and Product (Cont'd.)

	<u>1 9 5 1</u>	<u>1 9 5 0</u>	<u>Incr.</u>	<u>Decr.</u>
Average Product Stoping	27.02	27.88		.86
Average Wages Contract Miners	15.95	14.57	1.38	
<u>Total Number of Days</u>				
Surface	11,516½	11,490½	26	
Underground	33,472	29,764	3,708	
Total	44,988½	41,254½	3,734	
<u>Amount of Labor</u>				
Surface	157,966.05	134,026.66	23,939.39	
Underground	500,510.21	384,875.60	115,634.61	
Total	658,476.26	518,902.26	139,574.00	

Proportion of Surface to Underground Men

1951 - 1 to 2.90  
1950 - 1 to 2.59  
1949 - 1 to 2.70  
1948 - 1 to 1.67  
1947 - 1 to 2.80

6. SURFACE

a. Buildings

There was no building construction and only minor repairs were required to maintain the existing buildings in good condition.

Early in the morning on February 8th a fire broke out in the small building that is used as a check room south of the shaft. The fire originated from an over-heated chimney and was brought under control in a short time. Only slight damage resulted to the building.

A shower room was constructed in the basement of the enginehouse for the convenience of the surface crew.

b. Stocking Grounds

The stockpile of Lloydale grade in the area to the east of the shaft was loaded out before the end of the shipping season. It was not necessary to dismantle the trestle on the south side of this area and only several broken bents were repaired and new bracing installed to put the trestle in good condition again for stocking Lloydale grade.

The area east of the shaft where Silica grade has been stocked was filled to capacity before the shipping season opened making it necessary to erect trestle to the west of the shaft. A total of 20 bents of trestle were erected to provide stocking capacity for Silica grade well into 1952.

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6. SURFACE (Cont'd.)

b. Stocking Grounds (Cont'd.)

The present rock trestle south of the shaft has been nearly filled to capacity. In view of the 10th Level development program it will be necessary to erect additional trestle south of the shaft for rock disposal.

c. Roads

There were no new roads constructed and only minor repairs were required to maintain existing roads around the surface plant in good condition.

7. UNDERGROUND

a. Shaft Sinking

There was no shaft sinking in 1951.

b. Development

The development program was confined almost entirely to the mining areas above the 8th and 9th Levels and nearly all of it was in ore. There were no main level extensions driven and the work was concentrated on the development of sub level stopes and caving areas.

In the small deposit above the 8th Level, development was confined to driving transfer drifts and intermediate drifts and raises for sub level stoping. At the close of the year mining was nearing completion in this deposit as operations approached the 8th Level elevation.

In the main orebody above the 9th Level, the development comprised driving scraping drifts, short raises and intermediate sub drifts for two caving areas at the west end and one at the east end of the deposit. In the caving area at the east end a small amount of development was driven in the footwall slate and with this exception the balance of the development was in ore.

In the sulphurous deposit, development was driven for three small scam stopes and a caving operation that has been continued at the east end.

For the sub level stopes, transfer drifts were advanced from loading slides above the east crosscuts along the strike of the orebody and the balance of the development consisted of driving numerous mill raises and intermediate sub drifts above the transfer. In the caving area at the east end, scraping drifts were advanced on the 95' Sub Level and also on the 45' Sub Level and the balance of the development consisted of driving numerous short mill raises and intermediate sub drifts.

c. Stoping

Caving and stoping methods have continued to be employed exclusively and the bulk of the production was mined by the caving operations. Mining was conducted on 12 sub levels above the 8th Level and 4 above the 9th Level. There was an average of 8 contracts employed, 5 of which were engaged in mining and 3 on development.



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7. UNDERGROUND (Cont'd.)

c. Stoping (Cont'd.)

The following is a detailed description of the mining:

Subs above the 8th Level

390', 360', 350', 325', 300', 285', 260', 250', 235', 225' and 210' Sub Levels

At the close of the year the reserves in the small deposit above the 8th Level were nearly depleted with only a small pillar of ore remaining at the bottom of the stope. The pillar will be recovered by driving top timber transfers directly above the level elevation.

Subs above the 9th Level

Main Orebody

170', 145', 120' and 95' Sub Levels

At the close of the year the area above the 95' Sub Level was completely mined out and caving operations had nearly completed the mining at the west end above the 45' Sub Level. Caving operations were underway late in the year in the pillar at the east end between the 45' and the 95' Subs.

Sulphurous Deposit

170', 145', 95', 70' and 45' Sub Levels

Mining above the 95' Sub Level was completed during the year and at the west end and center of the orebody mining was completed above the 45' Sub Level. Operations were concentrated at the east end of the deposit at the close of the year.

d. Timbering

There was less timber used than last year due to a reduction in the number of mining areas and the cost per ton for timber was lower. The cost of timber supplies increased but factors that have affected timber costs favorably are the continued use of caving and stoping methods and the absence of a large repair program.

Some timber repair work was required on the 9th Level and it consisted of installing lining sets in the two crosscuts, and in a section of the footwall drift between the two crosscuts. Timber had to be installed in a section where the footwall slate is slabbing badly. Lining sets were also installed in the 4th Level drift near Section 6 Shaft.

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7. UNDERGROUND (Cont'd.)

d. Timbering (Cont'd.)

The following is a comparative timber statement for the past two years:

	<u>Lineal Feet</u>	<u>Avg. Price Per Foot</u>	<u>Amount 1951</u>	<u>Amount 1950</u>
6" to 8" Cribbing Timber	2,041	.0770	157.09	1,334.96
8" to 10" Stull Timber	8,578	.1620	1,389.35	1,079.63
10" to 12" Stull Timber	6,217	.2082	1,294.13	1,269.77
12" to 14" Stull Timber	2,477	.2735	677.42	779.57
Total Timber 1951	19,313	.1822	3,517.99	
Total Timber 1950	37,037	.1205		4,463.93
7' Lagging	145,369	.01546	2,246.79	3,771.66
9½' Poles	59,639	.03446	2,055.19	3,152.43
Total Lagging and Poles 1951	205,008	.02098	4,301.98	
Total Lagging and Poles 1950	367,163	.01886		6,924.09
Product - Tons			259,082	221,636
Cost Per Ton For Timber			.0136	.0201
Cost Per Ton For Lagging			.0087	.0170
Cost Per Ton For Poles			.0079	.0142
Cost Per Ton For All Timber			.0302	.0514

E & A cc-346

10" to 12" Stull Timber	59.30
7' Lagging	81.64
9½' Poles	194.32
Total Lagging and Poles E & A cc-346 1950	275.96
Total Timber Used in Mine 1950	4,523.23
Total Lagging and Poles Used in Mine 1950	7,200.05

The following table shows a comparison of total cost of timbering for the past five years:

<u>Year</u>	<u>Amount</u>	<u>Cost Per Ton</u>
1951	7,819.97	.0302
1950	11,388.02	.0514
1949	10,469.95	.0503
1948	9,079.00	.0924
1947	12,291.85	.0484

e. Drifting and Raising

There was less footage driven than in 1950 and it was again chiefly drifting and raising in ore in connection with the stoping and caving operations.

<u>Year</u>	<u>Drifting</u>		<u>Total</u>	<u>Raising</u>		<u>Total</u>	<u>Grand Total</u>
	<u>Ore</u>	<u>Rock</u>		<u>Ore</u>	<u>Rock</u>		
1951	4269'	127'	4396'	3422'	81'	3503'	7899'
1950	4698'	139'	4837'	3457'	135'	3592'	8429'



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7. UNDERGROUND (Cont'd.)

e. Drifting and Raising (Cont'd.)

The following table shows a comparison of the development footage excluding the footage classified under small drift and raise:

<u>Year</u>	<u>Drifting</u>			<u>Raising</u>			<u>Grand Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Total</u>	<u>Ore</u>	<u>Rock</u>	<u>Total</u>	
1951	1788'	105'	1893'	-	20'	20'	1913'
1950	2322'	24'	2346'	240'	-	240'	2586'

f. Explosives, Drilling and Blasting

There was a decrease in the amount of explosives consumed over last year due to completion of the exploration drifting under E & A cc-346 on the 8th Level. Despite the increases in the cost of explosive supplies, the cost per ton was lower because of the larger production. Gelamite 1-X powder has continued to be used exclusively in the mining and development and high pressure Gelatin in 5 lb. cartridges is used in blasting large chunks in the caving and stoping operations. A small quantity of Hercomite X powder was used in blasting the frozen stockpile ahead of the loading operations during the early part of the shipping season.

The explosives statements are shown in the following tables:

	<u>Quantity</u>	<u>Average</u>	<u>Amount</u>	<u>Amount</u>
	<u>Lbs.</u>	<u>Price</u>	<u>1951</u>	<u>1950</u>
<u>Breaking Ore</u>				
Gelamite 1-X 60%	83,720	.1675	14,023.46	16,119.96
Gelatin Hi-Pressure 60% 5x5	14,500	.2200	3,190.00	1,273.50
Total Powder	98,220	.1753	17,213.46	17,393.46
Fuse - Feet	259,095	.00926	2,400.11	2,769.32
Blasting Caps No. 6	34,541	.01567	541.15	535.35
Fuse Lighters 7"	7,329	.00900	65.97	52.21
Primacord - Feet	8,233	.03322	273.48	22.40
Total Fuse, Caps, Etc.			3,280.71	3,379.28
Total Expense Breaking Ore			20,494.17	20,772.74
Product - Tons			259,082	221,636
Lbs. Powder Per Ton of Ore			.379	.488
Cost Per Ton For Powder			.066	.078
Cost Per Ton For Fuse, Caps, Etc.			.013	.015
Cost Per Ton For All Explosives			.079	.093
<u>Development in Rock</u>				
Gelamite 1-X 60%	1,850	.1675	309.92	75.33
Fuse - Feet	8,265	.00926	76.51	11.80
Blasting Caps No. 6	799	.01589	12.70	7.50
Fuse Lighters 7"	171	.00901	1.54	-
Primacord - Feet	67	.03254	2.18	-
Total Fuse, Caps, Etc.			92.93	19.30
Total Expense Development in Rock			402.85	94.63

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7. UNDERGROUND (Cont'd.)

f. Explosives, Drilling and Blasting (Cont'd.)

	<u>Quantity</u> <u>Lbs.</u>	<u>Average</u> <u>Price</u>	<u>Amount</u> <u>1951</u>	<u>Amount</u> <u>1950</u>
Rock Drifting - Feet			154	24
Cost Per Foot For Powder			2.01	3.14
Cost Per Foot For Fuse, Caps, Etc.			.60	.80
Cost Per Foot For All Explosives			<u>2.61</u>	<u>3.94</u>
Total Explosives Used - Breaking Ore and Rock Development			20,897.02	20,867.37
Cost Per Ton - All Explosives			.081	.094
Average Price Per Lb. For Powder			.1751	.1605
 <u>Blasting Stockpile</u>				
Hercomite X	500	.1550	77.50	81.25
Gelamite 1-X 60%				<u>15.25</u>
Total Explosives Used - Blasting Stockpile			77.50	96.50
 <u>E &amp; A cc-346</u>				
Gelamite 1-X 60%			-	2,377.13
Fuse - Feet			-	395.22
Blasting Caps No. 6			-	<u>96.80</u>
Total Fuse and Caps			-	492.02
Total Explosives Used - E & A cc-346			-	2,869.15
 Grand Total Explosives Used in Mine			20,974.52	23,833.02
Average Price Per Lb. For Powder			.1750	.1584

g. Ventilation

Two fans operating in series have continued to provide good ventilation in the mine. The main fan located at Section 6 Shaft and the other on the 8th Level together deliver a volume slightly in excess of 18,000 C.F.M. In the summer months the fans exhaust up the Section 6 Shaft and in freezing weather the direction of the ventilating current is reversed for long periods to exhaust up the hoisting shaft and reduce the formation of ice.

In the mining areas above the 8th Level and also two separate areas above the 9th Level, ventilation is supplied by auxiliary fans with metal pipe extending from the level to the working place and exhausting the air into raises and drifts that connect with the 4th Level airway.

There was a new ventilation connection driven on the 9th Level to insure adequate ventilation for mining areas above the east crosscut. On the 5th Level a long section of the old haulage drift has caved but the drift has not been blocked and still serves satisfactorily as an airway.



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8. COST OF OPERATING

a. Comparative Mining Costs

	<u>1951</u>	<u>1950</u>
Product - Tons	259,082	221,636
Underground Costs	2.496	2.408
Surface Costs	.499	.512
General Mine Expenses	.615	.601
Cost of Production	3.610	3.521
Depreciation	.222	.290
Taxes	.037	.034
Loading and Shipping	.086	.089
Total Cost at Mine	3.955	3.934
Budget Estimated at Mine	4.039	3.771
No. of Shifts and Hours	15, 1-8 Hr.	18, 1-8 Hr.
	57, 2-8 Hr.	24, 2-8 Hr.
	235, 3-8 Hr.	244, 3-8 Hr.
Total Operating Days	278	266
Average Daily Product	932	775

b. Detailed Cost Comparison

	<u>1951</u>		<u>1950</u>	
	Amount	Per Ton	Amount	Per Ton
Additional Wage Adjustment	28,273.72	.109	2,392.66	.010
1. Exploring in Mine	12,565.00	.048	1,454.63	.007
2. Sinking in Shaft	-	-	-	-
3. Development in Rock	5,440.53	.021	841.46	.004
4. Development in Ore	61,726.48	.239	96,928.17	.437
5. Stoping	189,149.57	.731	138,431.12	.625
6. Timbering	48,978.99	.189	54,883.99	.248
7. Trammig	154,096.31	.595	103,361.42	.466
8. Ventilation	3,996.83	.015	5,417.95	.024
9. Pumping	37,153.18	.143	34,149.83	.154
10. Compressors and Air Pipes	23,159.17	.089	25,954.73	.117
11. Back Filling	-	-	-	-
12. Underground Superintendence	21,140.51	.082	19,190.09	.087
13. Cave-in or Fire in Mine	-	-	-	-
14. Maint.: Compressors and Power Drills	5,913.66	.023	5,985.08	.027
15.       Scrapers and Mech. Loaders	23,538.64	.091	15,345.25	.069
16.       Trammig Equipment	20,768.69	.080	21,420.81	.096
17.       Pumping Machinery	10,746.51	.041	10,390.53	.047
Total Underground Costs	646,647.79	2.496	536,147.72	2.418

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8. COST OF OPERATING (Cont'd.)b. Detailed Cost Comparison (Cont'd.)

	1951		1950	
	Amount	Per Ton	Amount	Per Ton
18. Hoisting	43,769.18	.169	40,397.26	.183
19. Stocking Ore	23,726.14	.091	17,523.95	.079
20. Screening - Crushing at Mine	326.55	.001	1,241.19	.006
21. Dry House	16,826.17	.065	14,463.94	.065
22. General Surface Expense	20,342.22	.079	18,272.58	.082
23. Maint.: Hoisting Equipment	12,999.05	.050	12,890.68	.058
24.     Shaft	3,295.36	.013	2,884.26	.013
25.     Top Tram Equipment	2,809.70	.011	3,488.43	.016
26.     Docks, Trestles & Pockets	2,970.14	.011	860.16	.004
27.     Mine Buildings	2,251.50	.009	1,347.90	.006
Total Surface Costs	129,316.01	.499	113,370.35	.512
28. Geological	885.80	.003	1,200.00	.005
29. Mining Engineering	5,460.60	.021	4,038.28	.018
30. Mechanical & Electrical Engineering	2,042.74	.008	1,641.08	.007
31. Analysis and Grading	22,391.36	.086	17,232.33	.078
32. Safety Department	2,322.88	.009	1,981.36	.009
33. Telephones and Safety Devices	3,378.65	.013	3,058.54	.014
34. Local and General Welfare	2,116.50	.008	2,042.23	.009
35. Special Exp., Pensions & Allowances	3,556.15	.014	4,278.46	.019
36. Ishpeming Office	17,250.49	.067	13,540.23	.061
37. Mine Office	22,119.38	.085	20,987.19	.095
38. Insurance	12,778.19	.049	13,196.81	.060
39. Personal Injury	23,412.14	.091	13,652.98	.062
40. Social Security Taxes	14,672.69	.057	13,198.82	.060
41. Employees Vacation Pay	22,661.64	.088	20,160.00	.091
42. Research Laboratory	4,145.91	.016	718.64	.003
Total General Mine Expenses	159,195.12	.615	130,926.95	.591
Cost of Production	935,158.92	3.610	780,445.02	3.521
43. General Supplies	24,459.85	.094	22,669.81	.102
44. Iron and Steel	8,495.21	.033	14,209.81	.064
45. Oils and Greases	2,505.01	.010	2,225.63	.010
46. Machinery Supplies	22,050.82	.085	20,803.09	.094
47. Explosives	20,974.52	.081	20,963.87	.095
48. Lumber and Timber	16,808.60	.065	17,051.63	.077
49. Fuel	4,297.98	.017	5,115.32	.023
50. Electric Power	56,575.13	.218	51,084.45	.230
51. Sundries	14,542.64	.056	16,666.21	.075
Total Supplies	170,709.76	.659	170,789.82	.770

The following is the maintenance expense during the idle period on account of the strike:

<u>Month</u>	<u>Amount</u>
July	\$ 7,262.15



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8. COST OF OPERATING (Cont'd.)

b. Detailed Cost Comparison (Cont'd.)

Following are explanations of operating costs that show significant variations as compared with the previous year:

1. Exploring in Mine

The large increase in this expenditure is due to the drilling that was conducted from the 9th Level to explore the downward extension of the sulphurous and main orebodies.

3. Development in Rock

The increase in this expenditure is due to driving more rock development for ventilation purposes.

4. Development in Ore

There was a decrease in this expenditure due to the smaller ore development program.

5. Stoping

There was a large increase in this account due to the increase in wages and supply costs.

	<u>1951</u>		<u>1950</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
General Supplies	2,210.43	.009	2,091.66	.009
Iron and Steel	2,779.18	.011	3,444.93	.016
Oils and Greases	271.11	.001	430.53	.002
Machinery Supplies	3,691.14	.014	5,451.46	.025
Explosives	15,336.14	.059	12,386.80	.056
Lumber and Timber	19.19	-	22.71	-
Electric Power	7,533.01	.029	6,415.07	.029
Sundries	669.92	.003	181.54	.001
Expense Accounts	2,900.07	.011	1,993.49	.009
<u>Total Supplies</u>	<u>35,410.19</u>	<u>.137</u>	<u>32,418.19</u>	<u>.147</u>
Payroll Labor	143,107.05	.553	97,404.09	.439
Gen'l. Sthse. & Gen'l. Shops Labor	843.58	.003	469.84	.002
Shops, Labor Etc.	9,788.75	.038	8,139.00	.037
<u>Total Labor</u>	<u>153,739.38</u>	<u>.594</u>	<u>106,012.93</u>	<u>.478</u>
Grand Total	189,149.57	.731	138,431.12	.625

7. Tramming

The large increase in this account is due chiefly to the increase in wages.

8. Ventilation

The decrease in the expenditure in this account is due to less maintenance required on ventilating equipment.

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8. COST OF OPERATING (Cont'd.)

b. Detailed Cost Comparison (Cont'd.)

9. Pumping

The slight increase in this expenditure is due to the increase in wages.

Dec.	Year	Total Inland Steel Co.			C.C.I. Co. Proportion		
		Amount	Avg. G.P.M.	Percent	Amount	Avg. G.P.M.	Percent
	1951	8,663.71			1,252.53	200.0	10.89
	1950	63,975.21	1805.3	93.59	7,286.86	123.7	6.41
	1949	100,820.55	1192.5	93.24	5,400.93	86.4	6.76
	1948	84,077.89	1076.3	93.07	5,855.38	80.2	6.93
	1947	65,474.05	966.8	90.00	7,482.69	109.2	10.00

Water was diverted to the Morris Mine in December from 12/3 to 12/31 inclusive when the Wheatley pump on the 8th Level was undergoing repairs.

10. Compressors and Air Pipes

The slight decrease in this expenditure is due to less maintenance work on air and water piping.

12. Underground Superintendence

The size of the supervisory force has remained the same. The expenditure in this account was larger due to the increase in salaries. A Christmas bonus of \$100.00 was paid each salaried supervisor.

15. Scrapers and Mechanical Loaders

The increase in this account is due to more maintenance and purchase of new equipment.

18. Hoisting

The increase in this expenditure is due to the increase in wages.

19. Stocking Ore

The increase in this account is due to more trestle construction and the increase in wages.

22. General Surface Expense

The increase in this expenditure is due to the increase in wages.

27. Mine Buildings

The increase in this account is due to more maintenance required on the buildings and the installation of a baseboard insulation in the office building.



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8. COST OF OPERATING (Cont'd.)

b. Detailed Cost Comparison (Cont'd.)

28. - 42. Inclusive

The expense in direct charges was higher in nearly every account due to the increase in wages, salaries and supply costs.

9. EXPLORATION AND FUTURE EXPLORATION

A drilling program was conducted to test the downward extension of the ore below the 9th Level. Three holes were drilled from the 9th Level and one from the #45' Sub Level. The drilling proved sufficient tonnage to warrant sinking the winze shaft an additional 150' and develop the 10th Level. Early in 1952 work was started in this development. Two additional holes were drilled from the exploration drift that was driven south on the 8th Level. No ore was encountered by this exploration and the program was abandoned early in the year. The following are logs of the drilling during the year:

D.D.H. No. 185  
8th Level N 0° -35' W Dip -59°

0' - 53'	Hem. Cherty I. F.
53' - 65'	Lean Cherty Carb. I. F.
65' - 180'	Hard Hem. Cherty I. F.
180' - 208'	Hem. Goethitic Cherty I. F.
208' - 215'	Hem. Cherty I. F.
215' - 245'	Hem. Goethitic Cherty I. F.
245' - 330'	Cherty I. F.
330' - 335'	Dike
335' - 502'	Cherty I. F.
502' - 565'	Hem. Cherty I. F.
565' - 573'	Dike
573' - 663'	Hem. Cherty I. F.
663' - 711'	Normal Hem. Cherty I. F.
711' - 718'	Lean Ore
718' - 741'	Rich Hem. Cherty I. F.
741' - 748'	Argillite

D.D.H. No. 186  
8th Level Due South Dip 90°

0' - 10'	Semi Hard Hem. Cherty I. F.
10' - 34'	Cherty Carb. I. F.
34' - 100'	Hem. Cherty I. F.
100' - 368'	Cherty Carb. I. F.
368' - 583'	Cherty Mag. Carb. I. F.
583' - 766'	Cherty Mag. Carb. I. F.
766' - 858'	Cherty Carb. I. F.
858' - 1177'	Cherty Carb. I. F.
1177' - 1223'	Cherty I. F.

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9. EXPLORATION AND FUTURE EXPLORATION (Cont'd.)

D.D.H. No. 187

9th Level S -55° 25' W 0° 58'

0' - 140'	Argillite and Graywacke
140' - 193'	Dike
193' - 315'	Argillite

D.D.H. No. 188

9th Level S 0° 18' E Dip -45° 22'

0' - 7'	Dark Gray Argillite
7' - 26'	Fe. Argillite
26' - 81'	1st Class Ore
81' - 94'	Dike
94' - 114'	Intrusive
114' - 123'	Lean Ore
123' - 125'	1st Class Soft Ore
125' - 160'	Intrusive
160' - 165'	Ore
165' - 174'	Intrusive
174' - 185'	Ore
185' - 219'	Argillite

D.D.H. No. 189

9th Level Vertically

0' - 20'	Hem. Cherty I. F.
20' - 27'	Lean Soft Ore
27' - 50'	1st Class Soft Ore
50' - 70'	1st Class Sulphurous Ore
70' - 176'	1st Class Hi Sulphur Ore
176' - 200'	2nd Class Hi Sulphur Ore
200' - 245'	1st Class Soft Ore
245' - 274'	Fe. Intrusive
274' - 284'	No Sample
284' - 302'	Argillite

D.D.H. No. 190

9th Level N 2° 10' W Dip -75°

0' - 25'	Rich Hem. Cherty I. F.
25' - 42'	Lean Soft Granular Ore
42' - 148'	1st Class Sulphurous Soft Ore
148' - 192'	2nd Class Sulphurous Soft Ore
192' - 249'	Argillite



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10. TAXES

The following shows a comparison of the taxes paid in 1951 and 1950 in Ishpeming Township:

	<u>1 9 5 1</u>		<u>1 9 5 0</u>	
<u>Lloyd and Section 6</u>	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6, 47-27, 40 Acres)				
N $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6, 47-27, 81.67 " )				
N $\frac{1}{2}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27, 80 " )	100,000	2,030.59	125,000	1,990.51
Personal, Ore in Stock, Supplies and Equipment	370,000	7,513.18	345,000	5,493.81
Total by State Tax Commission	470,000	9,543.77	470,000	7,484.32
Collection Fee		95.44		74.84
Total	470,000	9,639.21	470,000	7,559.16
<u>C.C.I. Co. Misc. Lands</u>				
S $\frac{1}{2}$ of NE $\frac{1}{4}$ of Sec. 6, 47-27, 80 Acres	550	11.16	550	8.76
SE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec. 6, 47-27, exc. R/W 41.08 A.	550	11.16	550	8.76
S $\frac{1}{2}$ of SW $\frac{1}{4}$ of Sec. 6, 47-27, 81.26 Acres	900	18.28	900	14.33
SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27	550	11.17	550	8.76
SE $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec. 6, 47-27	600	12.18	600	9.55
Total	3,150	63.95	3,150	50.16
Collection Fee		.64		.50
Total Lloyd Mine	473,150	9,703.80	473,150	7,609.82
<u>West Ishpeming</u>				
Lot 4 Block 2	75	1.53	75	1.20
<u>North Lake Location</u>				
Houses on Sec. 6, 47-27	10,075	206.63	10,075	162.05
Total Ishpeming Township	483,300	9,911.96	483,300	7,773.07
Rate		2.03059		1.59241
Taxes Per Ton Produced	<u>1951</u>	<u>1950</u>	<u>1949</u>	<u>1948</u>
Taxes Per Ton Shipped	.037	.034	.031	.117
	.042	.041	.044	.070
			.070	.029

11. ACCIDENTS AND PERSONAL INJURY

The accident frequency rate was lower than last year but there was a large increase in the severity rate due to a fatal accident. There were eight compensable accidents and one fatality as compared with seven compensable accidents in the previous year. The total man days worked increased from 41,771 in 1950 to 44,296 in 1951 and the man days lost on account of all accidents was 6,542 which includes the time charge of 6,000 days for the fatality. The following table shows a comparison of the severity and frequency rates:

<u>Year</u>	<u>Frequency Rate</u>	<u>Severity Rate</u>
1951	47.97	18.480
1950	59.84	.966

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

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11. ACCIDENTS AND PERSONAL INJURY (Cont'd.)

The accidents are listed in detail as follows:

Accident No. 905, January 8, 1951, Eugene D. Peterson, Motorman. While pulling cars off the winze cage with an electric tugger he noticed the coupling on the car in the cage was not lined up to couple with the end car in the train of empties. He left the hoist running, releasing the handles, and went into the cage to line up the coupling. While doing this the control handle dropped into position causing the train of empty cars to be pulled into the cage, squeezing him against the edge of the cage. Contusion dorsol area and right upper arm - time lost - 13 days.

Accident No. 906, March 3, 1951, Eric A. Setala, Brakeman. While replacing the stopper board across the chute he slipped off the end of the car and struck his leg against the side of the car. Cellulitis right lower leg - time lost - 14 days.

Accident No. 907, April 13, 1951, Napoleon Peppin, Carpenter. While he was climbing the back end of a railroad car under the pocket he grabbed the brake wheel and the wheel suddenly released throwing him to the ground. Contusion of left side of body - time lost - 9 days.

Accident No. 908, April 17, 1951, John E. Maki, Contract Miner. Maki and his partner were planking No. 830 Raise and while his partner was driving a spike with an axe Maki was steadying the plank with one foot and the axe glanced off the head of the spike striking him in the foot. Fracture of first phalanx 5th toe left foot - time lost - 59 days.

Accident No. 909, May 21, 1951, Albert Poirier, Timberman. Poirier was trimming loose ground from the back and when a large chunk dropped he let go of the bar and swung his hand back striking it against the corner of a car. Fracture of 4th left metacarpal - time lost - 53 days.

Accident No. 910, May 16, 1951, Felix Juhola, Co. Acc't. Miner. While hanging scraper ropes on the side of the drift about 10' from the edge of a mill raise, a chunk rolled from the mill and struck him on the left foot. Fracture of the 5th metatarsal bone left foot - time lost - 65 days.

Accident No. 911, June 10, 1951, Paul F. Grund, Miner. Paul Grund, Francis Nault and Wilhardt Alanko were cutting out and timbering No. 832 Raise. Room had been blasted for two sets of timber and two legs were hoisted into the place and put up at the North end of the raise. Two more legs were then hoisted and landed into the place. Nault then stepped over to the ladder compartment and called for Alanko to bring up a short piece of pole. At this instant a large chunk dropped from the hanging side of the raise striking Grund and killing him instantly. Fatality - time charged - 6,000 days.

Accident No. 912, August 14, 1952, Fred J. Peppin, Blacksmith. While working in the tunnel in the basement of the office building he bumped and broke a 3/4" pressure release pipe on the steam line causing the escaping steam to burn his right arm. First and second degree burns - time lost - 9 days.



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11. ACCIDENTS AND PERSONAL INJURY (Cont'd.)

Accident No. 913, December 5, 1952, Arthur Dolkey, Contract Miner. While Dolkey was drilling at the entrance to a stope a piece of ground fell from the right side and struck him in the back and right leg. Fracture comminuted right tibia and fracture simple right fibula. Fracture spinous processes 2nd, 3rd and 4th vertebrae left - time lost to end of year - 26 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was very little new construction on surface and the usual construction of stocking trestle at the close of the shipping season comprised most of the work.

There was no new construction underground during the year but early in 1952 the 10th Level development program will be started. Before work is started sinking the winze it will be necessary to move the winze hoist to a position 55' back from its present location to provide a permissible fleet angle for the additional depth from which hoisting will be done. A new hoist room will be constructed and turn sheaves will be installed at the present hoist site. Upon completion of this work the winze shaft will be sunk 150' to the 10th Level elevation.

It is planned to construct a new sump and pump station near the 8th Level plat and replace the sump now in use. It is planned to convert the present sump near the shaft into a storage trench and eliminate hoisting operations on one shift when the new level is brought into production.

13. EQUIPMENT AND PROPOSED EQUIPMENT

There was some new equipment purchased in view of the decision to develop the 10th Level. Listed below are the additions to the equipment inventory:

<u>Item</u>	<u>Number</u>	<u>Cost</u>
G.E. 100 h.p. Motor	1	\$ 1609.14
Wheatley Pump 500 G.P.M.	1	5184.98
Thor Electric Drill	1	55.00
I.R. RB 12 Drill Machines	5	1640.00
Joy Chunk Breakers	4	840.00
I.R. Scraper Hoist	1	3020.00
Westinghouse 25 h.p. Motor	1	850.00
G.E. Elec. Welding Machine	1	510.00
Wright Power Saw	1	295.65
Gasoline Power Chain Saw	1	394.70
Hot Water Tank	1	317.25

14. MAINTENANCE AND REPAIRS

a. Mine

There was only one major breakdown of equipment and that was failure of the pinion gear shaft on the winze hoist on June 19th. A new shaft was machined and fitted to the pinion gear in the General Shops.

In the skip compartments above the 4th Level new runners were installed replacing a large number of old runners that were worn badly after many years of service.

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14. MAINTENANCE AND REPAIRS (Cont'd.)

a. Mine (Cont'd.)

Transferring the underground tram cars through the winze between the 8th and 9th Levels has continued to cause more than the usual amount of wear on the cars and these have required a lot of attention to realize the best efficiency in tramping.

b. Surface

Normal repairs and maintenance was done on the surface buildings. On February 8th a fire in the check room building caused some damage which required minor repairs.

c. Location

1. General Maintenance

There has been no maintenance expense on the water supply system since it was turned over to Ishpeming Township. On March 1st, 1951 the clubhouse was turned over to the Roman Catholic Diocese of Marquette, Michigan. This building was closed and unused since 1946.

2. Rented Buildings

The maintenance expense on rented buildings was much less than last year. The sale of the Manager's former residence and less repairs on the store building accounts for the decrease in this expense. The following is a comparison of the expenditures on rented buildings for the past five years:

<u>Year</u>	<u>Amount</u>
1951	130.44
1950	486.37
1949	1504.12
1948	455.91
1947	581.23

15. POWER

There was an increase in the amount of power consumed due to the larger operation. There was a delay to operations due to lack of electric power when lightning struck the substation at the Morris Mine and the resulting fire cut off power to the Lloyd Mine until the next day. The following is a five-year comparison of the power cost:

<u>Year</u>	<u>K.W.H.</u>	<u>Cost</u>	<u>Rate</u>
1951	3,519,600	57,504.42	.01634
1950	3,026,400	51,125.78	.01689
1949	2,208,000	35,444.04	.01605
1948	1,994,400	31,640.64	.01586
1947	2,335,200	36,760.08	.01580

16. WATER SUPPLY

The water supply has continued to be obtained from the Morris Mine deep well and from the 2nd Level. The water supply is being chlorinated as in the past.



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17. CONDITION OF PREMISES

There were no improvements or landscaping done on the premises but the trees and shrubbery around the mine buildings and the lawn have been maintained in an attractive condition during the summer months.

MATHER MINE "A" SHAFT  
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1. GENERAL:

The production for the year 1951 was 1,157,013 tons and the shipments for the year were 1,160,192 tons, this being the fourth year that the mine produced over a million tons. There was a decrease in production from the previous year of 94,950 tons. This decrease was due to the lack of developed reserves in the mine as the 7th Level development was not far enough advanced to get this level into production during the year. The mine operated on a full six day schedule through March 31st and then was decreased to five and two-thirds schedule for the balance of the year.

Mining operations were completed on the 2nd Level early in the year and production on the 3rd and 5th Levels dropped considerably, as the reserves on these levels were nearing depletion. The production on the 6th Level, the only level with adequate reserves, hit its peak during the year, as the large reserves on this level are practically depleted. The 7th Level development was continued with as many crews as possible in both sub-level and main level development and production on this level should start early in 1952. Production by levels for the year was as follows:  
2nd Level - 3,337 tons, 3rd Level - 179,802 tons, 5th Level - 215,239 tons, 6th Level - 719,424 tons and the 7th Level - 22,584 tons.

Satisfactory labor relations were continued throughout the year, as evidenced by the fact that there were no grievances that went beyond the discussion stage with the local grievance committee. There were two "quickie" strikes during the year; the first strike was on the job evaluation program and lasted four days, from June 10 to June 14, 1951; the second strike, which started July 2, 1951 and ended July 13, 1951, was caused by a grievance at the Athens Mine as a result of the discharge of one of the employees on the no-smoking rule infraction. Both of these strikes were very unpopular with a large majority of the employees at the mine and caused a considerable amount of resentment toward the union and union leaders by the members of the union.

The man power situation was not as favorable as in previous years, especially in the skilled miner class. Numerous men, woods workers and miners from outlying districts, would have been available for employment if the housing situation would not have been so acute. There definitely will be some relief from this situation when the houses in the new 8th Addition will become available for occupancy.

Shipments from pocket and stockpile were started early in April and were continued through to the latter part of November.



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

The 7th Level conveyor belt drift and the excavation for the crusher and pan feeder were completed during the year and work on the loading trench was nearing completion at the end of the year.

Shaft sinking operations were continued during the year and the shaft, at the end of the year, was down 211' below the 21' rock pentice. The excavation for the sinking hoist, 80' below the shaft bottom, was completed and the sinking hoist was installed early in the year. Operations in this project were slowed considerably due to bad ground conditions.

A considerable amount of experimenting was done with the arched and circular steel supports for transfer drifts. The latest design, which is a four piece circular set, has proven far superior to wood timber sets in supporting both stoping and block caving transfer drifts. Rotary drilling, using flight auger steel, has proven very successful in drilling long holes for under-cutting and stoping in ore. Drilling speeds have practically been doubled with the rotary machines, as compared with percussion machines.

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2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:

a. Production by Grade:

	<u>Product</u>	<u>Stockpile</u> <u>Overrun</u>	<u>Total</u>	<u>1950</u> <u>Total</u>
Mather	1,061,686	16,627		
Mather Special	78,700	-		
Total	1,140,386	16,627	1,157,013	1,251,963
Rock			170,467	169,026

b. Shipments:

	<u>Pocket</u> <u>Tons</u>	<u>Stockpile</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>	<u>Total</u> <u>1950</u>	<u>Decrease</u>
Mather	525,091	556,401	1,081,492		
Mather Special	50,280	28,420	78,700		
Total	575,371	584,821	1,160,192	1,274,440	114,248

All three stockpiles were cleaned up by the end of the year, developing an overrun of 16,627 tons.

c. Stockpile Inventories:

	<u>1951</u>	<u>1950</u>
Mather	121,361	124,540

d. & e. Division of Product by Levels and by Months:

<u>Months</u>	<u>Second</u> <u>(1600')</u> <u>Level</u>	<u>Third</u> <u>(1750')</u> <u>Level</u>	<u>Fifth</u> <u>(2050')</u> <u>Level</u>	<u>Sixth</u> <u>(2200')</u> <u>Level</u>	<u>Seventh</u> <u>(2400')</u> <u>Level</u>	<u>Total</u>	<u>Rock</u>
January	3,337	19,462	40,549	59,436	2,537	125,321	12,672
February	-	19,075	29,462	36,900	824	86,261	25,014
March	-	18,712	37,649	42,911	2,125	101,397	13,233
April	-	22,945	30,190	66,418	1,208	120,761	12,914
May	-	21,156	14,475	72,375	3,340	111,346	11,880
June	-	21,051	10,983	58,576	915	91,525	14,443
July	-	10,917	4,776	51,173	1,365	68,231	8,503
August	-	10,600	6,744	76,122	2,891	96,357	14,850
September	-	4,386	8,772	72,805	1,754	87,717	13,926
October	-	6,365	11,820	71,830	909	90,924	16,533
November	-	15,346	8,526	59,686	1,705	85,263	12,507
December	-	9,787	11,293	51,192	3,011	75,283	13,992
	3,337	179,802	215,239	719,424	22,584	1,140,386	170,467

Current Year Stockpile Overrun

16,627  
1,157,013

Mather "A" 1951



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2. PRODUCTION,  
SHIPMENTS &  
INVENTORIES:  
(Continued)

f. Ore Statement:

	<u>1951</u>	<u>1950</u>
On Hand January 1, 1951	124,540	147,017
Output for Year	1,140,386	1,236,712
Overrun	16,627	15,251
Total	1,281,553	1,398,980
Shipments	1,160,192	1,274,440
Balance on Hand	121,361	124,540
Decrease in Output	96,326	
Increase in Output		189,799
Decrease in Ore on Hand		22,477
Decrease in Ore on Hand	3,179	

Working Schedule:

1951 - 3-8 hr. shifts, 6 days per week, Jan. 1st to Mar. 31st.  
3-8 hr. shifts, 5-2/3 days per week, April 1st to Dec. 31st.

1950 - 3-8 hr. shifts, 5 days per week, Jan. 1st to Aug. 20th.  
3-8 hr. shifts, 6 days per week, Aug. 21st to Dec. 31st.

1949 - 3-8 hr. shifts, 6 days per week, Jan. 1st to June 26th.  
3-8 hr. shifts, 5 days per week, June 27th to Sept. 30th.  
Idle account of strike, Oct. 1st to Nov. 13th.  
3-8 hr. shifts, 5 days per week, Nov. 14th to Dec. 31st.

1948 - 2-8 hr. shifts\*, 6 days per week, Jan. 1st to Dec. 31st.  
(Practically a three shift operation by the end of the year)

1947 - 2-8 hr. shifts\*, 6 days per week, Jan. 1st to Feb. 18th.  
Idle account of water trouble, Feb. 19th to 26th.  
2-8 hr. shifts\*, 6 days per week, Feb. 27th to Dec. 31st.

1946 - 2-8 hr. shifts\*, 6 days per week, Jan. 1st to Feb. 7th.  
Idle account of strike, Feb. 8th to May 21st.  
2-8 hr. shifts\*, 6 days per week, May 22nd to Dec. 31st.

1945 - 3-8 hr. shifts, 5 days per week, Jan. 1st to 3rd.  
2-8 hr. shifts, 5 days per week, Jan. 4th to 19th.  
2-8 hr. shifts, 6 days per week, Jan. 22nd to Dec. 31st.

1944 - 3-8 hr. shifts, 5-1/3 days per week, Jan. 1st to July 31st.  
3-8 hr. shifts, 5 days per week, Aug. 1st to Dec. 31st.

1943 - 3-8 hr. shifts, 5-2/3 days per week, Jan. 1st to 31st.  
3-8 hr. shifts, 5-1/3 days per week, Feb. 1st to Dec. 31st.

\* Main level development 3-8 hr. shifts, 6 days per week.







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4. ESTIMATE AND  
ANALYSIS OF  
ORE RESERVES:  
(Continued)

This estimate indicates a gross loss of 2,880,895 tons as compared with a gross loss of 1,257,327 tons in 1950.

	Total Tons
Net Total December 31, 1950	9,766,286
Net Total December 31, 1951	<u>5,728,378</u>
Net Loss in Reserves	4,037,908
1951 Production	<u>1,157,013</u>
Gross Loss in Reserves	2,880,895

The bulk of the loss in reserves is in the drilling estimate. The drilling estimate for 1950 showed 5,159,986 tons of reserves below the 6th Level. This estimate was based mainly on surface diamond drill holes #27-A and #38, which had favorable runs of ore below the 6th Level. However, exploration on the 7th Level has proven that the ore areas estimated from these holes are not as extensive as originally anticipated.

Expected Average Natural Analysis of Ore Reserves:

<u>Grade</u>	<u>Total Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sulph.</u>	<u>Loss</u>	<u>Moist.</u>
Mather by Surface Diamond Drilling...	2,262,083	53.15	.122	5.08	0.25	2.62	0.58	0.60	.014	1.97	12.50
Mather by Undg. Development.....	<u>3,466,295</u> 5,728,378	51.50	.100	8.15	0.20	2.45	1.00	0.50	.110	2.25	11.85



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4. ESTIMATE AND  
ANALYSIS OF  
ORE RESERVES:

The ore estimate shows a net total reserves of 5,728,378 tons. Of this total, 3,466,295 tons are estimated from underground development and 2,262,083 tons from surface drilling. Of the total tonnage, 407,122 tons are estimated as Sulphurous grade and the balance, Standard grade.

	<u>Standard</u> <u>Mather</u>	<u>Sulphurous</u> <u>Mather</u>	<u>Total</u> <u>Underground</u>	<u>Diamond</u> <u>Drilling</u>	<u>Total</u> <u>Tons</u>
Reserves Indicated By Surface Diamond Drilling.....				2,513,426	
Reserves Indicated By Underground Development:					
Above 2nd Level.....	24,509	27,043	51,552		
Between 2nd & 3rd Levels....	13,537	417,336	430,873		
Between 3rd & 5th Levels....	375,108	153,467	528,575		
Between 5th & 6th Levels....	1,344,070	-	1,344,070		
Between 6th & 7th Levels....	1,472,740	-	1,472,740		
Below 7th Level.....	459,625	-	459,625		
	<u>3,689,589</u>	<u>597,846</u>	<u>4,287,435</u>	<u>2,513,426</u>	<u>6,800,861</u>
Less Production 8-31-51 to 12-31-51.....	<u>267,410</u>	<u>133,939</u>	<u>401,349</u>	<u>-</u>	<u>401,349</u>
Total Gross as of 12-31-51..	3,422,179	463,907	3,886,086	2,513,426	6,399,512
Less Loss in Mining And Rock.....	<u>363,006</u>	<u>56,785</u>	<u>419,791</u>	<u>251,343</u>	<u>671,134</u>
Net Total as of 12-31-51....	3,059,173	407,122	3,466,295	2,262,083	5,728,378

Mather "A" 1951



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5. LABOR AND WAGES:

a. Comments:

There was a net loss of 48 men for the year, with 135 additions and 183 separations. Of the additions, 128 were new men and 7 were transfers from other mines. Of the separations, 57 were transferred to other properties, 95 quit, 2 retired, 7 were discharged, 21 joined the armed forces and 1 died.

Number of Men 1/1/51.....	772
Added to Roll During the Year.....	<u>135</u>
Total.....	907
Separations.....	<u>183</u>
Total on Payroll 12/31/51.....	724
Net Loss.....	48

All of the men who had previously signed requests for transfers to the Mather Mine "B" Shaft were transferred during the year. Very satisfactory relations between management and labor were continued through the year. There were no formal grievances presented, all of the differences being ironed out with the local grievance committee at the mine.

The high contract pay for a single period during the year was \$25.72 as compared with \$25.00 the previous year.



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5. LABOR AND WAGES: (Continued)

b. Comparative Statement of Wages and Product:  
(Operating Only - Not Including E&A Work)

	<u>1951</u>	<u>1950</u>
Product	1,157,013	1,251,963
<u>Number of Shifts &amp; Hours:</u> Equiv. to	278, 3-8 hr.	263, 3-8 hr.
<u>Average No. of Men Working:</u>		
Surface	126	114
Underground	<u>511</u>	<u>548</u>
Total	637	662
<u>Average Wages Per Day:</u>		
Surface	\$13.86	\$11.84
Underground	15.65	13.23
Total	<u>\$15.29</u>	<u>\$12.98</u>
<u>Wages Per Mo. of 23 Days:</u>		(22 Days)
Surface	\$318.78	\$260.48
Underground	359.95	291.06
Total	<u>\$351.67</u>	<u>\$285.56</u>
<u>Tons Per Man Per Day:</u>		
Surface	31.86	41.05
Underground	7.96	8.70
Total	<u>6.37</u>	<u>7.18</u>
<u>Labor Cost Per Ton:</u>		
Surface	\$ .435	\$ .288
Underground	<u>\$1.965</u>	<u>\$1.521</u>
Total	<u>\$2.400</u>	<u>\$1.809</u>
Average Product Stopping	29.96	31.41
Average Wages Contract Miner	\$16.72	\$15.04
<u>Total No. of Days:</u>		
Surface	36,319 $\frac{1}{2}$	30,495 $\frac{3}{4}$
Underground	<u>145,297<math>\frac{1}{2}</math></u>	<u>143,968</u>
Total	181,616 $\frac{1}{2}$	174,463 $\frac{3}{4}$
<u>Amount for Labor:</u>		
Surface	\$ 503,577.08	\$ 360,952.52
Underground	<u>\$2,273,455.62</u>	<u>\$1,904,376.13</u>
Total	<u>\$2,777,032.70</u>	<u>\$2,265,328.65</u>
Proportion of Surface to Underground Men	1:4.1	1:4.8



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6. SURFACE:

a. Buildings:

Building maintenance was confined to painting the offices and routine repairs.

b. Headframe:

The two new bottom dump skips were installed in May and, except for some difficulty encountered with the guide rollers, worked very satisfactorily. No changes were made in the headframe flow sheet and, except for occasional repairs on the crusher, screen and pan feeder, this equipment operated without any major delays throughout the year.

c. Stocking:

Stocking was continued with both the old and new larry cars with very few delays.

d. Landscaping, Roads and Parking Area:

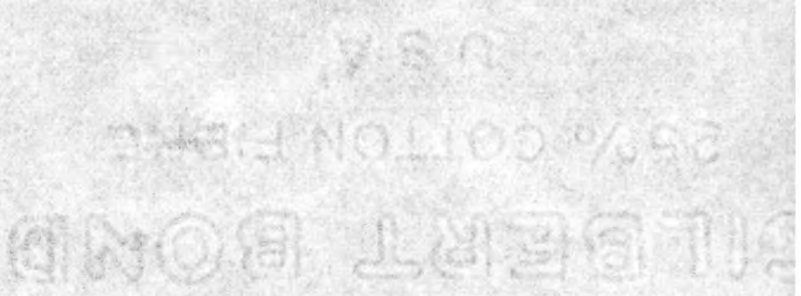
Work on the grounds, roads and parking areas was of routine nature.

e. Timber Tunnels and Yards:

No work of importance was done in the timber tunnels and yards during the year.

f. Surface Drainage and Subsidence:

Tests were continued with the geophones in Subsidence Hole #65 throughout the year. Readings on the tape recorder indicate that there is some movement and caving in the vicinity of the hole, however, the rate of caving cannot be determined until the caving reaches the bottom of the hole.



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7. UNDERGROUND:

a. Shaft Sinking:

Shaft sinking operations were continued through the year. The shaft, at the end of the year, was completed to a depth of 211' below the 21' rock pentice, which serves as protection between the bottom of the shaft and the new sinking operations. The excavation for the hoist room, 80' below the shaft bottom, was completed and the hoist was installed. Operations in this project have been slowed up considerably due to bad ground conditions. The walls of the engine room and practically every set in the shaft had to be concreted.

b. General:

Block caving and sub-level radial stoping were the two methods of mining used in the main ore body. Sub-level caving and sub-level stoping were the methods of mining used in the interbedded ore body. By the end of the year, practically all of the new development was supported by the circular steel sets, which have proven much stronger than the wood timber sets. The set, presently being used, is composed of four pieces: three circular, which make up the cap and posts and one short, straight sill piece. All four pieces have butt plates welded on both ends and are bolted to each other with two 1" bolts at each joint. The sets are fabricated from 6"-15.5# wide flange beams.

A new method of undercutting the block has proven very successful with the circular steel sets. In this method, all of the undercut drilling and coning is done from inside of the drift. Two mill raises are first put up, starting from near the main scraping raise. These raises are then coned with long hole drilling from the drift, the holes averaging 25' in length and drilled, fan shaped, at an angle of 45° on each end to 90° in the middle. The top half, or approximately 13' of the hole is charged and blasted with regular electric delays, leaving 12' of solid ground above the steel. The balance of the undercut is drilled in the same manner with burdens of 4' per round and retreating toward the center of the block. When the mill raises are reached, a 6' to 8' cut is drilled from the drift and this breaks into the broken ground of the undercut. By undercutting in this manner, 75% of the raising and coning of raises is eliminated. Scraping does not interfere with the undercutting, as the undercut is retreating away from the main scraping raise.

Rotary drilling of long holes has proven very successful in soft to medium hard ores. The machines used are powered by 7½ and 12 HP, air operated, vane type motors with an RPM ranging from 100' to 600' per minute. The drill rods are welded flight auger with snap button couplings. The drilling speed, with the rotary drills, is practically twice as fast as that of percussion machines.



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7. UNDERGROUND: (Continued)

b. General: (Continued)

Practically all of the ore produced during the year came from the 3rd, 5th and 6th Levels; 2nd Level mining was completed early in the year and only a small amount of ore was produced on the 7th Level. Of the total tonnage, the 3rd Level produced 16%, the 5th Level - 19%, 6th Level - 63% and the 7th Level - 2%.

2nd Level:

Mining of the remaining ore on this level was completed in January and the total tonnage produced on this level, from the latter part of 1943, when the level was first opened up, was 1,238,471 tons.

3rd Level:

Production on this level totaled 179,802 tons and came from three mining areas: one above #1 Cross-cut, which produced approximately 65,000 tons, one above #3 and #4 Cross-cuts, which produced approximately 55,000 tons and one above #7 Cross-cut, which produced approximately 60,000 tons.

Reserves above #7 Cross-cut were depleted during the year and reserves above #1 and #3 and #4 Cross-cuts are sufficient for continued mining operations through 1952.

5th Level:

Production on this level totaled 215,239 tons and came from the interbedded ore body and two mining areas in the main ore body. Production in the main ore body came from above #1 Cross-cut, which produced approximately 65,000 tons and above #7 Cross-cut, which produced approximately 80,000 tons. Production in the interbedded ore body totaled 70,000 tons. Production in the interbedded ore has improved with the new system of mining, which includes developing this ore with the circular steel sets and long hole drilling with rotary machines from inside of the steel to cave this ore.

6th Level:

Production on this level totaled 719,424 tons and came from six areas: one above #2 Cross-cut, which produced approximately 60,000 tons, one above #3 Cross-cut, which produced approximately 160,000 tons, one above #4 Cross-cut, which produced approximately 150,000 tons, one above #5 Cross-cut, which produced approximately 60,000 tons, one above #7 Cross-cut, which produced approximately 240,000 tons and one above #9 Cross-cut, which produced approximately 50,000 tons. Production on this level will drop considerably in the next year, as the bulk of the remaining ore is confined to small pillars between old caving and stoping areas.

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7. UNDERGROUND: (Continued)

b. General: (Continued)

7th Level:

Production on this level was confined to development ore from sub-level and main level development. Development of the first block, north of the main footwall drift, is nearing completion and production from this area will start early in 1952. Production on this level for 1952 is estimated at 475,000 tons and will come from areas above #2, #3 and #4 Cross-cuts, west of the fault and from areas north of the main footwall drift and #5 Cross-cut, east of the fault.

Main Level Drifting:

Drifting on this level was confined mainly to cross-cutting south in #2 and #4 Cross-cuts and east in #2 Cross-cut. On completion of the loading end of the belt, drifting will be continued in the main footwall drift.

Conveyor Belt:

The conveyor belt drift was completed during the year and the conveyor belt, crusher and pan feeder were installed.

d. Timbering:

The use of circular steel sets for support in block caving and stoping transfer drifts increased considerably during the year. These sets are fabricated from 6", 15.5#/ft., wide flange beams and are circular, except for a short, straight sill piece on the bottom. Development per transfer drift is faster and considerably more strength is attained with the circular steel sets as compared with wood timber sets. Maintenance in the larger block caving areas, supported with circular steel sets, is only a fraction of what it used to be when these areas were supported with timber.



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7. UNDERGROUND: (Continued)  
d. Timbering: (Continued)

Statement of Timber Used - All Operations

	<u>LINEAL FEET</u>	<u>AVG. PRICE PER FOOT</u>	<u>AMOUNT 1951</u>	<u>AMOUNT 1950</u>
5'4" Cribbing	161,432	.08359	13,494.58	10,190.01
6' Stulls	24	.35000	8.40	.00
7' Stulls	11,282	.18956	2,138.58	3,175.65
8' and 16' Stulls	102,504	.31041	31,818.04	32,366.57
9' and 18' Stulls	4,473	.26977	1,206.70	5,909.24
Total	<u>279,715</u>	<u>.17399</u>	<u>48,666.30</u>	
Total 1950	312,689	.16515		51,641.47
		<u>PER 100'</u>		
7' Lagging	1,847,847	1.6893	31,215.02	35,468.41
9 1/2' Poles	757,374	3.2427	24,559.00	24,498.53
7' Slabs	52,850	2.1429	1,132.50	.00
Total	<u>2,658,071</u>	<u>2.1409</u>	<u>56,906.52</u>	
Total 1950	3,162,839	1.8960		59,966.94
		<u>PER FOOT</u>		
4" x 4" "H" Beam 13#	74,727	.69726	52,103.92	46,669.62
6" x 6" "H" Beam 15.5#	5,265	.78810	4,149.35	.00
4" x 8" "I" Beam 23#	2,313	.93963	2,173.36	5,174.34
6 1/2" x 8" "I" Beam 24#	272	1.20375	327.42	.00
6 1/2" x 12" "I" Beam 50#	560	1.13966	638.21	.00
3/8 x 2 x 2 Angle Iron	153,846#	.04852	7,465.27	7,081.31
Misc. (Bolts, Plates, etc.)			8,671.58	2,807.08
Total			<u>75,529.11</u>	
Total 1950				61,732.35
4" x 4" Arched "H" Beam 13#	00		.00	1,499.90
5" x 5" Arched "H" Beam 18.5#	11,655	1.90652	22,220.48	.00
6" x 6" Arched "H" Beam 15.5#	15,995	2.17857	34,846.25	.00
6" x 6" Circular "H" Beam 15.5#	17,340	1.84642	32,016.95	.00
4" x 4" "H" Beam 13#	61,118	.68747	42,016.66	1,026.66
6" x 6" "H" Beam 15.5#	4,635	.79208	3,671.30	.00
Misc. (Bolts, etc.)			4,733.87	173.24
Total			<u>139,505.51</u>	
Total 1950				2,699.80
6' Steel Hat Section	17,838	.40875	7,291.22	7,473.69
7' Steel Hat Section	16,828	.34730	5,844.30	9,894.95
Total	<u>34,666</u>	<u>.37892</u>	<u>13,135.52</u>	
Total 1950	53,191	.32653		17,368.64
2 1/4" x 8" x 6' Minecrete Poles	5,880	.22333	1,313.20	4,952.64
2 1/4" x 8" x 3' Minecrete Poles	18	.25	4.50	105.00
4" x 8" x 12" Minecrete Blocks	696 pcs	.18	125.28	239.94
6" x 8" x 12" Minecrete Blocks	48 pcs	.22	10.56	215.60
8" x 8" x 12" Minecrete Blocks	501 pcs	.26	130.26	17.16
Total			<u>1,583.80</u>	
Total 1950				5,530.34
<b>GRAND TOTAL, INCLUDING STEEL AND CONCRETE</b>			<b>\$335,326.76</b>	<b>\$198,939.54</b>

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7. UNDERGROUND: (Continued)

d. Timbering: (Continued)

Statement of Timber Used Under Operating Account "Timbering"

	<u>LINEAL FEET</u>	<u>AVG. PRICE PER FOOT</u>	<u>AMOUNT 1951</u>	<u>AMOUNT 1950</u>
5' 4" Cribbing	161,432	.08359	13,494.58	10,190.01
6' Stulls	24	.35000	8.40	.00
7' Stulls	11,261	.18959	2,135.00	3,175.65
8' and 16' Stulls	102,504	.31041	31,818.04	32,366.57
9' and 18' Stulls	4,473	.26977	1,206.70	5,868.86
Total	<u>279,694</u>	<u>.17399</u>	<u>48,662.72</u>	
Total 1950	312,500	.16512		51,601.09
		<u>PER 100'</u>		
7' Lagging	1,615,572	1.6833	27,195.48	28,652.64
9½' Poles	702,694	3.2431	22,788.96	21,152.92
7' Slabs	49,875	2.1430	1,068.81	.00
Total	<u>2,368,141</u>	<u>2.1558</u>	<u>51,053.25</u>	
Total 1950	2,601,056	1.9148		49,805.56
		<u>PER FOOT</u>		
4" x 4" "H" Beam 13#	47,873	.68671	32,874.98	26,022.00
6" x 6" "H" Beam 15.5#	3,699	.79562	2,942.99	.00
4" x 8" "I" Beam 23#	1,053	.95011	1,000.47	3,438.19
6½" x 8" "I" Beam 24#	79	1.18076	93.28	.00
6½" x 12" "I" Beam 27#	180	1.13967	205.14	.00
3/8 x 2 x 2 Angle Iron	94,102#	.04892	4,603.77	3,844.65
Misc. (Bolts, Plates, etc.)			<u>5,389.51</u>	<u>1,611.87</u>
Total			<u>47,110.14</u>	
Total 1950				34,916.71
4" x 4" Arched "H" Beam 13#	00		.00	1,499.90
5" x 5" Arched "H" Beam 18.5#	11,277	1.90616	21,495.80	.00
6" x 6" Arched "H" Beam 15.5#	15,470	2.17857	33,702.50	.00
6" x 6" Circular "H" Beam 15.5#	17,340	1.84642	32,016.95	.00
4" x 4" "H" Beam 13#	59,698	.68859	41,107.41	1,026.66
6" x 6" "H" Beam 15.5#	4,635	.79208	3,671.30	.00
Misc. (Bolts, etc.)			<u>4,707.70</u>	<u>173.24</u>
Total			<u>136,701.66</u>	
Total 1950				2,699.80
6' Steel Hat Section	7,944	.40642	3,228.61	1,432.15
7' Steel Hat Section	3,913	.34729	1,358.96	3,627.08
Total	<u>11,857</u>	<u>.38691</u>	<u>4,587.57</u>	
Total 1950	15,722	.32179		5,059.23
2½" x 8" x 6' Minecrete Poles	3,726	.22333	832.14	4,711.44
2½" x 8" x 3' Minecrete Poles	18	.25	4.50	105.00
4" x 8" x 12" Minecrete Blocks	558 pcs	.18	100.44	197.46
6" x 8" x 12" Minecrete Blocks	30 pcs	.22	6.60	194.48
8" x 8" x 12" Minecrete Blocks	261 pcs	.26	67.86	11.96
Total			<u>1,011.54</u>	
Total 1950				5,220.34
<b>GRAND TOTAL, INCLUDING STEEL AND CONCRETE</b>			<b>\$289,126.88</b>	<b>\$149,302.73</b>



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7. UNDERGROUND: (Continued)

d. Timbering: (Continued)

Product for Year	1951 <u>1,157,013</u>	1950 <u>1,251,963</u>
Foot Timber per Ton of Ore	.2417	.2496
Foot Lagging per Ton of Ore	1.3963	1.5133
Foot Poles per Ton of Ore	.6073	.5643
Foot Slabs per Ton of Ore	.0431	-
Foot Lagging per Foot of Timber	5.7762	6.0629
Cost per Ton for Timber	.0421	.0412
Cost per Ton for Lagging	.0235	.0229
Cost per Ton for Poles	.0197	.0169
Cost per Ton for Slabs	.0009	-
Cost per Ton for Steel & Concrete Supplies	.1637	.0383
Cost per Ton for All Timbering Supplies, Including Steel & Concrete Supplies	.2499	.1193

Costs for supplies in the account "Timbering" increased from \$.1193 per ton in 1950 to \$.2499 per ton in 1951. This higher cost was due to the increased use of the more expensive circular steel sets for support in transfer drifts and the accelerated mining of interbedded ore. The higher cost of the circular steel sets is more than off-set in maintenance of the transfer drifts, as this set is considerably stronger than the wood timber sets. In mining the interbedded ore body, a greater amount of timber supplies are needed per ton of ore mined due to the narrow thickness of this ore.

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7. UNDERGROUND: (Continued)

e. Drifting and Raising:

The following table includes all of the miscellaneous development work on all operations throughout the year, including the main level drift and conveyor belt drift on the new 7th Level, main level drifting on both the "A" Shaft and "B" Shaft side of the line on the 5th Level and also the raising and drifting in the new shaft sinking project below the 7th Level. 55,475' were driven at an average rate of 4,623' per month as compared with an approximate rate of 5,100' per month during 1950.

	<u>Drifting</u>		<u>Raising</u>		<u>Total</u>
	<u>Ore</u>	<u>Rock</u>	<u>Ore</u>	<u>Rock</u>	
Large Size	8,365'*	12,984'**	17'***	49'***	21,415'
Small Size	4,286'	2,735'	11,340'⊥	11,326'⊥⊥	29,687'
Circular	<u>1,363'</u>	<u>3,010'</u>	—	—	<u>4,373'</u>
	14,014'	18,729'	11,357'	11,375'	55,475'
			Grand Total Last Year.....		60,971'

- \* Timbered
- \*\* 8,950' Timbered
- \*\*\* Cribbed
- ⊥ 2,533' Cribbed
- ⊥⊥ 4,844' Cribbed

The following table of main level drifting includes drifting on the 5th and 7th Levels:

	<u>Timbered</u>	<u>Timbered</u>	<u>Naked</u>	<u>Total</u>
	<u>Ore Drift</u>	<u>Rock Drift</u>	<u>Rock Drift</u>	
NM-27C 5th Level	—	858'	—	858'
NM-44L5 5th Level "B"	—	501'	—	501'
NM-60 7th Level	—	500'	5'	505'
NM-71 7th Level	<u>303'</u>	<u>1,020'</u>	<u>148'</u>	<u>1,471'</u>
Total	303'	2,879'	153'	3,335'
Total 1950	640'	6,081'	148'	6,869'

In addition to the above, there were 1,590' of drifting and raising and 1,098' of stripping for the conveyor belt installation and ventilation connection on the 7th Level.



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7. UNDERGROUND: (Continued)

f. Explosives:

The average price paid for explosives during the year increased 4½% from \$15.87 to \$16.67 per hundredweight. The use of Hercomite #2x, 1¼" x 8" for developing operations and Hercomite #2 - 2" x 24" for block cave undercutting and stoping was continued. The high pressure 60% Gelatin 5" x 5# cartridge was used exclusively for mill raise blasting in the caving and stoping operations.

The following table is a record of all explosives and supplies used on all operations during the year.

	<u>Quantity</u>	<u>Average Price</u>	<u>1951 Amount</u>	<u>1950 Amount</u>
Hercomite 2x, 1¼" x 8"	403,950#	16.00 CWT	\$ 64,632.00	\$ 55,298.52
Hercomite 2, 2" x 24"	234,294#	16.00 CWT	37,487.04	29,455.57
60% HP Gelatin, 5" x 5#	72,550#	22.00 CWT	15,961.00	18,640.09
60% Gelatin Extra, 1¼" x 8"	19,800#	18.75 CWT	3,712.54	17,908.20
Gelamite 2x, 1¼" x 8"	89,100#	16.75 CWT	14,924.33	14,755.00
Total Powder	819,694#	16.679 CWT	\$136,716.91	
Total Powder 1950	857,167#	15.873 CWT		\$136,057.38
No. 6 Blasting Caps	228,090	1.570 C	3,581.03	2,804.01
Blasting Fuse	1,823,920'	9.252 M'	16,874.78	13,042.90
Electric Caps	35,494	24.031 C	8,529.68	13,142.19
Regular Primacord	508,500'	3.400 C'	17,280.06	17,008.00
No. 14 Lead Wire	68,600'	24.796 M'	1,701.00	2,866.50
Small Powder Bags	45	2.050 ea	92.25	.00
Large Powder Bags	228	5.495 ea	1,252.75	653.53
7" Fuse Lighters	44,300	9.000 M	398.70	391.50
Paper Tamping Shells	25,170	6.915 M	174.05	215.35
Total Fuse, Caps, Wire, etc.....			\$ 49,884.30	\$ 50,123.98
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			\$186,601.21	\$186,181.36

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7. UNDERGROUND: (Continued)

f. Explosives: (Continued)

The amount of explosives used per ton of ore in the stoping and developing in ore operations increased approximately 2% over the previous year.

Explosives Used in Breaking 1,157,013 Tons of Ore in  
Stoping and Development in Ore

	<u>Quantity</u>	<u>Average Price</u>	<u>Amount</u> <u>1951</u>	<u>Amount</u> <u>1950</u>
Hercomite 2x, 1 $\frac{1}{4}$ " x 8"	211,436#	16.000 CWT	\$ 33,829.76	\$ 37,692.58
Hercomite 2, 2" x 24"	223,785#	16.000 CWT	35,805.60	28,565.42
60% HP Gelatin, 5" x 5#	70,400#	22.000 CWT	15,488.00	18,232.81
60% Gelatin Extra, 1 $\frac{1}{4}$ " x 8"	1,325#	18.750 CWT	248.44	385.26
Gelamite 2x, 1 $\frac{1}{4}$ " x 8"	15,125#	16.750 CWT	2,533.45	2,480.05
Total Powder	522,071#	16.838 CWT	\$ 87,905.25	
Total Powder 1950	551,327#	15.845 CWT		\$ 87,356.12
No. 6 Blasting Caps	142,630	1.570 C	\$ 2,239.30	\$ 2,260.08
Blasting Fuse	1,140,240'	9.235 M'	10,530.05	10,507.28
Electric Caps	7,926	22.931 C	1,817.48	1,189.40
Regular Primacord	468,750'	3.398 C'	15,929.13	16,192.00
No. 14 Lead Wire	19,900'	24.870 M'	494.92	581.75
Small Powder Bags	11	2.050 ea	22.55	.00
Large Powder Bags	101	5.544 ea	559.90	396.23
7" Fuse Lighters	39,300	9.000 M	353.70	357.75
Paper Tamping Shells	11,250	6.895 M	77.57	95.17
Total Caps, Wire, Fuse, etc.....			\$ 32,024.60	\$ 31,579.66
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			\$119,929.85	\$118,935.78
Product			1,157,013	1,251,963
Pounds of Powder per Ton of Ore			.451	.440
Tons of Ore per Pound of Powder			2.216	2.271
Cost per Ton for Powder			.076	.070
Cost per Ton for Fuse, Caps, etc.			.028	.025
Cost per Ton for all Explosives			.104	.095

In addition to the above, explosives costing \$44,346.65 were used in miscellaneous rock work which was charged to "Development in Rock". This compares with \$22,358.79 in 1950.



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7. UNDERGROUND: (CONTINUED)

f. Explosives: (Continued)

Explosives Used in Driving 3,032' of Main Level Rock Drift

	<u>Quantity</u>	<u>Amount</u>	<u>Pounds of Powder Per Foot of Drift</u>	<u>Cost Per Foot</u>
Hercomite 2x, 1 $\frac{1}{4}$ " x 8"	11,000#	\$ 1,760.00		
60% HP Gelatin, 5" x 5"	150#	33.00		
60% Gelatin Extra, 1 $\frac{1}{4}$ " x 8"	1,225#	229.69		
Gelamite 2x, 1 $\frac{1}{4}$ " x 8"	45,900#	7,688.28		
Total Powder	58,275#	\$ 9,710.97	19.22	\$3.20
Miscellaneous Blasting Supplies		5,373.24		1.77
Grand Total		\$15,084.21	19.22	\$4.97
Grand Total 1950 - 6,229'		\$32,210.92	21.73	\$5.17

g. Loading and Trammig:

The three Model 125 Conway loaders were used throughout the year on main level development work. The maintenance on these loaders continued to be high and delays, due to breakdowns, were greater than in previous years.

Underground trammig was continued with the 100 cubic foot Lohed cars and locomotives. The combination of the conveyor belt and motor haulage, which will be used on the 7th Level, looks very favorable for the longer trammig distances on the new levels.

h. Ventilation:

The ventilation in the mine improved considerably since the 100,000 C.F.M. fan was installed on the Mather Mine "B" Shaft side of the 6th Level. With the intake air coming from the "B" Shaft and discharging through "A" Shaft, 100% new air is carried through the mine at all times and the re-circulation of old air is eliminated.

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7. UNDERGROUND: (Continued)

i. Pumping:

	<u>960'</u> <u>Level</u>	<u>3rd</u> <u>Level</u>	<u>6th</u> <u>Level</u>	<u>Total</u>
January	7	51	483	541
February	0	49	518	567
March	0	48	502	550
April	12	50	484	546
May	20	52	444	516
June	40	53	406	499
July	66	53	375	494
August	27	53	369	449
September	41	54	367	462
October	37	53	431	521
November	27	55	394	476
December	25	54	392	471
Total Gallons	12,700,300	27,473,409	226,243,500	266,417,209
Average G.P.M.	24 5%	52 10%	430 85%	506 100%

Pumping of underground water was continued on the 960' Level, 3rd Level and the 6th Level. There was no material increase on the 960' and 3rd Levels. The average for the year on the 6th Level increased from 339 G.P.M. in 1950 to 430 G.P.M. in 1951. This increase in volume on the 6th Level was all due to the water being pumped from the Mather Mine "B" Shaft.