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1. GENERAL:

The initial stripping program at the Ohio Mine, which was started early in September of 1951, continued until April 1, 1952. A fifteen shift per week schedule was maintained throughout the winter until the Spring break-up terminated operations. The necessary surface stripping in the East Pit was completed January 8, 1952 and the shovel was then moved into the Norwood Lease to start moving earth from the proposed West Pit. From this operation, the dikes enclosing the tailings pond were enlarged, haul roads gravelled, and the stocking grounds were graded. The remainder of the stripping was placed on the East Pit dump with Beaufort stripping being replaced on the lease according to the agreement with the State. The 29-T churn drill rig operated almost continuously in the Webster (East) Pit during January, February and March, drilling 60 foot exploration holes until February 18, 1952 when blast holes were started in preparation for the ore season.

Miscellaneous installation work in the mill began February 25, 1952 with a small crew handling jobs of a minor nature. This crew was maintained until the ore season commenced.

Only a small crew overhauled pit equipment from April 1st to the 25th at which time final preparations were started to open the mill and begin the Webster Pit operation. Surfacing of the roads was completed early in May and the mill began operations on the day-shift of May 5th. Production during May was very low due to an unusually large amount of mechanical difficulties and the necessary circuit adjustments in the mill. Due to the completely inexperienced plant crew and the limited information available concerning the ore, the first concentrates produced were below normal grade with most of the tonnage being stockpiled.

A strike occurred on June 3rd and all operations ceased until an agreement was reached in late July. After a two-week repair program in which numerous changes were made in the mill circuit, the Ohio plant again began operations on August 11th and continued until the fall shut-down on October 29, 1952. The mill operated on a three-shift, six-day per week schedule during the season producing a total of 59,507 tons of concentrate averaging 54.05% iron, 12.21% silica, .190% phosphorus and .030% sulphur.

At the close of the ore season stripping was again resumed on a three-shift five-day per week schedule. A total of 130,710 cubic yards of rock and overburden were removed during November and December making a total of 547,649 cubic yards for the year which included 109,058 cubic yards moved by contractors. The plant was cleaned and a winter repair program began immediately with four men and a foreman being maintained as a general repair crew.

An extensive program on the treatment of the fines fraction of ore from -1/8" to +150 mesh was started in September at the Research Lab and continued into 1953.

2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Operating Schedule:

	No of Days	Shifts Per Day	Hours Per Shift	Total Shifts
Pit Operating	70	2	8	140
Mill Operating	96	2 & 3	8	291

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (Con't)

b. Pit: (Webster Ore)

	Tons
Crude Ore - Pit to Surge Pile.	201,740
Average Total Crude Ore Per Day.	2,882
Average Total Crude Ore Per Shift.	1,441
Average Total Crude Ore Per Man Day.	44.33

c. Mill: (Webster Ore)

Crude Ore - Surge Pile to Mill	199,698
Webster Concentrates - Pocket in Cars	51,166
Webster Concentrates - Pocket to Stockpile . .	8,341
Total Webster Concentrates Produced.	59,507
Average Total Concentrates Per Day	620
Average Total Concentrates Per Shift	204
Average Total Concentrates Per Man Day	9.53
Per Cent of Recovery.	29.80

d. Shipments: (Gross Tons)

Grade	From Pocket	From Stockpile	Total Year	Remaining Ore in Stock	Balance On Hand
Webster Concentrates	51,166	8,341	59,507	-0-	-0-

e. Stockpile: (Webster Conc.)

	Gross Tons
In Stock January 1, 1951.	-0-
Placed in Stockpile	8,341
TOTAL	8,341
Removed from Stockpile, 1952 Season	8,341
Stockpile Balance December 31, 1952	-0-

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2. PRODUCTION, SHIPMENTS AND INVENTORIES: (Con't)

f. Production by Months: (Webster Ore, Crude and Concentrates)

	Crude	Concentrates
May	20,180	6,155
June	3,680	288
July	-----	-----
August	40,940	12,022
September	74,360	23,587
October	57,520	17,455
Total Tons	196,680	*59,507

3. ANALYSIS:

a. Analysis of Pit Crude Ore:

Grade	Tons	Iron	Silica
Webster	201,740	42.79	29.01

b. Tonnage and Analysis of Concentrates Produced and Shipped:

Grade	Disposition	Tons	Iron	Phos	Sil	Sulph	Moist
Webster Conc.	Pocket (Shipped)	51,166	54.05	.190	11.89	.032	10.12
Webster Conc.	Stockpile (Shipped)	8,341	52.67	.173	15.70	.022	6.67
Webster Conc.	Total Shipped:						
Average of Above		59,507	53.86	.187	12.48	.030	9.64
Shipping Dept Average		59,507	54.08	.190	12.21	.030	9.64
Laboratory Average		59,507	53.85	.200	13.00	.029	7.50
Average From Plant Control Samples		59,507	54.99		12.75		

c. Estimated Analysis 1952:

Tons	Percent Recovery	Iron	Sil	Phos	Sulph	Moist
56,443	38.00	55.10	9.80	.268	.016	7.50

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4. ESTIMATE OF ORE RESERVES:

a. Developed Ore - Factors Used:

	Cubic Feet Per Ton of Crude	Rock Deduction	Per Cent Recovery
Webster Concentrates	15	0	30%
Norwood Concentrates	15	0	40%

b. Ore Reserve As of December 31, 1952:

PROVEN ORE

	Webster	Portland	Ohio, Norwood Beaufort @110' Pit Depth	Ohio, Norwood Beaufort @135' Pit Depth	Total
Reserves Dec. 31, 1951:					
Crude	593,433	-0-	-0-	1,609,222	
Recovery	38.2	-0-	-0-	46.84	
Concentrates	226,687	-0-	-0-	753,760	980,447
Mined 1952:					
Crude	201,740	-0-	-0-	-0-	
Concentrates	59,507	-0-	-0-	-0-	59,507
Balance After Mining:					
Crude	391,693	-0-	-0-	1,609,222	
Concentrates	167,180	-0-	-0-	753,760	920,940
Changed by Re-estimate:					
Crude	+115,007	-0-	-319,722	--81,722	
Concentrates	-15,180	-0-	-237,960	-142,760	
Reserves Dec. 31, 1952:					
Crude	506,700	9,100	1,289,500	1,527,500	
Recovery	30.	30.	40.	40.	
Concentrates	152,000	2,730	515,800	611,000	
Concentrates @135' Pit Depth					765,730
Concentrates @110' Pit Depth					670,530

POSSIBLE ORE

	Webster	Portland	Ohio, Norwood Beaufort @110' Pit Depth	Ohio, Norwood Beaufort @135' Pit Depth	Titan
Reserve Dec. 31, 1952:					
Crude	-0-	150,000	724,500	486,500	100,000
Recovery	-0-	30.	40.	40.	40.
Concentrates	-0-	45,000	289,800	194,600	40,000

Total Possible Concentrates - 374,800 Tons

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4. ESTIMATE OF ORE RESERVES: (Con't)

c. Estimated Analysis: 1953

Leases:	Tons	Iron	Phos	Sil	Sul	Moist
East Pit						
Webster	152,000	55.00	0.200	9.80	0.035	7.50
Portland	2,730	55.00	0.200	9.80	0.035	7.50
West Pit						
Ohio-Norwood-Beaufort @ 110' Depth	515,800	53.50	0.180	9.50	0.60	7.50
Ohio-Norwood-Beaufort @ 135' Depth	611,000	53.50	0.180	9.50	0.60	7.50

5. LABOR AND WAGES:

a. Comments:

Although a large labor supply was available due to the lack of industry in Baraga County, it was not possible to hire any experienced mill hands. The necessity of breaking in a crew to handle the concentrating plant added to the many difficulties encountered in opening the mill. However, the labor from this area represented a competent and diligent group which helped overcome the general lack of experience. Since logging and woods work constitute the most important industry in the district, it was possible to arrange for a pit crew that was very familiar with heavy equipment. The Ohio was naturally idle during the general steel strike in June and July, however, labor relations were very good during the operating months.

b. Comparative Statement of Production and Wages: Operating (Ore)

Production	59,507	Tons
Number of Days Operated	96	
Number of Shifts Operated	291	
Average Daily Product	620	
Average Product Per Shift	204	
Average Number of Men Employed	61	
Product Per Man Per Day (Total Men)	9.53	
Average Wages Per Man Per Day	$15.76	
Total Amount Paid for Labor During Operating Season	$92,270.92	
Labor Cost Per Ton	$1.551	

6. GENERAL SURFACE:

a. Buildings and Repairs:

Because of the limited storage space originally provided for the Ohio Mine, a warehouse, 32' X 16' in size was constructed during the operating season. Numerous other small buildings such as pump houses and a tire storage unit were also built during the summer to protect equipment. The area surrounding the mill and office was improved by the addition of stairways for steep banks and safety tunnels for traveling under conveyors.

During September the mill was completely enclosed as the original construction job had not included the covering of the ground floor of the plant.

6. GENERAL SURFACE: (Con't)

b. Roads, Transmission Lines, etc.

All haul roads and the area surrounding the mill site were graveled before mill operations started in the spring, A total of 16,000 cubic yards of gravel was needed to complete this surfacing job. The drilling of churn drill holes in preparation for blasting a foot-wall haul road to our present working level in the East Pit was started in November and continued into January.

Power lines in the West Pit area were moved and extended during the year to facilitate stripping and the stacking of coarse rejects. A new pole line to a pump station in the East Portland Pit was erected in order to dewater the pit as well as to enable further stripping in the Portland Lease.

c. Miscellaneous General Construction:

The settling of the dikes retaining the tailings basin made it necessary to enlarge and reinforce them throughout the year. Also graded were the stocking grounds which required 10,000 cubic yards of overburden and lean ore to ready for future use.

A pump was installed in the old Portland Pit and the water directed into Bass Lake. The water level in the West Portland Pit was also lowered by this operation indicating a connection between these two old pits.

The construction of track leading to the loading hopper was completed by the D. S. S. & A. Railroad Company in the spring.

7. OPEN PIT:

a. Stripping Operations - Webster Pit:

Truck and Shovel	No. Days	Shifts Per Day	Total Shifts
Year	55	1, 2 & 3	117
Program to Date	109	1, 2 & 3	229

Production: (Cubic Yards)	Estimated
Total Scheduled Program	
E&A CC-430	
Original Estimate	92,508 Surface
	115,670 Rock
New Estimate	168,926 Surface
	160,340 Rock

Actual Stripping	Year	Completed to Date
Surface	55,725	168,056
Rock	87,270	87,270
TOTAL	142,995	255,326

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7. OPEN PIT: (Con't)

a. Stripping Operations - Webster Pit: (Con't)

Production: (Cubic Yards) (Con't)

	Year	Completed to Date
Average Stripping Per Shift		
Surface	476	1,167
Rock	746	1,027
TOTAL	1,222	1,115
Estimated Cost Per Cu Yd		
Surface	0.45	0.45
Rock	0.60	0.60
Actual Cost Per Cu Yd		
Surface	0.455	.476
Rock	0.385	.385
TOTAL	0.413	.445

b. Stripping Operations - Portland Pit:

Truck and Shovel	No. Days	Shifts Per Day	Total Shifts
Year	1	3-8 Hrs	2
Program to Date	1	3-8 Hrs	2

Production: (Cubic Yards)	Estimated
Total Scheduled Program	
E&A CC-430	
Original Estimate	54,000 Surface
	32,000 Rock

	Year	Completed to Date
Actual Stripping		
Surface	2,400	2,400
Rock	-----	-----
TOTAL	2,400	2,400
Average Stripping Per Shift		
Surface	1,200	1,200
Rock	-----	-----
TOTAL	1,200	1,200
Estimated Cost Per Cu Yd		
Surface	0.45	0.45
Rock	0.60	0.60
Actual Cost Per Cu Yd		
Surface	0.696	0.696
Rock	-----	-----
TOTAL	0.696	0.696

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7. OPEN PIT: (Con't)

c. Stripping Operations - Norwood & Beaufort Pit:

Truck and Shovel	No. Days	Shifts Per Day	Total Shifts
Year			
Program to Date	83	1,2 & 3	234

Production: (Cubic Yards)		Estimated
Total Scheduled Program		
E&A CC-430		
Estimate		1,430,300 Rock
		1,397,498 Surface

	Year	Completed to Date
Actual Stripping		
Surface (Contract)	109,058	136,308 *
Surface (C.C.I. Norwood)	272,730	272,730
Surface (C.C.I. Beaufort)	20,460	20,460
TOTAL	402,248	429,498
Average Stripping Per Shift		
Surface	1,253	1,253
Rock	-----	-----
TOTAL	1,253	1,253
Estimated Cost Per Cu Yd		
Surface	0.45	0.45
Rock	0.60	0.60
Actual Cost Per Cu Yd		
Surface	0.323	0.323
Rock	-----	-----
TOTAL	0.323	0.323

* 4,678 Cu Yds. - LeBreque and Pierce for County Road
5,120 Cu Yds. - Jos. Hamel - Gravel Roads and Area
102,476 Cu Yds. - A. Lindberg and Sons Contract
24,034 Cu Yds. - D.S.S. & A. R.R. for Railroad Spur
136,308 Cu Yds. - TOTAL

d. Detail of Stripping:

Webster (East) Pit

The bulk of the necessary earth stripping in this area was completed early in January of 1952. Upon terminating the operating season on October 29, 1952, surface and rock stripping was again started with a total of 55,725 cubic yards of overburden and 87,270 cubic yards of rock being moved by the end of the year. Included in this rock total are 64,630 cubic yards stripped during the operating months.

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7. OPEN PIT: (Con't)

d. Detail of Stripping: (Con't)

Webster (East) Pit: (Con't)

Fall stripping in the Webster Pit was completed on a 3 shift 5 day per week schedule with the exception of the first week of the deer hunting season during which a 2 shift per day program was arranged. This stripping operation entailed moving small quantities of material from various corners of the pit and therefore necessitated a great deal of shovel moving. Despite this handicap and the need for blasting along the east end of the pit, costs amounted to $0.413 per cubic yard including both earth and rock. Also during this stripping program, 940 tons of high-grade mill feed from an old Webster Mine dump were stocked in the pit.

Portland Lease:

During November while stripping overburden along the west end of the East Pit, 2,400 cubic yards of surface material were also moved from the Portland Lease.

Ohio-Norwood-Beaufort:

The major portion of the stripping during the year was moved from the West Pit area comprising the Ohio, Norwood, and Beaufort Leases. This program totaled 402,248 cubic yards of overburden including 109,058 cubic yards by contractors, and cost $0.323 per cubic yard. Stripping was hampered throughout the year by the occurrence in the overburden of numerous large boulders measuring up to 10 feet in diameter. Most of this rock was not blasted during the year, which will increase the costs in this area during 1953. An old Beaufort Mine drift was uncovered late in December which also interfered with the stripping operations.

e. Detail of Stripping Costs:

	Ohio-Norwood-Beaufort: (Surface) Year	Program to Date
Cubic Yards.	402,248	429,498
Pit Operating.	.273	.288
General Mine Expense	.004	.004
Cost of Production	.277	.292
Depreciation of Equipment. .	.046	.044
Total Cost at Mine	.323	.336

Cubic Yards:	Webster: Year	(Surface and Rock) Program to Date
Earth.	55,725	168,056
Rock.	87,270	87,270
Total	142,995	255,326

7. OPEN PIT: (Con't)

e. Detail of Stripping Costs: (Con't)

	Webster: (Surface and Rock) (Con't) Year	Program to Date
Pit Operating.	.359	.365
General Mine Expense	.016	.009
Cost of Production	.375	.374
Depreciation of Equipment.	.038	.071
Total Cost at Mine	.413	.445

	Portland: (Surface) Year	Program to Date
Cubic Yards	2,400	2,400
Pit Operating.	.588	.588
General Mine Expense	.048	.048
Cost of Production	.636	.636
Depreciation of Equipment.	.060	.060
Total Cost at Mine	.696	.696

f. Detail of Open Pit Mining:

Mining of crude ore in the pit began on May 5th with a total of 196,680 tons being hauled to the primary crushing pocket by the end of the season. Production was limited to the Webster Lease throughout the year, the cost per ton amounting to $0.279 per ton of crude ore. Because of the summer strike and the intermittent operation of the mill, the pit only operated 70 days on a two shift per day basis. By the end of October the mining and stripping program had completely moved one cut in the pit and a second bench had progressed 500 feet along the west half of the pit. Because of the weathered nature of the top cut of the pit which when concentrated at best mill conditions produced a product high in silica, it became necessary to strip a larger portion of this bench than would ordinarily be necessary. However, upon opening the ore body it was found that considerable stripping will be necessary on most of the benches since the actual enrichment of cherty limonite and goethite are averages only 110 feet in width while an additional width, averaging 30 feet to 60 feet depending on depth along the hanging wall side is made up of a series of lean ferruginous argillites. Recovery from this material averages from 15 to 20% which makes it econonically impossible to absorb the entire hanging reserve as mill feed. Since the ore body dips at 30 degrees and a season's crude production will require more than one cut in the pit, it therefore becomes necessary to strip a large portion of the hanging material during the operating season.

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7. OPEN PIT: (Con't)

f. Detail of Open Pit Mining: (Con't)

One 29-T churn drill rig was able to keep a drilling program ahead of the shovel during the year although it became necessary at times to add the third shift. Two blasts were fired before the proper hole spacing and powder charge were determined. Due to the occurrence of alternating layers of hard and soft material in the ore body it became necessary to load the holes, averaging 25 feet in depth, with 300# of powder.

The following table summarize the details of the mining in the Webster Pit:

TRUCK HAULAGE

Location	Material	Total Loads	Average Loads Per Shift
Webster	Crude Ore	9,834	70 (To Mill)
Webster	Rock	4,309	110 (To Dump)
Total		14,143	90

CHURN DRILLING

Location	Shifts	Holes Drilled	Footage Drilled	Avg. Depth Per Hole	Ft. Per Shift
Webster	394	646	13,158	20.36	33.39

PRIMARY BLASTING

Location	No of Holes	Tons Ore Broken	Tons Rock Broken	Pounds Powder	Tons of Material Broken Per Lb of Powder
Webster	524	264,420	133,734	87,950#	4.527

TOTAL POWDER USED:

Primary Blasts: (East) (Webster Pit)

Powder		Quantity	Average Price	Amount
E.P. 137		55,850#	17.65 CWT	$9,857.53
E.P. 142	Hercules Powder	22,750#	16.40 CWT	3,731.00
Titan "3"	Company	9,350#	15.85 CWT	1,481.98
Total Powder		87,950#	17.135 CWT	$15,070.51
Primacord Fuse		35,000'	36.49 M'	1,277.00
Tubular Boosters		800!	41.56 c	332.50
Thermoplastic Wire		1,000'	23.00 M	23.00
Total Fuse, Caps, Wire Etc.				$1,632.50
Total Explosives & Blasting Supplies				$16,703.01
Cost Per Ton for Powder and Blasting Supplies				$0.042

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7. OPEN PIT: (Con't)

f. Detail of Open Pit Mining: (Con't)

TOTAL POWDER USED (Con't)

Secondary Blasting (East & West Pit)

Powder	Quantity	Average Price	Amount
60% Gelatin Extra 1-1/8 X 8"	44#	$ 20.00 CWT	$ 8.80
40% H.P. Gelatin 1-1/4 X 8"	3060#	17.75 CWT	543.24
60% Gelatin Extra 5" X 5#	2000#	22.19 CWT	443.75
Total Explosives	5104#	$ 19.510 CWT	$ 995.79
Cloverland Fuse	3100'	$ 9.45 M'	29.29
Hot Wire Lighters	500	9.00 M	4.50
Caps & Electric Caps	1520	52.22 M	79.38
Total Fuse, Lighters, Caps Etc.,			$ 113.17
Total Explosives & Blasting Supplies (Secondary Blasting)			$ 1108.96

8. BENEFICIATION:

a. Season Production:

	Tons	% Wt. Crude	Iron	Sil	TPH Gross	TPH Net
Crude Ore to Plant	199,698		42.79	29.01	86.84	120.61
Crude Ore to H.M. Section	128,349	64.27	40.61	32.73	55.82	77.52
Crude Ore to Spiral Section	61,051	30.57	47.47	23.03	26.55	38.95
Fines to Tailing Pond	10,298	5.16	46.13	22.56		
Total Concentrates Produced	59,507	29.80	54.49	12.75	25.88	
H.M. Concentrates Produced	43,440	21.75	54.75	11.65	18.89	
Spiral Concentrates Produced	16,067	8.05	53.77	15.74	6.99	

b. Plant Operations:

The Ohio mill operated from May 7th through June 2nd, and from August 11th through October 28th when the operating season was terminated. Production from June 2nd through July 25th was halted because of the strike, and from July 26th through August 10th because of the need for revising and repairing the plant.

The concentrating plant treated 199,698 tons of crude ore during the season producing a total of 59,507 tons of concentrate. The shipping analysis of the product assayed 54.08% iron, 190% Ph., 12.21% sil and .030% sul, the overall weight recovery being 29.80%. Of this total, the heavy media section produced 43,440 tons of concentrate analyzing 54.75% iron and 11.65% sil, with a crude weight recovery of 21.75%, while the spiral section produced 16,067 tons analyzing 53.77% iron and 15.74% sil with a crude weight recovery of 8.05%.

8. BENEFICIATION: (Con't)

b. Plant Operations: (Con't)

The feed rate to the plant from the surge pile averaged 86.84 tons per hour throughout the season including delays (gross) or 120.61 tons per actual operating hour (net). Concentrate was produced at a rate of 25.88 tons per hour (gross). The media loss for the season was 0.995# of ferrosilicon per ton of heavy media feed, and 2.822# of ferrosilicon per ton of heavy media concentrate.

The above figures do not present a true picture of the capacity and production potential of the plant. They include figures from the first month of operation when production and operating time were low and the assay of the concentrate was far below grade. The figures from the last two months of operations approach a more normal operation. In September the highest monthly production was realized with a total of 23,587 tons of concentrate produced analyzing 55.14% iron, 11.93% sil with a crude weight recovery of 33.90%. In October the best grade of concentrate was produced although tonnage output was hampered by poor weather. 16,889 tons of concentrate were placed in cars assaying 55.15% iron, 10.59% sil with a crude weight recovery of 27.39%.

Although extreme difficulty is always anticipated in opening a mill, many other factors helped make the initial Ohio mill operation unsatisfactory. These factors included the lack of sufficient information concerning the ore and the many improper design features of the mill. Throughout the operating season a detailed research program and the continous changing and repairing in the mill helped overcome the situation although it will take the winter season of 1952-53 before most of the work will be satisfactorily completed.

As is evident in reading the production figures and rates of the 1951 season, the plant was at no time free of operating delays and difficulties. The hydrocone crusher was by far the major source of delay not only consuming considerable time for repairs, but when operating it was necessary to continually compromise between size reduction and tonnage.

Although a detailed discussion of every item of delay will not be made, the following outlines the trouble experienced with the crusher as such difficulties represented a total of 171.75 lost hours.

c. Major Sources of Delay:

Hydrocone Crusher:
(171.75 Hours Lost, 26.68% of all Delays, 7.4% of total working hours)

The initial installation of this crusher was designed for dry crushing. After a short time it became apparent that it would be necessary to add considerable amounts of water to prevent the sticky fraction of the ore from plugging the crusher and reducing the rated capacity. However, only limited amounts of water were added in May and June because of the inability of the crusher discharge arrangement to handle the excessive belt spillage and the wet conditions. After the strike ended in late July, a screen was placed under the crusher and a sump was installed to handle the drainage. In the latter part of the season more water was added to keep the hydrocone free from plugging, and in addition a 3/4" eccentric sleeve was installed on September 21st to raise plant capacity.

8. BENEFICIATION: (Con't)

c. Major Sources of Delay: (Con't)

Hydrocone Crusher: (Con't)

Throughout the season the inability of the crusher to handle any tonnage without plugging not only was the cause of frequent delays but also seriously curtailed operating at a high feed rate.

The packing of ore in the crusher caused excessive "whipping" in the hydraulic lines of the automatic reset system. This led to frequent cracking of connections in spite of the installation of heavy duty fittings. The automatic reset began to jam the mantle of the crusher against the top shell when leakage occurred from the reset nitrogen bladder into the hydraulic system. The automatic reset was then taken out and no further trouble occurred until a new nitrogen bladder was installed later in the season. Subsequently, it became necessary to bypass the reset again, as it once more began jamming the crusher.

On October 8th the large studs which bolt the top shell to the bottom shell began to break which forced the entire plant to shut down while replacements were made at the General Shops. An Allis Chalmers representative supervised the removal of the top shell and cleaning of the exposed bearing surfaces following this breakdown period and it was found that the taper fit which secures the top shell to the bottom shell had worn. It then became necessary to insert shims on the support ring in the hope that this would compensate for the wear.

On October 12th it became impossible to hold the two shells together with studs and a steel band was welded on the two shells to hold the joint tight. This held for the remainder of the season and was trouble-free.

All the major causes of delay are tabulated below constituting almost 85% of the lost time during the entire season. The remaining 15% fall mainly into the category of usual plant maintainance problems and are labeled as general repairs.

	Total Hours	% of Total Working Hours
Hydrocone Crusher	171.75	7.46
Initial Start of Plant	72.00	3.13
Conveyors - Spillage, Breaking Belts, Freezing Etc.,	63.80	2.77
Building up Specific Gravity Volume of H.M.	50.15	2.18
Feeding from Stockpile	45.63	1.98
Tailing Pump Motor	41.50	1.80
Chutes and Feed Boxes	25.28	1.10
Primary Preparation Screen	24.41	1.06
Hydroseparator Underflow Pump	22.58	0.98
Start of Plant After Strike	20.42	0.89
General Repairs	106.31	4.61
TOTAL	643.83	27.96%

Recapitulation:

Crude Ore Delays (Ore to Plant Head)	45.63	1.98
Ore Processing Delays	598.20	25.98
TOTAL	643.83	27.96

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8. BENEFICIATION: (Con't)

d. Hourly Operating Rates: Total Year

The following tables outline in detail the concentrating data for 1952.

	Tons	Gross Hours Operation	Net Hours Operation	TPH Gross	TPH Net
Pit Crude to Stockpile	201,740	1125.00	938.42	179.32	214.98
Stockpile to Plant	199,698	2299.50	1655.67	86.84	120.61
Heavy Media Feed	128,349	2299.50	1655.67	55.82	77.52
Spiral Feed	61,051	2299.50	1567.62	26.55	38.95
Concentrates	59,507	2299.50		25.88	

Operating Time 72.04%

Hourly Operating Rates: Monthly

TPH - Gross

	Pit Crude to Stockpile	Stockpile to Plant	Heavy Media Feed	Spiral Feed	Concentrates
May	126.12	40.45	29.26	11.19	9.86
August	196.82	96.06	53.68	46.84	23.73
September	189.69	115.97	81.34	33.47	39.31
October	189.21	101.48	62.34	31.02	27.79

TPH - Net

	Pit Crude to Stockpile	Stockpile to Plant	Heavy Media Feed	Spiral Feed
May	*	78.79	57.00	21.79
August	*	122.05	68.20	57.58
September	232.92	131.96	92.55	38.09
October	282.42	138.25	84.93	43.06

* No reliable figures available

e. Monthly Plant Delays:

	Hours	Per Cent of Season Delays	Per Cent of Season Working Hours
May	303.67	47.17	13.19
June	13.75	2.13	.59
August	91.98	14.29	4.00
September	72.73	11.30	3.16
October	161.70	25.11	7.02
TOTAL	643.83	100.00	27.96

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8. BENEFICIATION: (Con't)

f. Plant Analyses:

Product	Tons	% Wt.	Crude	% Fe	% Sil
Pit Crude	201,740			42.79	29.01
Plant Head	199,698			42.27	29.62
Heavy Media Concentrate	43,440	33.85	21.75	54.75	11.65
Heavy Media Tailing	84,909	66.15	42.52	33.37	43.52
Heavy Media Feed	128,349	100.00	64.27	40.61	32.73
Classifier Sand	16,067	26.32	8.05	53.77	15.74
Spiral Tailing	44,984	73.68	22.52	45.22	25.63
Spiral Feed	61,051	100.00	30.57	47.47	23.03
Hydroseparator Overflow	10,298		5.16	46.13	22.56
Calculated Plant Head	199,698		100.00	42.99	29.24

Plant Analyses: - Concentrates

Product	Tons	% Wt.	Crude	% Fe	% Sil
Heavy Media Concentrate	43,440	73.00	21.75	54.75	11.65
Classifier Sand	16,067	27.00	8.05	53.77	15.74
Calculated Total Concentrate	59,507	100.00	29.80	54.49	12.75

Shipping Analyses: - Concentrates

	Tons	% Fe	% Phos	% Sil	% Sul
Total Conc. Shipped from Pocket	51,166	54.05	.190	11.89	.032
Total Conc. Stockpiled	8,341	52.67	.173	15.70	.022
Total Concentrate	59,507	54.08	.190	12.21	.030

g. Concentrate Stockpile, Surge Pile, and Coarse Reject Pile Balances:

Concentrate on Hand 7:00 A.M., May 1, 1952	-0-				
Concentrate Stocked During Season	6,005	52.70	.179	15.86	.014
Concentrate Shipped During Season	8,341	52.67	.173	15.70	.022
Concentrate on Hand 7:00 A.M., October 29, 1952	-0-				

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8. BENEFICIATION: (Con't)

g. Concentrate Stockpile, Surge Pile, and Coarse Reject Pile Balances: (Con't)

Surge Pile Balance:

	Tons	% Fe	% Phos	% Sil	% Sul
Crude Ore on Surge Pile 7:00 A.M., May 1, 1952	5,060				
Plus Crude Ore to Surge Pile During Season	196,680	42.79		29.01	
Less Crude Ore from Surge Pile to Plant During Season	199,698	42.27		29.62	
Crude Ore on Surge Pile 7:00 A.M., October 29, 1952	2,042				

Heavy Media Reject Pile Balance:

	Tons	% Fe	% Phos	% Sil	% Sul
H.M. Reject Pile, 7:00 A.M., May 1, 1952	-0-				
H.M. Rejects to Pile During Season	84,909	33.37		43.52	
H.M. Reject Pile 7:00 A.M., Oct. 29, 1952	84,909	33.37		43.52	

h. Media Loss by Inventory:

	Barrels	Lbs
Ferrosilicon on Hand, 7:00 A.M., May 1, 1952	619	332,403
Ferrosilicon Dumped During Season	294	157,878
Ferrosilicon on Hand 7:00 A.M., October 29, 1952 in Barrels	325	174,525
Ferrosilicon on Hand in Plant		35,280

Loss #FeSi/Ton H.M. Feed - .955
Loss #FeSi/Ton H.M. Concentrate - 2.822

Calculated Media Loss by Weekly Test:

Attachment Losses:	Loss #FeSi Ton Sink	Loss #FeSi Ton Float
Highest Observed Value	.694	1.008
Lowest Observed Value	.123	.167
Average of all Tests	.358	.432

Secondary Crockett Tailing Loss:	Loss #FeSi Gallon
Highest Observed Value	.00451
Lowest Observe Value	.00079
Average of All Tests	.00185

Calculated Loss
#FeSi/Ton Heavy Media Feed - 0.837
#FeSi/Ton Heavy Media Concentrate 2.473

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8. BENEFICIATION:

i. Production Mettalurgy:

The composition of the crude ore varied considerably in the East Pit with the best ore along the footwall. In the first cut many basic igneous boulders of high gravity were mined with the ore but these gradually disappeared as the second cut was made into the formation. Crude analysis of the ore was as follows:

	Crude		Heavy Media Feed		Spiral Feed	
	% Fe	% Sil	% Fe	% Sil	% Fe	% Sil
May	41.01	31.88	35.67	40.52	45.38	25.85
August	41.88	30.82	40.11	34.68	44.34	27.36
September	42.71	29.09	42.17	30.61	48.11	22.23
October	42.58	28.39	40.74	31.28	49.77	19.64

The proportion of fines and coarse material varied greatly in the pit and this influenced the rate at which the plant was run. In dense rich goethite ore the media circuit operated at near capacity while the spirals received very little feed. During this time the fines were nearly high grade enough to run directly into the concentrate. In the limonite ore or in the hanging ferruginous argillites the spirals and the heavy media section were often overloaded with fines which hampered operations and at times produced a product high in silica. It should be possible in 1953 to operate at slightly lower gravities while milling the richer ore, and to send the spiral feed directly to the concentrate classifier. Close coordination between mining and metallurgy should result in a higher production and more constant grade.

Testing during the year was limited by the time consumed in the supervision of operations necessary with the opening of the plant. Control work on all portions of plant products will be more complete for the 1953 season. Metallurgical work centered mainly on 1) eliminating "jackpots" or sudden loss of media in the drum separator in the heavy media circuit, 2) removing of a coarse final concentrate from the primary spirals, 3) improving the classification of spiral concentrates, 4) testing on other methods of concentration for fines, 5) improving operation of the spirals, 6) testing the efficiency of the Crockett magnetic separators, and 7) testing attachment losses on heavy media products.

The most important jobs of those listed above were those dealing with "jackpots" and those dealing with the improvement of the spiral concentrate grade. The former problem was solved when the differential between the sink and float side specific gravity was maintained at between 0.1 and 0.15. This gave enough fines to the media bath to permit the suspension to hold high gravities without "jackpotting" and also eliminated a high viscosity that would hinder the separation.

It was found during the first part of the season that most of the high grade concentrate in the spiral feed occurred in the coarser sizes. It was decided that these values could be best recovered if the second and fourth ports of the primary spirals were opened to the maximum and allowed to feed directly to the classifier since the spirals were not recovering this material efficiently. It was also thought that the removal of this fraction would also benefit the operation of the secondary spirals.

8. BENEFICIATION: (Con't)

i. Production Mettalurgy: (Con't)

Ten collectors were tried experimentally in September and a second set of ten were added late in the month. In October an additional twenty were completed so that all primary spirals were sending their first two port concentrates directly to the classifier. This setup was made flexible enough so that the original system could be restored by replacing the hoses.

Testing showed that the classifier product was also high grade in the coarser sizes and that the fine sizes were contaminating the concentrates. Washing sprays and lifter bars were put on the classifier, and the pool was made smaller with baffles in order to overflow a coarser product. This coarse separation in the classifier was a major factor in improving the grade of the spiral product later in the season. All middlings were recirculated to the hydroseparator in order to keep the material in the circuit. However, recovery in the spiral system islow and additional tests will be conducted on this problem during 1953.

9. MAINTENANCE, REPAIRS AND MILL CHANGES:

Since the mill was completed in late fall of 1951 without being operated and most of the pit equipment was delivered new also at that time, little repair or maintenance was necessary throughout the first quarter of 1952. However, upon opening the mill numerous repairs and changes were started and continued throughout the year. A large quantity of this work was completed after the strike when a repair shutdown kept the mill idle until August 11th. During this period a wash screen, catch basin, pump and sump were installed to the secondary crushing unit which allowed the addition of water to the hydrocone crusher and therefore increased capacity. Installation of "lifter bars" and water sprays in the spiral classifier to produce a coarser overflow was completed later in the season. The eccentric sleeve in the secondary crusher (hydrocone) was changed, increasing the throw from 1/2" to 3/4", which also was intended to increase the capacity of the unit. In an effort to remove a coarse fraction from the spiral section, a special port arrangement was installed in the primary spirals. As previously described, under this setup the product from the top ports in the primary section was scalped out as a concentrate as testing proved it to be grade.

Following the mill shutdown on October 29th, a crew consisting of 4 men and a foreman started a general overhauling of the mill with countless items of both major and minor importance being scheduled for repair or changing. Among the major jobs included the replacing of the hydrocone crusher, the extension of the reject conveyor, the remodeling of the crude ore hopper, the installation of an additional fine tailings pump and the installation of a 3' x 10' triple deck screen under the new crusher.

10. COST OF OPERATION:

a. Comparative Mining and Concentrating Costs:

Product	1952 Budget	1952 Cost Per Ton
Webster Concentrates Produced		59,507
Average Daily Product		620
Tons Per Man Day		8.16
Days Operated		96

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10. COST OF OPERATION: (Con't)

a. Comparative Mining and Concentrating Costs: (Con't)

Cost:	1952 Budget	1952 Cost Per Ton
Pit Operating	1.15 (Conc)	0.279 (Crude)
Concentrating	1.20	1.563
Loading Stockpile Ore		.087
General Mine Expense	0.50	.758
Winter and Idle Expense	0.52	.648
Cost of Production	3.37	3.978
Depreciation		
Amortization	1.38	.543
Taxes		
Total Dep. Amort. and Taxes	1.38	.543
Total Cost at Mine	4.75 (Conc)	4.521 (Conc)

The 1952 cost does not include taxes and amortization. Taxes were included as strike expense and the yearly stripping expenditures were written off under Federal regulations for income tax relief.

b. Cost Comments:

Although overall production costs were in excess of the budget, they can be regarded as reasonable if the tremendous quantities of delays suffered throughout the season are completely considered. However, pit costs at $0.279 per ton of crude compared well with most truck and shovel operations throughout the Lake Superior Region.

In comparing the budget with the actual costs in the above table, the concentrating costs as expected are high. However it is also evident that the general mine expense is entirely out of line. Although numerous factors contributed to this high cost it is in general due to the fact that the property was opened after a minimum of exploration, research and development. This necessitated the need of carrying such programs to a great extent throughout the year and added a considerable amount to the general mine expense during the summer. As an example, grading and analysis plus geology and metallurgy alone totaled $0.396 per ton. Although this situation will burden the Ohio for a portion of 1953, it is expected that such high costs can be reduced during the next season.

11. EXPLORATION AND FUTURE EXPLORATION:

The exploration of the Webster Pit area by churn drilling to supplement the original diamond drilling started in December of 1951 and continued through the first 1-1/2 months of 1952. A total of 24 holes averaging approximately 60' were drilled. During November a series of 10 churn drill holes were put down at the east end of the Webster Pit for information on structure, grade, and location of the footwall contact. Large samples of Webster Pit crude, coarse and fine tailings were shipped to the research lab for a test program that is aimed at increasing the recovery in the plant.

11. EXPLORATION AND FUTURE EXPLORATION: (Con't)

Three 50' holes were drilled on the Portland-Webster Lease line. These holes indicated that stripping and mining in the Portland area would be quite possible.

In the Norwood area two test pits were started for the purpose of obtaining samples of the ore, and also to study the structure of the ore body. During December some old mine workings were uncovered in the Norwood-Beaufort area and plans were made to dewater and explore these old drifts. A diamond drilling program to further outline the Norwood-Beaufort area as well as the Portland is being planned for 1953.

12. TAXES:

Since the Ohio Mine is classified as a "lean ore property" and the ore material requires beneficiation before shipment, the valuation of this property is covered by State House Bill No. 315. In figuring the valuation, the f.o.b. mine value of ore shipped during 1952 as calculated by the State Tax Commission is $6.5929 and multiplied by 2% yields a tax of $.131858 per ton of ore shipped. The shipments amounted to 59,507 tons which multiplied by $.131858 yields a total tax of $7,846.00. Applying the local tax rate of $39.21 per $1,000, the calculated value amounts to approximately $200,000. However, according to the Bill, the value of the property cannot be less than the sales value of the plant and equipment which was estimated in June of 1952 at $370,000. The company reported that total expenditures as of December 31, 1952 amounted to $785,606.36. To this must be added the supply inventory of $50,244.03 or a total of $835,850.39. To arrive at a sales value, an allowance of $50,000 was made for dismantling and questionable items reducing the above to $786,000. By using a factor of 5/8 for inflation correction and a further factor of 80% of full and true yields an approximate present value by this method of $390,000 on which to base 1953 taxes.

Mine Value of Ore: (State Tax Commission Calculation)

9.30000	L.E. Base
- .093	1% Shrinkage
9.20700	See Calculation Opposite
-2.6141	F.O.B. Mine Value (Ohio)
6.59290	

.9730	Rail Haulage
1.5811	Lake Freight
.003	Insurance
.007	Analysis
.05	Selling
2.6141	Total Rail Haulage, Etc.

Detail of Valuation and Taxes:

	1951	1952	1953
Value	$17,200	$370,000	390,000
Taxes	$715.51	14,652.78	-

During 1952 18% of the taxes paid were proportioned to the Webster operation and 82% were charged against the remaining property.

13. ACCIDENT AND PERSONAL INJURY:

There were no compensable injuries at the Ohio Mine during 1952.

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14. PROPOSED NEW CONSTRUCTION:

Additional warehouse space for the storage of parts and equipment is being planned. The program calls for an addition to the present warehouse for the exclusive storage of truck, tractor and shovel parts and construction of a new warehouse near the mill for spare mill equipment and parts. It is also planned that part of the mill warehouse will also house a sample preparation room. A new concrete platform for storing barrels of heavy media is scheduled for construction during the 1953 season.

15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT:

a. Equipment Received During 1952:

1 - D-8 Tractor with Angle Dozer
1 - 12000 Amp Circuit Breaker
1 - 20,000 Pound Garage Jack
1 - Allis Chalmers Centrifugal 2500 G.P.M. Pump
1 - Platform Scale
1 - Hazleton 3" - 150 G.P.M. Pump
1- 7-1/2 H.P. Westinghouse Motor
1 - Hot Water Storage Tank (10' X 30")
1 - 5" Machinists Vise

b. Proposed New Equipment:

1 - 4' Shorthead Symons Cone Crusher
1 - Simplicity Triple Deck Horizontal Screen
2 - Sand Pumps (1) 2500 G.P.M. (1) 500 G.P.M.
1 - 150 H.P. - G.E. Motor
1 - 160' Extension to Conveyor for Stacking Coarse Rejects
1 - 48" X 20' 3" Wemco S-H Classifier
1 - 50 H.P. Allis-Chalmers Motor
1 - 100' x 24" Trailing Conveyor for Stacking Rejects
1 - 32' x 24" Classifier Discharge Conveyor.

16. NATIONALITY REPORT:

Men employed were of the following nationalities:

	American Born		Foreign Born		Total	
Nationality	1951	1952	1951	1952	1951	1952
French - German	3	2			3	2
Irish	3	1			3	1
English	3	1			3	1
Polish	1	-			1	-
Swedish	3	3	1		4	3
Swedish - French	1	1			1	1
Norwegian	1	1			1	1
French	5	3			5	3
Finnish	28	28	3	3	31	31
English - French	1	1			1	1
Irish - French	1	-			1	-
English - Finnish	1	1			1	1
German - Dutch - Swedish	1	1			1	1
Croatian	1	1			1	1
German - Swedish	-	1			-	1
Total	52	45	4	3	56	48

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GENERAL

With the current and anticipated future demand for iron ore and the necessity of developing additional iron ore producing properties, an estimate on capital expenditures to construct a two unit flotation plant to produce 400,000 tons of iron ore concentrates was made in August 1952. The basis used in making the estimate was the Humboldt Mine experience up to that date with some changes due to adapting the Humboldt type of plant to the terrain at Republic.

From an economic value standpoint the Republic low grade ore body,which contains up to 65 million tons of known reserves and millions of additional tons of probable reserves, it appears as though the Republic ore body is the most desirable to develop at this time. Not only is it desirable to be in the field on development of low grade properties to supplement direct shipping grade ore produced in underground mining, but also to be able to produce a high grade concentrate to mix with and improve the iron content of the ore mined from underground properties. The Republic ore body includes several million tons of crude ore which is partially exposed on the surface, requiring a minimum of stripping to begin mining.

After completion of the capital expenditure estimate in August, field survey crews working out of our Engineering Department began surveying locations for proposed plant sites. Mr. Abe Mathews of Hibbing, Minnesota, was employed to begin plant layout and design with Mr. Ralph Boeck, our consulting engineer on structural design.

The L.S.& I.Railroad Company was informed of the proposed plans for the mine plant in September, which resulted in immediate action from this organization. A contract was let to construct the railroad grade into the plant site. By the end of the year, the grading was completed and a single track completed to a point 500 feet beyond the location of the proposed railroad loading pocket.

In October, after two months of plant location study, an excellent general plant layout was completed. Plans for an excavation contract were drawn up and submitted for unit cost bids to four local contractors. A Lindberg & Sons, Inc., were the low bidders on the excavation work which was started in December. By the end of the year this phase of the project was well underway.

PLANT DESIGN

With the large tonnage of reserves available, initial plant design was based on constructing a two mill unit plant with provisions for addition of five mill units resulting in an ultimate yearly production of 1,500,000 tons of iron ore concentrates from the seven mill units.

In the layout of the secondary tertiary crushing plant, possible provisions to produce a Tilden grade and also small shipments of high grade lump were also kept in mind. Some of the exploratory drilling had proven 15 foot runs of high grade ore which may prove economically feasible to ship direct after pit operation is in progress.

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The general arrangement of equipment and plant layout is very similar to the Humboldt Mine, except for the following:

1. An excavation in solid rock is being made to install the Primary Crusher. By this method the dump point of the trucks will be at approximately the same elevation as the first operating benches in the pit, which eliminates approximately 62 feet of elevation or almost 800 feet of 8% plus grade, which would be encountered with every truck load of ore from the pit. Dirt embankment ramps to and from the primary crusher, if the structure were built above ground, would also be costly.

2. Present planning includes use of a catenary type of bin for the mill feed instead of a circular type as used at Humbuldt, due to an ultimate of seven mill units instead of the proposed ultimate of three units at Humboldt.

3. In some instances equipment of different manufacture from the equipment purchased at Humboldt is also proposed to compare operating efficiency.

4. Plant location and the topography at Republic has necessitated changes from the Humboldt plan.

5. The larger ultimate capacity of the Republic plant also made other changes necessary.

Although the aforementioned changes from Humboldt design were necessary, studies of the proposed plant to date indicate that a more desirable plant location was available at Republic.

RAILROAD TO PLANT SITE

The L.S.& I.Railroad Company did an excellent job of rushing a railroad into the plant site from Humboldt. With construction of the plant scheduled to begin early in 1953, which would require railroad shipment of materials and supplies, the railroad company cooperated in beginning this project immediately after being notified of the time schedule. The rough terrain in the area adjacent to the plant site presented problems in location and grades for the track. Borrow dirt for fills was also hard to find between the many solid rock outcrops in the area. An example of the grade problem to be overcome can be noted from the fact that the railroad enters the property at elevation 1515 and terminates in the mill building at elevation 1622,or 107 feet of elevation within the property.

EXCAVATION CONTRACT

A Lindberg & Sons, Inc. began excavation work on the mill site on December 15, 1952 and by the end of the year the massive boulders and the earth covering the ledge was almost entirely removed from the grinding bay which proved that the heavy equipment to be installed in this area would have excellent foundation bearing on solid rock. Drilling of the solid rock to excavate this area to grade was started immediately after stripping.

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Excavation for the primary crusher was started December 26, 1952, and by the end of the year the excavation was completed to a depth 15 feet below the original surface elevation. At this depth solid rock had not been reached in the northwest corner of the excavation due to the sloping condition of the rock outcrop chosen for the excavation. Conditions around the excavation indicated that solid rock would be encountered in the next cut.

SURVEYS AND OTHER ENGINEERING

A field survey crew working out of the Mining Engineering Department in Ishpeming tied in railroad surveys with the base line surveys of the proposed plant.

Surveys of old rock piles from underground operations were also started to determine the quantity of plant crude ore available from this source. Cross-sectioning of the plant area was completed at 50 foot intervals and in some instances at 24 foot intervals along lines of columns in buildings in order to have exact information on field conditions for planning purposes.

A study of the Republic Township water supply was scheduled to begin early in 1953 to determine what would be involved in bringing potable water to the plant.

Tentative plans for a new building plat adjacent to Republic were also under consideration to have a location available for the houses which will have to be moved when pit operations begin.

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1. GENERAL:

The Tilden Mine did not operate during 1952, activities being limited almost wholly to loading from the stockpile and repairing the crushing plant and Euclid Trucks.

Other work of a minor nature included the completion of a churn drill program in the West Pit which was started in December of 1951, the operation of the crushing plant in October and November to reduce Humboldt ore for the research laboratory and general repair and clean-up work on all equipment and buildings. The latter also included the dismantling and moving of the old pipe line formerly used to pump water from a pond south of the pits to hydraulic the overburden. This setup was no longer considered practical and should such earth moving be necessary in the future, a new water system will have to be installed.

During September two Tilden 15 ton Euclids were transferred to the Humboldt Mine and by the end of the year arrangements were being made to send additional equipment to that project.

2. PRODUCTION, SHIPMENTS AND INVENTORIES:

a. Shipments: (Gross Tons)

Grade	From Pocket	From Stockpile	Total For Year	Remaining Ore in Stock: From Mine Records	Remaining Ore in Stock: From Survey Estimate
Tilden Silica	-0-	64,590	64,590	-0-	19,000
Tilden Low Phos	-0-	15,859	15,859	552	2,000
T O T A L		80,449	80,449	552	21,000

An overrun of 7,510 tons was realized during the year from the Tilden Silica stockpile.

b. Broken Ore Reserves:

	East Pit	West Pit	Summit Pit	Total Tons
Broken Ore, Jan. 1, 1952	28,454	-0-	9,290	37,744
Shipped and Stocked, 1952	-0-	-0-	-0-	-0-
Reserves, Dec. 31, 1952	28,454	-0-	9,290	37,744

c. Comparison of Shipments - 5 Year Period: (1948-1953)

Year	Tons Silica	Tons Low Phos	Total Year	Yearly Decrease	Yearly Increase
1948	78,641	43,750	122,391		
1949	69,446	9,373	78,819	43,572	
1950	91,510	23,926	115,436		36,617
1951	78,627	9,959	88,586	26,850	
1952	64,590	15,859	80,449	8,137	

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3. ANALYSIS:

a. Analysis of Shipments: (Dried)

Grade	Tons	Iron	Phos	Silica	Sulphur	Moisture
Tilden Silica	64,590	39.85	0.036	41.45	0.015	2.46
Tilden Low Phos	15,859	35.69	0.013	47.41	0.010	2.29

b. Analysis of Ore Remaining in Stock: (Dried) (Estimated)

Grade	Tons	Iron	Phos	Silica	Sulphur	Moisture
Tilden Silica	19,000	39.75	0.035	41.46	0.010	2.40
Tilden Low Phos	2,000	36.00	0.013	46.90	0.010	2.32
T O T A L	21,000					

The above figures are estimated since the records at the end of the year as indicated in a previous table show only 552 tons of low phos remaining. The indicated tonnage over 552 tons is overrun that will be realized. The following analyses are shipping department figures for the 552 tons.

Grade	Tons	Iron	Phos	Silica	Sulphur	Moisture
Low Phos	552	36.54	0.017	46.27	0.012	2.19

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

1. West Pit - Above floor at 1430'

Assumption: 13 Cu. Ft. equals one ton.

Total Stripped & Developed as of January 1, 1952	1,317,337 Tons	
Mined during 1952	5,007	
Total Remaining December 31, 1952	1,312,330 Tons	

2. East Pit - Above floor at 1440'

Assumption: 14 Cu. Ft. equals one ton.

Total Stripped & Developed as of Jan. 1, 1952 1440' to 1500'		1,278,320 Tons
Total Stripped & Developed as of Jan. 1, 1952 above 1500'	1,688,712 Tons	
Mined during 1952	2,503	
Total Remaining above 1500' as of Dec. 31, 1952		1,686,209
Total Remaining above 1440' as of Dec. 31, 1951		2,964,529

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4. ESTIMATE OF ORE RESERVES: (Con't)

a. Developed Ore: (Con't)

3. Summit Pit - Above floor at 1620'

Assumption: 14 Cu. Ft. equals one ton.

Total Stripped & Developed as of Jan. 1, 1952	359,394
Mined during 1952	-0-
Total Remaining as of Dec. 31, 1952	359,394 Tons

Total Developed Ore as of Dec. 31, 1952:

West Pit	1,312,330
East Pit	2,964,529
Summit Pit	359,394
Total all Pits	4,636,253

Broken Ore in Pits is included in the above reserves.

	West Pit Lower Bench	East Pit	Summit Pit	Total
December 31, 1952	-0- *	28,454	9,290	37,744 Tons

* There is a small tonnage of broken ore in the West Pit but it is all overrun from the estimated tonnage on previous blasts.

Total Prospective Ore

West Pit

Balance remaining to be stripped in East half of Upper Bench 500,000 Tons

East & Summit Pits

Total above 1500' lying North & East of the East Pit	2,235,500
Total Prospective Ore as of December 31, 1952	2,735,500 Tons

b. Estimated Analysis of Reserves

		Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
1.	West Pit										
	Dried	39.17	.050	41.91	.09	.90	.20	.22	.009	.24	
	Natural	38.50	.049	41.20	.09	.88	.20	.22	.009	.24	1.70
2.	East Pit										
	Dried	37.00	.020	45.00	.09	.54	.20	.17	.009	.34	
	Natural	36.50	.020	44.40	.09	.53	.20	.17	.009	.34	1.34
3.	Summit Pit										
	Dried	36.00	.015	46.00	.09	.54	.20	.17	.009	.34	
	Natural	34.50	.015	45.40	.09	.54	.20	.17	.009	.34	

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4. ESTIMATE OF ORE RESERVES: (Con't)

c. Estimate of 1953 Production:

	West Pit	East Pit	Summit Pit	Total
Tilden Silica	95,000	45,000		140,000
Tilden Low Phos	______	8,000	22,000	30,000
T O T A L	95,000	53,000	22,000	170,000

The West Pit ore is mixed with the East Pit at an approximate ratio of 2 to 1 to produce the guaranteed grade of Tilden Silica. The low phos production is also graded with ore from the Summit Pit and The East Pit at a ratio of approximately 4 to 1.

d. Guaranteed Grade 1953:

	Grade	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
1.	Tilden Silica										
	Dried	39.00	0.040	42.30	0.07	0.69	0.25	0.20	0.010	0.35	----
	Natural	38.30	0.039	41.54	0.07	0.68	0.25	0.20	0.010	0.34	1.80
2.	Tilden Low Phos										
	Dried	36.00	0.015	46.90	0.07	0.66	0.20	0.20	0.010	0.30	----
	Natural	35.50	0.015	46.24	0.07	0.65	0.20	0.20	0.010	0.30	1.40

5. LABOR AND WAGES:

a. Comments:

A small crew averaging four men was the only labor force at the Tilden Mine during the year. Since the mine was idle, the summer strike had little effect on the managing of property.

6. GENERAL SURFACE:

a. Buildings and Repairs:

Routine repairs to all the buildings were completed during the year as well as the construction of a new blasting shelter and a new coal shed.

b. Roads, Transmission Lines, Etc.

The main road leading from the property gate to the upper portion of the dam was given a surfacing of rock and gravel and placed in good condition during May. This area was particularly damaged by the spring break-up and became almost impassable.

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7. OPEN PIT:

a. Stripping:

There were no stripping operations at the Tilden Mine during 1952.

b. Mining:

As previously mentioned there was no production of Tilden ore during 1952, although a drilling program consisting of 7 holes along the west end of the top bench of the West Pit was completed during January. The following tables outline the details of this churn drilling program.

CHURN DRILLING

Location	Shifts	No of Holes	Total Footage	Avg Depth Per Hole	Feet Per Shift	Cost Per Foot - 1952
West Pit	20	7	393	56.1	19.65	4.327

8. IDLE EXPENSE:

a. Cost Comments:

During 1952, the total expenses for maintaining the Tilden Mine amounted to $65,464.88. These expenditures were divided into idle costs totalling $28,166.80 and winter and idle costs totalling $37,298.08. The idle expenses including such expenditures as police protection, mine office expense and taxes were charged against general profit and loss and therefore were distributed against all the mines. The winter and idle expenses representing costs such as crusher repair and building maintenance will be charged to 1953 operations.

b. Detail of Expense:

1952 TOTAL WINTER AND IDLE EXPENSE:

MONTH	LABOR	SUPPLIES	TOTAL
January	4,343.96	1,168.50	5,512.46
February	4,045.93	2,987.12	7,033.05
March	3,270.70	1,633.50	4,904.20
April	3,312.32	2,030.79	5,343.11
May	3,569.78	2,066.32	5,636.10
June	2,794.86	1,146.90	3,941.76

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8. IDLE EXPENSE: (Con't)

b. Detail of Expense: (Con't)

1952 TOTAL WINTER AND IDLE EXPENSE: (Con't)

MONTH	LABOR	SUPPLIES	TOTAL
July	1,577.53	42.21	1,619.74
August	4,301.78	1,382.34	5,684.12
September	5,465.65	2,794.97	8,260.62
October	3,807.14	2,852.72	6,659.86
Nevember	2,514.18	3,369.82	5,884.00
December	2,686.09	2,299.77	4,985.86
T O T A L	41,689.92	23,774.96	65,464.88

9. TAXES:

Description:	1952 Valuation	1952 Taxes	1951 Valuation	1951 Taxes
$N\frac{1}{2}$ of Sec. 26, 47-27 320 A.	65,000	1,319.15	155,000	3,144.62
Personal Property, Equip. & Supplies	225,000	4,556.28	180,000	3,651.82
Total Tilden Mine	290,000	5,875.43	335,000	6,796.44

10. ACCIDENT AND PERSONAL INJURY:

There were no lost time accidents at the Tilden Mine in 1952.

11. PROPOSED NEW EQUIPMENT:

The purchase of a 3/4 ton pick-up truck with a dump box is proposed for use during the 1953 operating season.

12. NATIONALITY REPORT:

The following table outlines the descent of the men associated with the Tilden Mine during 1952.

English	5
Swedish	2
Finnish	1
Irish	1
German.	1
T O T A L	10

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1. GENERAL:

The Athens Mine operated on a schedule of a 6-day week from January 1st through July; on a $5\frac{1}{2}$ day week August through November 15th; and on a 5-day week from November 15th through December. During the year, mining operations were performed by a full 2-shift crew, with a small hoisting crew on the third shift. Mining operations were halted from June 3rd through July 27th, during which time the mine was on strike.

The mining operations in the Corbit Lease were completed in 1951, however, there remained 142 tons of stockpile overrun from prior years.

The production from the Athens Mine in 1952 was 497,277 tons as compared with 630,804 tons in 1951. During the year, the production was obtained from two levels, those being the 6th and 10th levels. Approximately two-thirds of the year's production was from the 10th level with the greater part of that production coming from block caving in the north ore body. In 1952, the production was less than the previous year because of a reduced working schedule and the eight weeks strike which occurred in June and July. Not only was the eight weeks production lost, but due to the long shutdown, normal production was not realized until December because of breakdowns throughout the mine caused by the heavy weight conditions in the mining areas.

All of the main level drifting during the year was confined to the 6th and 10th levels. The 10th level connection drift to the Negaunee Shaft was advanced 277 feet. The main line drift in the Bunker Hill was extended 170 feet to the west. Two crosscuts, 1600 and 1700, were extended to the south from the 10th level main line. Several diamond drill cutouts were prepared in these drifts in order to explore the Bunker Hill ore body.

The cost of timbering during the year was less than in the previous year, even though there was an increase in the cost of labor and supplies. The decrease was largely due to the replacement of wooden timber by permanent steel sets and the change from top slicing to sub-level caving in the area above the 6th level.

There was considerably less development work done in 1952 than in 1951. In 1952, there were 3,487 feet of ore development and 3,330 feet of rock development as compared with 5,127 feet of ore development and 5,040 feet of rock development in 1951. The decrease was largely due to less main level drifting and block cave development.

The subsidence of the surface area continued to have its effects on the shaft, trestles, offices, shops, engine house and various other buildings throughout the surface plant. It is somewhat doubtful whether the full capacity of the shop building can be utilized up to the time of the moving to the Negaunee Shaft. The coal dock was abandoned and the rock trestle, of necessity, had to be raised back to grade.

The exploration during the last five months in the Athens Mine was confined to the area below the 10th level. Drilling in both the north

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1. GENERAL: (Cont'd.)

and south ore bodies proved the location of the footwalls at the 12th level elevation. The previous estimates of ore locations were verified by the drilling that was done. In the Bunker Hill property, the exploration from the 10th level located the footwalls for the 12th level and the ore outlines for the 10th and 12th levels. There was more ore found above the 10th level than had been previously estimated. The reason for this being that a complex faulted structure was found and consequently some uplifting of lower ore resulted.

2. PRODUCTION:

Production by Grades and Months:

Month	Athens	Mitchell	Corbit	Bunker Hill	Total	Rock
January	39,551	7,730		1,319	48,600	3,350
February	42,356	6,645		565	49,566	3,985
March	47,476	10,325		989	58,790	3,525
April	45,287	8,591		1,290	55,168	3,780
May	35,816	9,263		6,087	51,166	3,295
June	691	262		138	1,091	145
July	4,519	944		1,824	7,287	335
August	23,921	7,913		8,970	40,804	2,405
September	24,478	5,520		8,945	38,943	4,425
October	34,049	7,769		8,609	50,427	3,645
November	20,865	15,133		7,362	43,360	1,390
December	23,088	14,706		6,910	44,704	2,195
Total:	342,097	94,801		53,008	489,906	32,475
Current Year's Stockpile						
Overrun	5,315	1,835	142	79	7,371	
Total 1952	347,412	96,636	142	53,087	497,277	32,475
Total 1951	515,622	79,950	32,106	3,126	630,804	38,675
Increase		16,686		49,961		
Decrease	168,210		31,964		133,527	6,200

Shipments:

Grades:	Pocket	Stockpile	1952 Total	1951 Total
Athens	133,063	237,575	370,638	498,462
Mitchell Lease	52,898	38,529	91,427	75,324
Corbit Lease		3,857	3,857	33,992
Bunker Hill	42,356	3,265	45,621	2,813
Total	228,317	283,226	511,543	610,591
Total Last Year	341,479	269,112	610,591	
Increase in Shipments		14,114		
Decrease in Shipments	113,162		99,048	

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

ORE STATEMENT - JANUARY 31, 1952

	Athens	Mitchell Lease	Corbit Lease	Bunker Hill	1952 Total	1951 Total
On Hand January 1, 1952	55,520	11,774	3,715	313	71,322	51,108
Output for Year	342,097	94,801		53,008	489,906	596,361
Prior Year Stockpile Overrun						
Current Year's Overrun	5,315	1,835	142	79	7,371	34,443
Total	402,932	108,410	3,857	53,400	568,599	681,912
Shipments	370,638	91,427	3,857	45,621	511,543	610,591
Balance On Hand	32,294	16,983		7,779	57,056	71,321
Increase in Output		15,835		49,882		8,069
Decrease in Output	143,519		28,653		106,455	
Increase in Ore on Hand		5,209		7,466		20,213
Decrease in Ore on Hand	23,226		3,715		14,265	

OPERATING SCHEDULE

Year	Days Per Week Mine Operated
1952	6 days through July; 5½ days through November 15; and 5 days through December.
1951	6 days - entire year.
1950	5 days - January through July; 6 days August through December.
1949	6 days - January through June; 5 days July through December.
1948	6 days - entire year.

Division of Products by Levels:

	1952 Tons	1952 Percent	1951 Tons	1951 Percent
4th Level				
6th Level	163,278	32.8%	228,226	36.2%
7th Level				
8th Level			62,977	10.0%
9th Level			29,786	4.7%
10th Level	333,999	67.2%	309,815	49.1%
Total:	497,277	100.0%	630,804	100.0%

Production Delays:

Date	Hours		Tons Lost
Feb. 16 & 18	10½	Repair skip hoist drum	1050
Nov. 19	4	Smoke from battery locomotive fire at Negaunee Shaft	400
Nov. 20	8	Smoke from battery locomotive fire at Negaunee Shaft	800
	79½	Miscellaneous	7950
Total:	102		10200

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2. PRODUCTION: (Cont'd.)

The U.S.A., C.I.O. strike, which started with the afternoon shift on June 2nd and continued through July 27th, caused a very considerable amount of production delay. During the two months of actual shutdown, the tonnage loss amounted to 90,800 tons. The strike not only caused a loss to production during this period but also caused a loss of production in the ensuing four months which amounted to approximately 19,200 tons. The total loss of production which was accredited to this shutdown amounted to approximately 110,000 tons.

3. ANALYSIS:

Average Mine Analysis on Output:

	1952					1951			
Grade:	Tons	Iron	Phos	Sil	Sul	Tons	Iron	Phos	Sil
Athens, Corbit & Bunker Hill	400,641	58.63	.108	9.36	.012	550,854	58.45	.115	9.06
Mitchell Lease	96,636	59.50	.118	7.83	.118	79,950	58.89	.119	8.67
Total:	497,277	58.80	.110	9.06	.012	630,804	58.51	.116	9.13

Average Analysis of Shipments:

Grade:	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
Athens and Mitchell Lease	58.35	.120	9.38	.56	3.06	.41	.81	.013	1.62	13.18
Natural	50.66	.104	8.14	.49	2.66	.36	.70	.011	1.41	

Average Analysis of Ore in Stock:

Grade:	Tons	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
Athens and	40,073	58.63	.105	9.31	.56	3.06	.41	.81	.011	1.62	13.18
Bunker Hill	Nat'l	50.90	.091	8.08	.49	2.66	.36	.70	.010	1.41	
Mitchell	16,983	59.65	.118	7.75	.53	3.05	.43	.81	.011	1.65	13.18
Lease	Nat'l	51.79	.102	6.73	.46	2.65	.37	.70	.010	1.43	

4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

Developed Ore:

In the Athens Mine, of the total ore reserve, which is based on the figures which were submitted to the tax commission, the reserve between the 4th and 6th levels, and between the 7th and 10th levels is considered as developed ore. The remaining ore, or that between the 6th and 7th levels and all the ore below the 10th level is considered as undeveloped ore.

In the Bunker Hill property, only the ore reserve above the 10th level is considered developed and in accord with this, all the ore reserve below the 10th level is considered as undeveloped.

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

Developed Ore: (Cont'd.)

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

	Athens	Mitchell Lease	Bunker Hill	Total
Ore Reserves - Dec. 31, 1951	1,310,934	316,676	436,852	2,064,462
Ore Production - 1952*	347,412	96,636	53,087	497,135*
Ore Reserves - Dec. 31, 1952	1,401,413	294,019	1,696,380	3,391,812
Tonnage Proved in 1952	437,891	73,979	1,312,615	1,824,485

*142 tons Corbit Lease stockpile overrun not included.

	Athens	Mitchell Lease	Bunker Hill	Total
4th to 6th Level	184,832	305,439		490,271
6th to 7th Level	6,000	77,082		83,082
7th to 8th Level	6,490			6,490
8th to 9th Level	156,200			156,200
9th to 10th Level	445,690		240,013	685,703
Below 10th Level	901,765		1,500,549	2,402,314
Total Gross Tons as of July 31, 1952	1,700,977	382,521	1,740,562	3,824,060
Less August Production	23,921	7,913	8,970	40,804
Total Gross Tons as of August 31, 1952	1,677,056	374,608	1,731,592	3,783,256
Tonnage Increase as Proven by Development - August 31, 1952 - Dec 31, 1952			188,725	188,725
Total as of Dec. 31, 1952	1,677,056	374,608	1,920,317	3,971,981
Less Production Aug. 31, 1952 to December 31, 1952	107,937	43,128	31,905	182,970
Total Gross Tons as of Dec. 31, 1952	1,569,119	331,480	1,888,412	3,789,011
Less 10% for Mining Loss and Rock	167,706	37,461	192,032	397,199
Net Tons 1952	1,401,413	294,019	1,696,380	3,391,812
Net Tons 1951	1,310,934	316,676	436,852	2,064,462
Increase	90,479		1,259,528	1,327,350
Decrease		22,657		

Expected Average Natural Analysis of Ore Reserves:

The following analysis is based on the figures which were submitted to the State Tax Commission.

Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
51.00	.100	8.00	0.30	2.75	0.40	0.76	0.012	1.40	13.50

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5. LABOR AND WAGES:

Labor Relations:

There were four grievances advanced to Step 2. The final decision of only one of these was obtained during the year and the other three were carried over into the following year. The one which was settled was won by the Company in Step 2.

It was very apparent that there was a feeling of unrest and insecurity among the men. This was undoubtedly due to the strike, the retroactive pay, and the job classifications. As a result of the prevailing mental attitude, the accident rate was raised, as the men were not mentally alert to hazards encountered.

Labor relations at the beginning of the year afforded considerable improvement. Later in the year, with the settlement of the strike and the clarification of job classification, the situation has shown a marked improvement.

Employment:

The average number of statistical employees in 1952 was 285¾ as compared with 333 in 1951, a decrease of 47¼ men. Some of the decrease resulted from the mine being idle during June and July due to the strike. There were 44 separations during the year. The separations consisted of 17 quits; 4 discharges; 8 transferred to other mines; 5 entered military service; 3 died and 7 were retired. Thirty-five men were hired during 1952.

Number of Men Beginning of Year	344
Added During the Year	35
Separations	44
Total End of Year	335

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

Vacations - 1952

	Number of Men	Number of Hours	Amount	Rate Per Hour
One Week	63	3024	$ 5,067.48	$1.675
Two Weeks	208	19968	34,539.11	1.729
Three Weeks	50	7200	11,923.55	1.656
Total:	321	30192	$51,530.14	$1.706

Paid Holidays - 1952

	Number of Men	Number of Hours	Amount	Rate Per Hour
Labor Day	280	2241	$ 3,469.60	$1.55
Thanksgiving Day	267	2117	3,790.31	1.79
Christmas	258	2060	3,696.18	1.795
Total:	805	6418	$10,956.09	$1.707

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5. LABOR AND WAGES:

Statement of Wages:

Average Wages Per Day	1952	1951	Increase	Decrease
Surface	$15.20	$13.51	$ 1.69	
Underground	17.20	14.91	2.29	
Total:	$16.80	$14.61	$ 2.19	
Average Wages Per Month:				
Surface	$366.92	$323.27	$43.65	
Underground	415.21	360.48	54.73	
Total:	$405.55	$352.77	$52.78	

Average Days Worked Per Month:
1952 - 24.14
1951 - 25.22

Tons Per Man Per Day:	1952	1951	Increase	Decrease
Surface	28.59	31.79		3.20
Underground	8.16	8.22		.06
Total:	6.35	6.53		.18
Labor Cost Per Ton:				
Surface	.535	.425	.110	
Underground	2.114	1.813	.301	
Total:	2.649	2.238	.411	

6. SURFACE:

All of the mine plant buildings with the possible exception of the new temporary dry building are settling and cracking due to subsidence. The most notable of these is the old dry building which was abandoned last year. Parts of this building have already collapsed. The southwest corner of the shops building which contains the blacksmith shop, has shown a very decided bulging and cracking of walls and windows. During the year, the coal dock was abandoned when a drop in elevation made it impossible to move railroad cars out on it. On November 11th, the west section of the north steel trestle collapsed with approximately 110 feet of the north track and 90 feet of the south track coming down. A wooden trestle was erected to take the place of the steel trestle which collapsed. The tension caused by the movement of the shaft house, in all probability, was the cause of the breakdown. When the grade of the rock trestle became too steep to tram on, it was raised up, returning it to normal grade. During the year, several small holes broke through to the surface on the southern edge of the surface working area.

The ore at the Athens Mine was stocked in three piles in the 1951-52 stocking season. The Athens and Bunker Hill ores were stocked from the north steel and center wooden trestles and the Mitchell Lease ore from the south steel trestle. The rock was stocked under the wooden trestle extending southwest from the shaft on caving ground. As it was accumulated under the trestle bents, it was bulldozed into the cave.

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6. SURFACE: (Cont'd.)

There was no surface real estate acquired during the year, however, some surface acquisition is contemplated in the near future in conjunction with the westward extension of mining in the Bunker Hill property.

The mine discharge water is directed eastward from the shaft along the mine service railroad tracks to Queen Street, thence northward to the north side of the D.S.S.&A. Railway; thence eastward and joins the Negaunee Shaft discharge water from where it travels eastward to the Carp River.

7. UNDERGROUND DEVELOPMENT:

The main level drifting on the 10th level in the Bunker Hill consisted of extension of the main line and the advancement of two crosscuts to the south of the main line.

The mining operations in the Bunker Hill property consisted of the semi-block caving operation which utilized four circular steel caving drifts. A large amount of water and the very heavy nature of the ore in this area combined to make caving operations very difficult. Despite these disadvantages, the operation was profitable and proved satisfactory under the extreme conditions which existed.

In the area above the 6th level, the top slicing method of ore extraction was abandoned during the year and was replaced by sub-level caving. With the initiation of sub-level caving, not only was the production from the area increased but there was also a large saving in the amount of supplies which were used. The quantity of stull timber used in sub-level caving as compared with top slicing resulted in a saving of approximately 75 percent in a given area. During the year, a block cave was developed above the 6th level. The block cave consisted of three circular steel caving drifts. By the end of the year, production from this area had not reached full capacity. The production from the block cave is carefully controlled as to create a uniform drawing of the ore.

Above the 10th level, mining operations continued in the east end of the south ore body and also in the north ore body. In the south ore body, radial caving operations were continued throughout the year. In the new ore body, block caving operations, from which a large percentage of the year's production was obtained, were maintained. A block cave of the type used in this area consists of a transfer drift and two grizzly drifts. During the year, one such block was developed and the greater portion of the ore in this area was mined. Another such block, which was developed in the previous year, was caved during the year. Because of the size and heavy weight condition which exists, a considerable amount of repairing had to be done to keep the transfer drift and grizzly drifts open. Provided the drifts can be reasonably maintained in block caves such as these, a very high rate of ore extraction at a relatively low cost can be obtained by this method of mining. Upon completion of the block caves, scramming drifts were advanced in the pillars from which the remaining pillars of ore were mined. Not only is a profitable production realized by this method but it also serves to make a level cut-off of the ore body and permits better recovery from the level below. In the western end of

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7. UNDERGROUND DEVELOPMENT: (Cont'd.)

the new ore body, a series of three circular steel caving drifts was started at the end of the year. The limited height of ore on the west end does not warrant the development of the regular block caves. The circular steel caving drifts provide a method of caving whereby a relatively short time is spent in development. During the year, two other circular steel caving drifts were driven in the east end of the new ore body but as of the end of the year, no ore had been mined from this area.

MAIN LEVEL DRIFTING

	Ore Drift	Rock Drift
6th Level		108'
10th Level	208'	1,031'

Exploration:

The diamond drilling exploration in the Athens Mine was carried on in the north and south ore bodies. The drilling was testing for the depth of ore and structural control below 10th level.

Holes #47 and 48 were drilled from S. 3487 along the 1800 W. These holes provided structural control and proved the south ore body to a depth of -1200 feet.

Hole #49 was drilled on the -990' sub-level from approximately S. 3160 and 1285 W. Drilling proved the position of the footwall as being higher than anticipated.

The drilling at the Athens Mine was done by Company rigs; a tabulation of the drilling is as follows:

Holes	Diamond Drilling	Footage 1st Class Ore
#47	368	130
48	190	76
49	108	25
	666	231

During the year 1952, an intensive campaign of exploration was initiated in the Bunker Hill property by both drilling and drifting. The main 10th level drift was extended to the 2400 W. coordinate and from the main drift, the 1600 and 1700 crosscuts were driven southward through the westward extension of the south ore body.

The diamond drilling campaign was carried on by two machines on a 2-shift basis; thirteen holes were drilled.

Holes #7, 13 and 17 were drilled from the -990' sub-level in the north ore body along the 1900 W. coordinate. These holes outlined the ore on the level and proved ore to depth.

Two other holes, #8 and 9, were drilled from the same location as holes #7, 13 and 17. Hole #8 was drilled as a down hole to the north-

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7. UNDERGROUND DEVELOPMENT: (Cont'd.)

Exploration:

west. This hole was drilled to test for the westward and downward extension of the north ore body. The results were significant because it was the first hole to show the discontinuity of the north ore body. Hole #9 was drilled to the northeast as a flat hole and it outlined the position of the 10th level ore body.

U.G. Hole #11 was drilled northward along the 2100 W. coordinate to test for structure. Holes #16 and 15 were drilled in the north ore body along the 2400 W. The results from Holes #15 and 16 were discouraging as they showed that our north ore body diminishes in size.

Hole #19 was being drilled N. 75 W. as a flat hole, testing for the Foley dike.

Holes #10, 14 and 18 were drilled in the south ore body. Holes #10 and 14 outlined the ore to -1335 along the 2200 W. Hole #18 was an up hole, testing for height above the 1700 crosscut. Drilling on the south side of the main Athens dike has indicated that a larger reserve of ore will be available than had been anticipated.

Hole #12 was drilled from the Bunker Hill into the Arctic 4.7 parcel. This hole cut ore on the Arctic parcel and to facilitate the exploration, plans were made to extend the 1600 crosscut. Drifting had not reached the area by the end of the year.

All drilling was done by Company rigs.

Holes	Diamond Drilling	1st Class Ore
# 7	388	----
8	452	153
9	350	105
10	382	270
11	218	*---
12	500	91
13	348	177
14	443	124
15	421	----
16	536	29
17	275	100
18	145	35
19	114	5
	4572	1089

Statement of Timber Used:

	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1952	AMOUNT 1951
Cribbing	31,281	.0994	3,109.52	6,562.70
Stulls	81,594	.3218	26,259.85	33,816.98
Lagging	734,637	2.08 c	15,291.04	13,956.88
Poles	341,183	3.566c	12,167.80	14,744.36
Steel	9,713	1.334	12,966.46	
			69,794.67	69,080.92

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7. UNDERGROUND DEVELOPMENT: (Cont'd.)
Statement of Timber Used: (Cont'd.)

	YEAR	AMOUNT	PER TON
Total Cost of Timber, Lagging, Poles, Etc.	1952	69,794.67	.1404
	1951	69,080.92	.1097
	1950	64,244.24	.1050
	1949	68,774.33	.1250
	1948	79,243.23	.1564
	1947	78,082.59	.1537
	1946	53,734.65	.1463
	1945	72,844.22	.1661
	1944	77,935.27	.1850
	1943	82,305.17	.1589

Explosives:

STATEMENT OF EXPLOSIVES USED DURING YEAR 1952
ORE DEVELOPMENT & STOPING

KIND	QUANTITY	AVERAGE PRICE_CWT.	AMOUNT 1952	AMOUNT 1951
No. 2-X Hercomite Powder	92,750 lb.	16.29	15,108.79	20,146.40
No. 2 Hercomite Powder	2,950 "	16.26	479.69	600.00
No. 1-X Gelamite Powder	23,850 "	17.04	4,064.35	4,306.44
No. 2 Gelamite Powder	5,650 "	17.10	966.15	
No. 1 Gelamite Powder	1,250 "	17.03	212.88	41.88
60% H. Pr. Gelatin, 5x5#	25,550 "	22.41	5,727.00	5,302.00
80% Gelatin, Extra	800 "	20.40	163.20	1,750.00
60% Gelatin, Extra	4,750	19.15	909.63	
Ditching Dynamite				21.75
Total Powder 1952	157,550 "	17.54	27,631.69	
Total Powder 1951	188,575 "	17.06		32,168.47
Total Fuse, Caps, Etc.			14,946.55	15,300.70
TOTAL ALL EXPLOSIVES			42,578.24	47,469.17
PRODUCT			497,277	630,804
Pounds Powder Per Ton of Ore			.3168	.2989
Tons of Ore Per Pound of Powder			3.1563	3.3451
Cost Per Ton for Powder			. 0556	.0510
Cost Per Ton for Fuse, Caps, Etc.			.0301	.0243
Cost Per Ton for All Explosives			.0857	.0753

ROCK DEVELOPMENT

No. 2-X Hercomite Powder	5,050	16.35	825.68	693.60
No. 1-X Gelamite Powder				829.96
Total Powder 1952	5,050	16.35	825.68	
Total Powder 1951	9,290	16.40		1,523.56

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7. UNDERGROUND DEVELOPMENT: (Cont'd.)
Explosives: (Cont'd.)

ROCK DEVELOPMENT (Cont'd.)

KIND	QUANTITY	AVERAGE PRICE	AMOUNT 1952	AMOUNT 1951
Fuse	25,220'	9.40	237.07	569.83
Caps	3,150	15.70	49.45	122.63
Electric Caps & Delays				10.69
Total Fuse, Caps, Etc.			286.52	703.15
TOTAL ALL EXPLOSIVES:			1,112.20	2,226.71
TOTAL EXPLOSIVES USED AT MINE			43,690.44	49,695.88
Avg. Price Per Pound for Powder			.1750	.1703

Pumping:

The number of gallons pumped per minute at the Athens Mine in each month of the year for the past ten years is given in the following statement.

Month	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943
January	471	348	346	294	331	297	303	306	315	359
February	423	341	341	291	329	290	331	302	297	334
March	399	338	324	296	307	287	282	293	296	330
April	390	355	324	299	307	292	327	342	295	356
May	448	466	422	324	327	363	366	365	307	404
June	461	498	471	336	329	385	330	359	312	411
July	440	501	450	337	323	376	321	359	314	431
August	420	525	409	356	331	374	314	355	313	429
September	404	495	387	396	323	368	316	338	311	390
October	397	494	375	373	321	357	316	329	312	364
November	394	499	367	361	310	346	304	325	316	337
December	376	473	350	350	307	346	302	307	308	328
Average	418	444	381	334	320	340	320	332	308	372

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

Comparative Mining Costs:

	1952	1951	Increase	Decrease
Product	497,277	630,804		133,527
Underground Costs	2.954	2.439	.515	
Surface Costs	.329	.349		.020
General Mine Expense	.595	.444	.151	
Cost of Production	3.878	3.232	.646	
Depreciation:	.095	.182		.087
Taxes	.203	.158	.045	
Loading and Shipping	.079	.070	.009	
Total Cost at Mine	4.255	3.642	.613	
Budget: Estimated Cost At The Mine	4.434	3.814		
Number of Shifts and Hours	6 - 1/8 Hr.	2-1/8 Hr.	4	
	243 - 2/8 Hr.	288-2/8 Hr.		45
Number of Days Operated	249	290		41
Average Daily Product	1997	2172		175

Proportion of Labor and Supplies:

COST OF PRODUCTION	1952	Percent	1951	Percent	Increase	Decrease
Labor	2.784	71.78	2.319	71.75	.465	
Supplies	1.094	28.22	.913	28.25	.181	
Total:	3.878	100.00	3.232	100.00	.646	

Detailed Cost Comparison:
Days and Shifts:

Year	Days Mine Worked	Shifts & Hours	Men Employed	Total Shifts Worked
1952	249	6 - 2/8 Hr. 5½ - 2/8 Hr. 5 - 2/8 Hr.	286	492
1951	290	6 - 2/8 Hr.	333	578
Increase				
Decrease	41		47	86

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8. UNDERGROUND: (Cont'd.)
Detailed Cost Comparison: (Cont'd.)

COST OF PRODUCTION

	1952		1951	
UNDERGROUND COSTS:	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine			3225.64	.005
2. Estimated Wage Adjustment	115360.25	.232	62121.21	.099
3. Development in Rock	18028.07	.036	37959.17	.060
4. Development in Ore	70576.60	.142	59996.19	.095
5. Stoping	375244.80	.755	405951.44	.644
6. Timbering	340745.34	.685	432399.96	.686
7. Tramming	216786.80	.436	198368.29	.315
8. Ventilation	29066.26	.059	31692.09	.050
9. Pumping	42991.59	.086	48307.22	.077
10. Compressors and Air Pipes	62874.22	.126	72464.15	.115
11. Back Filling				
12. Underground Superintendence	85836.45	.173	77492.78	.123
13. Cave-in, or Fire in Mine				
14. Maintenance				
15. Compressors and Power Drills	5754.38	.012	2851.19	.005
16. Scrapers and Mech. Loaders	50932.87	.102	56806.21	.090
17. Tramming Equipment	42806.22	.086	38737.73	.062
18. Pumping Machinery	11877.12	.024	8467.42	.013
19. Total Underground Costs:	1468880.97	2.954	1536840.69	2.439
SURFACE COSTS:				
20. Hoisting	57334.04	.115	69840.70	.111
21. Stocking Ore	22726.01	.046	20914.76	.033
22. Screening - Crushing at Mine				
23. Dry House	17116.29	.035	16584.81	.027
24. General Surface Expense	20182.33	.041	20257.68	.032
25. Maintenance				
26. Hoisting Equipment	19119.11	.038	26972.86	.043
27. Shaft	10038.49	.020	9790.89	.016
28. Top Tram Equipment	3917.21	.008	5866.75	.009
29. Docks, Trestles and Pockets	11559.87	.023	10036.05	.016
30. Mine Buildings	1498.67	.003	39243.19	.062
31. Total Surface Costs:	163492.02	.329	219507.69	.349
GENERAL MINE EXPENSE:				
32. Geological	2504.35	.005	2819.75	.004
33. Mining Engineering	17542.72	.035	10733.79	.017
34. Mech. & Elec. Engineering	2719.59	.006	3833.71	.006
35. Analysis and Grading	28374.49	.057	29797.84	.047
36. Safety & Personnel Departments	8163.91	.017	6864.63	.011
37. Telephones & Safety Devices	10636.82	.021	10133.80	.016
38. Local and General Welfare	3806.37	.008	4691.16	.008
39. Spec. Exp., Pensions & Allowances	9623.60	.019	7708.98	.012
40. Ishpeming Office	30945.46	.062	33239.09	.053
41. Mine Office	45538.32	.092	34515.34	.055
42. Insurance	26588.21	.053	27613.80	.044
43. Personal Injury	16410.49	.033	15656.45	.025
44. Society Security Taxes	34978.91	.070	31756.54	.051
45. Employees Vacation Pay	57745.92	.116	59965.72	.095
46. Research Lab.	281.46	.001	213.09	.000
47. Inventory Adjustment	99.04	.000		
48. Total General Mine Expense	295959.66	.595	279543.69	.444
49. COST OF PRODUCTION:	1928332.65	3.878	2035892.07	3.232

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8. UNDERGROUND: (Cont'd.)
Detailed Cost Comparison: (Cont'd.)

COST OF PRODUCTION (Cont'd.)

(1) No charges in 1952 as these charges appear in E&A.
(2) Increase because of \$.12½ retroactive payroll in July.
(3) Less rock raising and drifting.
(4) Due to increased cost of labor and material.
(5) Due to increased cost of labor and material.
(7) Increase in wages, long tram and wet dirt.
(30) Charges were high in 1951 because of new dry building and shop heating plant.

Most of the decreases in total money are due to the mine being idle because of the strike in June and July.

E&A AM-24 covers the rock development for the extension of the 8th and 10th levels in the Athens Mine. E&A CC-440 covers the extension and the exploration on the 10th level Bunker Hill. E&A AM-31 covers all development and purchases of underground equipment necessary for mining Athens and Bunker Hill ore through the Negaunee Shaft.

E&A Reference	Total Authorized	Prior Year Expenditures	1952 Expenditures	Total Expenditures
AM-24	154,255.00	93,134.78	18,072.79	111,207.57
CC-440	95,000.00	22,945.85	86,250.47	119,196.32
AM-31	177,000.00	90,916.79	704,297.26	795,214.05

9. TAXES:

DESCRIPTION:	1952 VALUATION	1952 TAXES	1951 VALUATION	1951 TAXES
ATHENS MINE				
Including Stockpiles, Supplies & Equip. as placed by State Tax Commission:				
Real Estate	1,870,000	93,406.50	1,880,000	85,446.00
Personal Property	455,000	22,727.25	350,000	15,907.50
Collection Fee		1,161.34		1,013.54
TOTAL ATHENS MINE:	2,325,000	117,295.09	2,230,000	102,367.04
Total Rented Buildings	40,400	2,038.20	46,750	2,146.05
TOTAL ATHENS IRON MINING COMPANY	2,365,400	119,333.29	2,276,750	104,513.09

BUNKER HILL:

Description	Valuation	Taxes
Realty as described and assessed by Michigan State Tax Commission 54.01A	300,000	14,985.00
Personal Property - Furnace Houses	4,200	209.79
Total		15,194.79
Collection Fee		151.95
	304,200	15,346.74

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10. ACCIDENTS AND PERSONAL INJURY:

The following table lists the compensable injuries for 1952:

Fatal	1
Time lost over 4 months	2
Time lost 1 to 4 months	7
Time lost less than 1 month	8
Total:	18

Acc. No.	Date of Accident			Days Lost
570	1/17/52	John Nopola	Two lacerations, right forefinger	33
571	1/29/52	Louis Terzaghi	Fatality	6,000
572	1/18/52	Walter Wakkuri	Prepatellar bursitis, right knee	7
573	2/27/52	Geno J. Paris	Hematoma, right thigh	Home
574	2/27/52	Walter Nummikoski	Sprained lower back	13
575	3/27/52	Paul Maino	Fracture first metacarpal, right	106
576	3/28/52	Joseph Bertino	Burned right hand	8
577	4/15/52	Gust Anderson	Contusion, extensor surface, right hand	11
578	6/ 2/52	Elias Lahtinen	Contusion and abrasions with swelling right ankle region	48
579	4/16/52	Arthur Baldini	Contusion left chest	42
580	8/25/52	Wilhart Etelamaki	Laceration of left temple region	18
581	8/ 8/52	Fred Wrigley	Fracture distal end proximal phalanx	25
582	10/ 8/52	William Tarbox	Fracture distal phalanx middle finger left	24
583	10/ 8/52	Edward Hooper	Severe laceration right parietal region	9
584	10/24/52	Eugene Roberts	Fracture proximal end left fibula	59
585	11/ 4/52	Albert Saari	Laceration right side of face	12
586	11/26/52	Michael Pietro	Sprain right knee	4
587	11/28/52	Roy Thurston, Sr.	Contusion, left side	11

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11. POWER:

Power is purchased according to the standard schedule defined as follows:

$.041 per k.w.h. for the first 72 k.w.h. of demand and $.0096 per k.w.h. for all additional k.w.h. The demand is the lowest average k.w. of the three fifteen minute periods of maximum use during the month.

The fuel adjustment is in addition to the above and is a factor depending on the cost of coal as delivered. That is $.00018 per k.w.h. for each $.01 above $.29 in company's cost per million B.T.U. This adjustment does not apply to the total k.w.h. as part of the power is furnished by hydro-electric plants.

The following table lists the costs of power for the year 1952.

Compressor	$36,593.59
Hoisting	28,881.41
Pumping	32,419.49
Shops	482.50
Dry House	1,099.39
Office	82.14
Stoping	6,975.17
Ventilation	13,364.82
Surface	458.74
Electric Haulage	9,058.27
#31 Power Shovel	759.25
Miscellaneous	4,256.32
Total:	$134,431.09

The twelve month average for 1952 is $.0165 per k.w.h.

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1. GENERAL

The Cambria-Jackson Mine operated six 2-8 hour shifts per week through May and thereafter reduced to five and one-half until November 15th, and then to a five-day operating week through the remainder of the year. The total number of operating days amounted to 253, compared with 293 in 1951. The production during the approximate ten-month period was 345,000 tons, compared with 353,394 tons in 1951. The average production per day amounted to 1,364 tons, compared with 1,205 tons in 1951. The tons per man per day was 6.28, compared with 5.93 in 1951. On June 2nd the mine was closed to production by the nation-wide strike of the United Steelworkers C.I.O. which continued through July 25th. The shutdown cost approximately $60,000.00, or slightly less than $1,400.00 per day, in wages, salaries, and overhead. The damage due to heavy ground pressure was very slight, although it was necessary for the supervisory force to carry on timber repairs.

The cost of all labor showed a rather sharp increase during the year by reason of a general wage increase requiring a number of adjustments and retroactive payments, together with a new mining incentive wage schedule. The latter proved to be quite satisfactory and during the last five months of the year production was at a high level.

Throughout the year explorations were carried on by diamond drilling in a number of areas where iron ore concentration was possible. In a number of cases the drilling was very satisfactory, while in other cases the small runs of ore were too isolated to be economically recoverable. In the east deposit diamond drilling has shown up approximately 350,000 tons of additional low-sulphur ore, and near the end of the year development was in progress toward exploring and opening this area to mining.

In general, conditions during 1952 were favorable and a very satisfactory year was only halted by the two-month strike which affected all phases of mining.

2. PRODUCTION

a. Production by Grade and Months

Month	Cambria Lease	Jackson Strip	Total Ore	Rock
January	-	33,259	33,259	1,628
February	-	28,039	28,039	1,808
March	-	30,776	30,776	2,200
April	-	30,890	30,890	2,812
May	-	33,664	33,664	1,616
June	-	1,163	1,163	-
July	-	4,758	4,758	296
August	-	32,706	32,706	1,912
September	-	39,955	39,955	1,780
October	-	41,589	41,589	628
November	-	34,580	34,580	-
December	-	33,621	33,621	704
Total 1952	-	345,000	345,000	15,384
Total 1951	21,631	331,763	353,394	41,412
Increase	-	13,237	-	-
Decrease	21,631	-	8,394	26,028

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2. PRODUCTION (CONT'D)

b. Shipments

	Pocket Tons	Stockpile Tons	Total Tons	Total Tons Last Year
Cambria Lease	-	-	-	27,326
Jackson Strip	206,847	138,666	345,513	348,782
Total 1952	206,847	138,666	345,513	376,108
Total 1951	191,639	184,469	376,108	-
Increase	15,208	-	-	-
Decrease	-	45,803	30,595	-

Shipments decreased 8.1% in 1952, and were 513 tons more than the product for the year. On December 31st, 1952, there were 39,049 tons remaining in stock.

c. Ore Statement

	1952	Total 1951
On hand Jan. 1, 1952	39,562	62,276
Output for year	338,506	343,087
Overrun	6,494	10,307
Total	384,562	415,670
Shipments	345,513	376,108
Bal. on hand Dec. 31, 1952	39,049	39,562
Decrease in output	4,581	97,004
Decrease in ore on hand	513	22,714

Tons shown for 1952 is from Jackson Strip only, as there was no inventory of Cambria Lease ore at the beginning of the year.

Days per Week Operating

1952 - Six 2-8 hour shifts 1-1-52 to 5-1-52.
Five and one-half 2&3-8 hour shifts 5-1-52 to 11-15-52.
Five 2-8 hour shifts 11-17-52 to 12-31-52.

1951 - Six 2-8 hour shifts 1-1-51 to 12-31-51.

1950 - Five 2-8 hour shifts 1-1-50 to 8-28-50.
Six 2-8 hour shifts 8-28-50 to 12-31-50.

1949 - Six 2-8 hour shifts 1-1-49 to 6-27-49.
Five 2-8 hour shifts 6-27-49 to 12-31-49.

1948 - Six 2-8 hour shifts 1-1-48 to 12-31-48.

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2. PRODUCTION (CONT'D)

d. Division of Product by Levels and Months

Month	6th Level	7th Level	8th Level	Total
January	-	12,814	20,445	33,259
February	-	10,854	17,185	28,039
March	-	8,405	22,371	30,776
April	-	7,366	23,524	30,890
May	-	4,185	29,479	33,664
June	-	153	1,010	1,163
July	-	580	4,178	4,758
August	-	4,894	27,812	32,706
September	-	7,976	31,979	39,955
October	-	10,059	31,530	41,589
November	-	4,673	29,907	34,580
December	-	6,599	27,022	33,621
Total 1952	-	78,558	266,442	345,000
Total 1951	21,631	239,564	92,199	353,394
Increase	-	-	174,243	-
Decrease	21,631	161,006	-	8,394

The product by months under the 7th level heading includes ore mined on and above this level, but not necessarily trammed. Because of the inside conveyor which elevates the ore from the 8th to 7th levels, this statement can only be used to check relative estimated reserves between levels.

e. Production Delays

There were no mechanical or electrical delays during 1952. The strike of the USW-CIO had a major effect on production. The total loss amounted to approximately 67,000 tons during the 45-day idle period. These two months were later eliminated in a revised production estimate and, at the end of the year, the production was approximately 23,000 tons over the budget estimate. There was no appreciable loss in production due to damage by excessive weight during the strike period, and the supervisory force was able to carry on all necessary underground repairs.

3. ANALYSIS

a. Average Mine Analysis on Output

Iron	Phos.	Sil.	Sulph.
58.29	.093	9.17	.203

b. Average Analysis of Shipments

Iron	Phos.	Sil.	Mang.	Alum.	Sulph.	Lime	Mag.	Loss	Moist.
58.45	.100	9.14	.25	2.63	.210	.81	.33	2.25	12.42

c. Average Analysis of Ore in Stock

Iron	Phos.	Sil.	Mang.	Alum.	Sulph.	Lime	Mag.	Loss	Moist.
50.31	.079	9.20	.22	2.30	.171	.71	.29	1.97	12.42

d. Analysis of Straight Cargo Shipments

All ore shipped was mixed with other grades.

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4. ESTIMATE AND ANALYSIS OF ORE RESERVES

The ore reserves which were estimated for the Cambria-Jackson Mine are located on the Jackson Strip only, and include high-sulphur and standard grade ore. During the year, according to the engineers' estimate which was made up near the middle of the year but adjusted to December 31, the actual developed ore amounted to about 175,000 tons. As previously mentioned over 300,000 tons of ore were added to the estimate by drilling, with the result that the total developed ore for the year amounted to approximately 500,000 tons.

Comparison of Production to Reserves

Reserves on Jan. 1, 1952	775,430
Production Jan. 1 to Dec. 31, 1952	345,000
Balance	430,430
Reserves as of Dec. 31, 1952	603,009
New Ore Developed	172,579

To summarize the general prospects for the future life of the Cambria-Jackson Mine, it might be mentioned that there are several favorable factors. Practically all the newly-developed ore reserves for 1952 are low in sulphur content and will tend to reduce the increasing sulphur content of 8th level ores, as those deposits are exhausted. These newly-explored reserves are also located on or above the 7th level where they will not require transfer by conveyor. One disappointing factor in the year's exploration work is that no new deposits have been found, and the bulk of the increase in reserves has been merely extensions laterally or vertically of known deposits. An accelerated exploration program will continue in 1953.

Developed Ore

Assumption	12.00 cubic feet equals one ton. 10% deduction for loss in mining and rock.
Percentage of Bessemer	None.

Area	Sulphurous Ore Negaunee	Sulphurous Ore Ishpeming	Total
Bet. 6th & 7th Levels	235,476	70,438	305,914
Bet. 7th & 8th Levels	243,817	319,368	563,185
Gross as of July 31, 1952	479,293	389,806	869,099
Less August Production	14,845	17,861	32,706
Gross as of Aug. 31, 1952	464,448	371,945	836,393
Less Prod. (Sept., Oct., Nov. & Dec.)	59,898	89,847	149,745
Gross as of Dec. 31, 1952	404,550	282,098	686,648
Less 10% for Mining & Rock	46,445	37,194	83,639
Net total reported to Michigan State Tax Commission as of December 31st, 1952	358,105	244,904	603,009

Expected Average Natural Analysis of Ore Reserves, Based on Tax Commission Figures

Iron	Phos.	Sil.	Mang.	Alum.	Sulph.	Lime	Mag.	Loss	Moist.
52.50	.105	6.56	.11	2.44	.224	.61	.44	1.69	12.50

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5. LABOR AND WAGES

Labor Relations

The relationship between the mine management and the union was very satisfactory during the year. The grievance committee has met with the superintendent and captain each month to discuss various matters, a number of which included agreement on various phases of the new union contract. It should be mentioned, however, that a vast majority of the employees are not active in union affairs and the officers' and committee's views, in many cases, do not represent the will of the majority of the membership.

As of December 31, 1952, there were 231 employees on the payroll, as compared with 222 the preceding year. The general turnover has not been great, although a considerable number of separations are the result of enlistments or draftees to military service. There were also a number of transfers to and from other mines, particularly with respect to the Lloyd Mine where a reduction in the working force was made during a 4-month period.

Employment

Number of men beginning of year	222
Added during the year	68
Separations	59
Total end of year	231
Average number of men, as per December Labor Statement	224

Accessions

Straight hires	40
Transferred from other mines	15
Temporary hires	9
Returned from military service	4
Total	68

Separations

Accepted other employment	18
Transferred to other mines	15
Inducted into military service	14
Returned to school (temp.hires)	5
Deceased	3
Retired	2
Discharged	2
Total	59

Paid Holidays

	Number of Men	Amount
Labor Day	197	2,877.92
Thanksgiving	196	3,083.80
Christmas	197	3,084.80
Average and Total	197	9,046.52

Vacations

Year	Amount
1952	36,594.73
1951	31,140.20

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5. LABOR AND WAGES (CONT'D)

Statement of Wages

Average Wages per Day	1952	1951	Increase	Decrease
Surface	15.55	13.64	1.91	-
Underground	17.80	15.42	2.38	-
Contract Labor	18.48	15.97	2.51	-
Total	17.30	14.98	2.32	-
Average Wages per Month				
Surface	318.13	329.87	-	11.74
Underground	364.16	376.74	-	12.58
Contract Labor	378.07	389.14	-	11.07
Total	353.93	365.02	-	11.09
Avg.Days Worked per Month	20.46	24.37	-	3.91
Tons per Man per Day				
Surface	28.04	23.88	4.16	-
Underground	8.09	7.88	.21	-
Total	6.28	5.93	.35	-
Labor Cost per Ton				
Surface	.554	.571	-	.017
Underground	2.200	1.957	.243	-
Total	2.754	2.528	.226	-

6. SURFACE

There were no major alterations or changes in the surface plant during the year. All buildings were maintained and repaired, and are in good condition.

The mine discharge is pumped into an open ditch south of the shaft where it continues to flow south into Partridge Creek. The subsidence continues to be very active, and at the present time is centered in an area approximately 1,000 feet southwest of the shaft. The various surface cracks and caves are surveyed regularly, and weir readings on the discharge have been taken in an effort to determine whether any seepage from the discharge ditch enters the mine through surface cracks or caves. To date, there is no evidence which would require rerouting the discharge ditch.

7. UNDERGROUND

Shaft Sinking

There was no sinking carried on in the main shaft during 1952.

General

The operations of the Cambria-Jackson Mine in 1952 were generally quite favorable. The production was well over the estimated figure. The cost of production was approximately 33¢ below the budget estimate. The safety program continued to produce good results, and during the past two years there has been a credit of approximately $24,000.00 in personal injury expense. The ore analysis of the year's production has been considerably better than the original estimated figure, and all ore in stock has usually been completely shipped by the middle of August.

7. UNDERGROUND (CONT'D)

General (Cont'd)

The year's production was mined from three areas, located just above and below the 7th level. These areas include the east, central, and west deposits. In the eastern area, mining has continued for approximately ten years in a vertical height of well over 500 feet. During the latter part of 1952, this area was reduced in size to accomodate only three mining contracts. The central deposit has been completely developed, and its reduced size has been rather disappointing as outlined between the 7th and 8th levels. This area during the year has had about five mining contracts; however, in 1953 this number will be reduced to three. The west deposit is approximately 900 feet long, and extends to the Mather Mine, "A" Shaft, boundary. Throughout the year, approximately eleven contracts have been mining in this long narrow orebody. This ore pinches out just above the 8th level elevation, is extremely hard and, because of the large amount of development, the mining costs are relatively high.

At the end of 1952, there were 19 active mining contracts in operation. This number was the same as that reported in 1951, and has been quite constant for some time past. An average of 9 contracts were caving during the year, 6 contracts were engaged in premining development, and 4 contracts in exploration or rock work.

Development and Stoping

The development throughout the year was considerably less than in 1951, at which time the 8th level was being opened. This year the emphasis was on exploration work, and what might be called exploration development. This was largely concentrated on the 6th level, approximately 1,000 feet south of the main hoisting shaft, where a large unexplored area exists adjacent to the Mather Mine, "B" Shaft, property. Approximately 1200 feet of main level rock drift were driven, under an exploration program capitalized in E. & A. No. CC-486. Diamond drilling cutouts were made and, by the end of 1952, diamond drilling was started. It should be mentioned that this area, east of the east deposit, is the only remaining territory unexplored in the Jackson Strip. A detail of the diamond drilling will follow.

The remaining development was, for the most part, carried on on the mining sublevels, in an effort to open the various sublevels well in advance of mining to allow a more constant production.

The ventilation system was completely altered in 1952. The air originally was drawn from surface caves, west of the shaft, in the Cambria Lease. It was drawn down through mining raises and workings, and thereafter distributed throughout the mine, exhausting up the main shaft. This system was very unstable, and was dependent on the old workings remaining open. A new ventilation system was worked out so that the intake came from Mather Mine, "A" Shaft, on the 8th level, where it was boosted to about 30,000 cfm and cleaned by a concentration

7. UNDERGROUND (CONT'D)

Development and Stoping (Cont'd)

of fine water sprays. By using two additional 15,000-cfm booster fans, the air was distributed throughout the entire working areas, finally exhausting through the main Cambria shaft.

Mining operations in the east deposit were carried on, early in the year, by five contracts. Three of these contracts were located just east of the main fault dike, where the area finally narrowed down to the size of approximately 150 feet by 140 feet. While this mining was being carried on, an exploration drift was driven south through a bounding dike. This drift showed approximately 80 feet of ore, and later development indicated a length of approximately 160 feet. A large amount of the developed ore, as previously shown, is located in this south east deposit. Near the end of 1952, two contracts were completing mining operations along the north footwall, where the ore finally pinches out against a series of dikes, or intrusives.

The central deposit, located north of the main south dike and west of the fault dike, was mined on the 7th level elevation during 1952. A transfer was driven at the bottom of the orebody, approximately 25 feet above the 8th level, and a series of mills was extended 50 feet to the mining sublevel. At the end of the year, all mining operations were nearing completion, and preparations were being made to open the first sublevel below the 7th level. Further to the west, mining was considerably more advanced, and had progressed from the 7th level elevation to a point 50 feet below. This was also true further west, where some exploration work was necessary adjacent to the north footwall and approaching the pillar protecting the 8th level plat and feeder station. In general, the ore in the central deposit was soft, and it has been possible to divert the ground water away from the active workings.

The west deposit is long and narrow, and is served by seven double-compartment raises. In several instances, it has been necessary to group two mining contracts, in order to facilitate both mining and development. The ore, at this elevation, varies in width from 65 to 140 feet. A vertical section appears to form a wide-angled wedge, with the base coinciding with the ore on the 7th level. In most cases, the transfers or connecting drifts were driven along the jasper capping on the south side, and all cribbed raises were extended 25 feet to the sublevel above, from which caving drifts were driven north to the footwall. As mining progresses downward, approaching the "tip of the wedge", the crosshaul drifts to the north become shorter, and the final stage, which will come late in 1953, will allow only a single drift driven between the footwall and capping, and caving all remaining available ore. As previously mentioned, the ore in the west deposit is very hard and, while it can be drilled by a dry auger machine, there is a considerable amount of secondary blasting.

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7. UNDERGROUND (CONT'D)

Diamond Drilling

Early in 1952, a very broad and extensive diamond drilling program was begun, to thoroughly explore all remaining possible ore concentrations in the mine. It should be mentioned that during the course of mining there are frequently areas which, while rather remote, should be tested. Oftentimes this testing, if done by drifting, will temporarily halt the production, thus in many cases it is more satisfactory to test by diamond drilling. This drilling program was located in three areas. Holes No. 197, No. 198, and No. 199 were drilled west of the fault dike, where a possible upward extension of the ore existed. Approximately 15,000 tons of ore were located, and the area will be further developed and mined in 1953.

The second area to be diamond drilled was located in the west end of the central deposit. Four holes were drilled to the south, in an effort to determine ore concentration near the intersection of several major and minor dikes. Approximately 20,000 tons of ore were outlined by this drilling, to be developed and mined in 1953.

The third area of exploration by diamond drilling was located in the east deposit, just above and below the 7th level elevation. Here again the holes were drilled to the south and east, and an estimated tonnage well in excess of 200,000 tons was found. This ore was located north and south of a very persistent 5-foot dike, which extends in an east-west direction for a distance of about 1,000 feet east of the main fault dike.

In November 1952, the diamond drilling program under E.&A. No. CC-486 was started on the 6th level. Hole No. 208 was drilled to locate the north footwall, as well as explore any ore concentration on either side of the east-west dike which was mentioned above. This program will continue throughout all of 1953, and will be followed by development as new ore is located.

A complete listing of the diamond drill holes and logs is included below:

No. of Hole 197.	Footage and Material	Fe.	P.	SiO2.	S.
Location 7th lev.,W.,	0' to 80' - Argillite				
S121.64 &	80' to 83' - Dike				
10681.68W.	83' to 215' - Argillite				
Dip +2°00'.	215' to 239' - Rich Hem. Cherty Iron Form.				
Course S6°00'E.	239' to 250' -	47.60	.080	27.13	
Elevation -92.32'.	250' to 261' -	56.40	.123	13.77	.057
	261' to 336' - Norm. Hem. Cherty Iron Form.				
	336' to 341' - Lean Hem. Cherty Iron Form.				
(Started 1-24-52 -	341' to 346' - Dike				
Completed 2-28-52.)	346' to 404' - Norm. Hem. Cherty Iron Form.				
No. of Hole 198.	0' to 160' - Argillite				
Location 7th lev.,W.,	160' to 177' - Ferruginous Banded Argillite				
S119.29 &	177' to 187' - Norm.Hem.Cherty Arg.Iron Form.				
10687.91W.	187' to 229' - Norm. Hem. Cherty Iron Form.				
Dip +17°.	229' to 265' -	62.71	.133		.154
Course S35°W.	265' to 281' -	53.10	.090	18.58	.034
Elevation -89.97'.	281' to 309' - Rich Hem. Cherty Iron Form.				
(Started 2-12-52 -					
Completed 2-22-52.)					

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7. UNDERGROUND (CONT'D)

Diamond Drilling (Cont'd)

No. of Hole 199.	Footage and Material		Fe.	P.	SiO2.	S.
Location 7th lev.,W.,	0' to 90'	- Argillite				
S122.21 &	90' to 110'	- Dike				
10685.36W.	110' to 210'	- Norm.Hem.Cherty Arg.Iron Form.				
Dip +10°.	210' to 225'	-	53.10	.076	17.70	.029
Course S8°04'W.	225' to 287'	- Rich Hem. Cherty Iron Form.				
Elevation -90.91'.						
(Started 3-3-52 -						
Completed 3-10-52.)						
No. of Hole 200.	0' to 35'	- Norm. Hem. Goeth. Cherty Iron Form.				
Location -140' sublev.	35' to 40'	- Rich Hem. Goeth. Cherty Iron Form.				
S289.11 &	40' to 45'	-	45.20	.063		
9678.97W.	45' to 50'	- Rich Hem. Goeth. Cherty Iron Form.				
Dip +2°00'.	50' to 70'	-	62.87	.123		.014
Course S50°24'E.	70' to 85'	-	52.68	.135		.013
Elevation -138.16'.	85' to 105'	- Dike				
	105' to 160'	- Norm. Hem. Cherty Iron Form.				
	160' to 175'	-	46.20	.080		
	175' to 185'	-	52.75	.109		
(Started 3-18-52 -	185' to 230'	- Norm. Hem. Cherty Iron Form.				
Completed 3-31-52.)	230' to 239'	- No Core				
No. of Hole 201.	0' to 43'	- Norm. Hem. Cherty Iron Form.				
Location -140' sub.E.	43' to 50'	-	49.10	.099		
S324.33 &	50' to 80'	-	63.40	.114		.772
10446.81W.	80' to 106'	- Dike				
Dip +2°00'.	106' to 130'	-	64.10	.074		.042
Course S48°17'W.	130' to 140'	- No Sample				
Elevation -130.59'.	140' to 160'	-	65.62	.066		.030
	160' to 175'	- Dike				
	175' to 185'	-	61.30	.169		.193
	185' to 190'	-	50.90	.101		.458
	190' to 198'	- Rich Hem. Cherty Iron Form.				
	198' to 210'	- Dike				
	210' to 228'	- Hematitic Cherty Iron Formation				
	228' to 255'	-	59.59	.143		.175
	255' to 260'	-	59.50	.173		.433
	260' to 265'	-	52.90	.088		.277
	265' to 276'	-	63.49	.063		.049
(Started 4-9-52 -	276' to 284'	-	47.50	.069		
Completed 4-22-52.)	284' to 360'	- Norm. Hem. Cherty Iron Form.				
No. of Hole 202.	0' to 30'	- Norm. Hem. Cherty Iron Form.				
Location -140' sub.	30' to 35'	-	48.00	.069		
S324.32 &	35' to 40'	- Rich Hem. Cherty Iron Form.				
10446.80W.	40' to 45'	-	50.60	.158		.416
Dip +10°00'.	45' to 76'	-	62.69	.140		.249
Course S48°11'W.	76' to 112'	- Dike				
Elevation -129.80'.	112' to 135'	-	64.22	.094		.412
	135' to 160'	-	63.52	.125		.045
	160' to 179'	- Dike				
	179' to 184'	-	60.40	.098		.128
	184' to 191'	- Dike				
	191' to 200'	- Lean Hem. Cherty Iron Form.				
(Started 4-23-52 -	200' to 216'	- Dike				
Completed 5-2-52.)	216' to 295'	- Norm. Hem. Cherty Iron Form.				

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7. UNDERGROUND (CONT'D)

Diamond Drilling (Cont'd)

	Footage and Material	Fe.	P.	SiO2.	S.
No. of Hole 203.	0' to 39' - Norm. Hem. Cherty Iron Form.				
Location -140' sub.	39' to 56' -	62.56	.190		.167
S326.19 &	56' to 57' -	51.40	.094		.009
10438.47W.	57' to 68' - Dike				
Dip +2°00'.	68' to 78' -	65.30	.073		.044
Course S1°07'W.	78' to 89' - Rich Hem. Cherty Iron Form.				
Elevation -131.13'.	89' to 110' -	47.40	.083	28.19	
	110' to 169' - Rich Hem. Cherty Iron Form.				
(Started 5-5-52 -	169' to 173' -	47.90	.234		
Completed 5-15-52.)	173' to 247' - Norm.Hem.Goeth.Cherty Iron Form.				
No. of Hole 204.	0' to 21' - Norm. Hem. Cherty Iron Form.				
Location -140' sub.	21' to 30' -	54.80	.074		
S326.02 &	30' to 50' -	61.29	.132		.073
10442.02W.	50' to 71' - Dike				
Dip +2°00'.	71' to 75' -	52.50	.101		.134
Course S22°11'W.	75' to 88' -	61.62	.058		.027
Elevation -131.17'.	88' to 93' - Rich Hem. Cherty Iron Form.				
	93' to 105' -	56.95	.114		.259
	105' to 182' - Rich Hem. Cherty Iron Form.				
	182' to 214' - Dike				
	214' to 222' -	54.75	.085		.047
	222' to 284' - Rich Hem. Cherty Iron Form.				
	284' to 290' -	49.80	.103		
	290' to 312' - Dike				
	312' to 315' - Rich Hem. Goeth. Cherty Iron Form.				
(Started 5-16-52 -	315' to 320' -	53.20	.110		.319
Completed 8-8-52.)	320' to 327' - Rich Hem. Cherty Iron Form.				
No. of Hole 205.	0' to 240' - Rich Hem. Cherty Iron Form.				
Location -80' sublevel					
S272.23 &					
9421.52W.					
Dip -19°00'.					
Course S1°46'E.					
Elevation -73.23'.					
(Started 8/27/52 -					
Completed 9/17/52.)					
No. of Hole 206.	0' to 69' - Rich Hem. Cherty Iron Form.				
Location -80' sub.	69' to 115' -	61.38	.075		.006
S272.69 &	115' to 141' - Dike				
9421.73W.	141' to 176' -	59.02	.116		.026
Dip +20°00'.	176' to 235' - Rich Hem. Cherty Iron Form.				
Course S2°49'E.					
Elevation -69.51'.					
(Started 9-22-52 -					
Completed 10-13-52.)					
No. of Hole 207.	0' to 75' - Rich Hem. Cherty Iron Form.				
Location -80' sub.	75' to 85' -	50.22	.080		
S270.87 &	85' to 158' -	64.00	.053		.020
9413.93W.	158' to 182' - Dike				
Dip +15°00'.	182' to 190' -	58.19	.074		.011
Course S44°04'E.	190' to 196' -	50.65	.066		.009
Elevation -69.49'.	196' to 292' - Rich Hem. Cherty Iron Form.				
(Started 10-16-52 -					
Completed 11-6-52.)					

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7. UNDERGROUND (CONT'D)

Diamond Drilling (Cont'd)

	Footage and Material	Fe.	P.	SiO2.	S.
No. of Hole 208.	0' to 48' - Rich Hem. Cherty Iron Form.				
Location 6th level	48' to 75' -	58.48	.079		.015
S354.52 &	75' to 85' -	49.10	.032	27.28	
8281.71W.	85' to 145' - Rich. Hem.Cherty Iron Form.				
Dip $+2^{\circ}00'$.	145' to 275' - Rich Hem. Arg. Cherty Iron Form.				
Course N14°42'E.	275' to 341' - Lean Cherty Carb. Iron Form.				
Elevation -107.92'.	341' to 408' - Argillite				
(Started 11-18-52 -					
Completed 12-31-52.)					

Statement of Timber Used

	Lineal Feet 1952	Lineal Feet 1951	Average Price per Foot 1952	Average Price per Foot 1951	Amount 1952	Amount 1951
Stulls	42,442	49,325	.2401	.1850	10,191.04	9,122.67
Square Cribbing	19,468	5,387	.1042	.0801	2,027.76	431.67
Round Cribbing	5,570	26,587	.0867	.0734	483.18	1,951.72
Lagging	598,264	563,541	.0227	.0170	13,565.87	9,595.26
Poles	185,468	182,772	.0352	.0312	6,525.07	5,706.42
Steel H Beams	9,117	2,690	.7757	.7193	7,071.84	1,934.97
Total					39,864.76	28,742.71

The increased use of steel H beams is the result of resupporting main level drifts, where the original hardwood sets or supports have been weakened by rotting. Steel sets, in combination with pipe or old rail back-lagging, make a very permanent installation, and have greatly reduced the amount of main level maintenance.

Explosives

	Quantity	Average Price	Amount 1952	Amount 1951
Gelamite #1 - Lbs.	26,400	.1712	4,519.77	2,099.28
Hercomite #2X - Lbs.	174,600	.1632	28,502.57	26,336.80
Total Powder	201,000	.1643	33,022.34	28,436.08
Fuse, Caps, Etc.	674,548	.0108	7,302.07	5,863.58
Tot.Exp.,Development & Mining			40,324.41	34,299.66
Gelamite #1 - Lbs.			-	9,834.18
Hercomite #2X - Lbs.			-	232.00
Total Powder			-	10,066.18
Fuse, Caps, Etc.			-	2,449.28
Tot.Exp.,E.&A.No.CC-373			-	12,515.46
Gelamite #1 - Lbs.	-	-	-	108.88
Hercomite #2X - Lbs.	200	.1600	32.00	536.00
Total Powder	200	.1600	32.00	644.88
Fuse, Caps, Etc.	3,394	.0101	34.40	16.28
Tot.Exp.,Tramming Equipment			66.40	661.16
Hercomite #2X - Lbs.	-	-	-	145.60
Fuse, Caps, Etc.	-	-	-	31.18
Tot.Exp.,Ventilation	-	-	-	176.78

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7. UNDERGROUND (CONT'D)

Explosives (Cont'd)

	Quantity	Average Price	Amount 1952	Amount 1951
Hercomite #2X - Lbs.				64.00
Fuse, Caps, Etc.				8.33
Tot.Exp.,Loading by Power Shovel			-	72.33
Hercomite #2X - Lbs.				38.54
Fuse, Caps, Etc.				12.25
Tot.Exp.,Pumping			-	50.79
Gelamite #1 - Lbs.	20,200	.1710	3,454.20	
Hercomite #2X - Lbs.	2,200	.1635	359.70	
Total Powder	22,400	.1703	3,813.90	-
Fuse, Caps, Etc.	57,730	.0105	608.62	-
Tot.Exp.,E.&A.No.CC-486			4,422.52	-
Grand Total Explosives Used in Mine			44,813.33	47,776.18
Average Price per Pound for Powder			.1649	.1619

Pumping

The average G.P.M. pumped during the year amounted to 376, compared with 461 in 1951. These totals are directly in proportion to the climatic conditions throughout the year, and their variation at times is unlimited. In practically all cases the high water month for underground pumping is May. In May 1952, the average amounted to 550 G.P.M. The low month is usually December or January. The pumps are all in good shape, the storage sumps are cleaned regularly, and it has always been possible to take care of any unusually high inflows.

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

Comparative Mining Costs

		1952	1951	Increase	Decrease
Product		345,000	353,394	-	8,394
Underground Costs		3.006	2.705	.301	-
Surface Costs		.284	.318	-	.034
General Mine Expenses		.582	.522	.060	-
Cost of Production		3.872	3.545	.327	-
Depletion & Depreciation		.209	.185	.024	-
Taxes		.181	.237	-	.056
Loading & Shipping		.068	.084	-	.016
Rental of Shaft Facilities		.089	.099	-	.010
Total Cost at Mine		4.419	4.150	.269	-
Budget Estimated Cost per Ton		4.785	4.067	.718	-
No. of Shifts & Hours	1-8	15	1	14	-
	2-8	238	292	-	54
No. of Days Operated		253	293	-	40
Average Daily Product		1,364	1,205	159	-

Proportion of Labor and Supplies

	1952	Percent	1951	Percent	Increase
Labor	2.933	66.4	2.682	64.6	.251
Supplies	1.486	33.6	1.468	35.4	.018
Total	4.419	100.0	4.150	100.0	.269

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8. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING (CONT'D)

Detailed Cost Comparison

		1952		1951
Days per Week		6 to 5-1-52 5½ to 11-17-52 5 bal. of yr.		6
Shifts and Hours		1-8 15 2-8 238		1-8 1 2-8 292
Production, Tons		345,000		353,394
Average Daily Production, Tons		1,364		1,205
Number of Days Worked		253		293
UNDERGROUND COSTS	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine	16,761.22	.049	53.46	-
2. Estimated Wage Adjustment	74,572.36	.216	39,470.74	.112
3. Development in Rock	23,502.61	.068	18,560.43	.053
4. Development in Ore	63,816.65	.185	33,712.64	.095
5. Stoping	298,609.33	.866	296,798.43	.840
6. Timbering	157,077.21	.455	189,961.69	.537
7. Tramming	196,855.31	.571	176,133.80	.499
8. Ventilation	13,613.29	.039	13,887.90	.039
9. Pumping	33,538.96	.097	40,280.64	.114
10. Compressors and Air Pipes	43,702.68	.127	43,680.80	.124
12. Underground Superintendence	38,089.20	.110	28,409.35	.080
14. Maint.: Comp. & Power Drills	2,539.98	.007	2,975.82	.008
15. Scrapers & Mech.Loaders	31,989.82	.093	29,265.62	.083
16. Tramming Equipment	37,447.26	.109	34,928.76	.099
17. Pumping Machinery	4,862.30	.014	7,665.71	.022
Total Underground Costs	1,036,978.18	3.006	955,785.79	2.705
SURFACE COSTS				
18. Hoisting	31,624.38	.094	35,396.55	.100
19. Stocking Ore	15,632.57	.045	17,508.30	.050
21. Dry House	10,614.06	.030	10,289.89	.029
22. General Surface Expense	18,524.29	.053	19,689.41	.056
23. Maint.: Hoisting Equipment	11,750.96	.034	17,718.88	.050
24. Shaft	5,605.74	.016	5,805.00	.016
25. Top Tram Equipment	1,797.29	.005	3,036.14	.009
26. Docks, Trestles & Pockets	894.55	.002	87.84	-
27. Mine Buildings	1,692.08	.005	2,838.80	.008
Total Surface Costs	98,135.92	.284	112,370.81	.318
GENERAL MINE EXPENSES				
28. Geological	568.45	.002	1,302.76	.004
29. Mining Engineering	10,519.31	.030	8,263.66	.023
30. Mechanical & Electrical Engineering	1,373.40	.004	4,109.36	.012
31. Analysis and Grading	17,134.06	.050	16,716.13	.047
32. Safety and Personnel Departments	2,936.07	.008	2,498.78	.007
33. Telephones and Safety Devices	7,824.15	.023	6,403.36	.018
34. Local and General Welfare	2,835.55	.008	3,099.06	.009
35. Special Exp.,Pensions & Allowances	5,883.17	.017	5,103.77	.014
36. Ishpeming Office	24,279.85	.070	24,758.86	.070
37. Mine Office	34,735.90	.101	33,098.09	.093
38. Insurance	18,026.81	.052	17,584.20	.050
39. Personal Injury	10,321.46	.030	7,059.59	.020
40. Social Security Taxes	21,485.96	.062	21,219.21	.060
41. Employees Vacation Pay	42,479.53	.123	33,415.40	.095
42. Research Laboratory	560.01	.002	-	-
Total General Mine Expenses	200,963.68	.582	184,632.23	.522
COST OF PRODUCTION	1,336,077.78	3.872	1,252,788.83	3.545

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8. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING (CONT'D)

Comparison of Idle Mine Expense during Strike Periods

	1952	1951
Exploring in Mine	62.57	-
Estimated Wage Adjustment	1,263.90	70.30
Stoping	527.88	-
Timbering	721.16	117.12
Tramming	1,695.74	366.72
Ventilation	86.10	80.00
Pumping	6,997.30	1,215.03
Compressors and Air Pipes	1,990.83	407.88
Underground Superintendence	5,922.47	674.36
Tramming Equipment	11.60	-
Hoisting	2,378.56	448.40
Dry House	618.68	380.33
General Surface Expense	2,386.16	-
Hoisting Equipment	648.65	-
Mine Buildings	32.42	-
Geological	-	32.00
Mining Engineering	1,548.25	188.00
Mechanical and Electrical Engineering	318.72	128.00
Analysis and Grading	1,253.31	376.00
Safety and Personnel Departments	603.00	71.00
Telephones and Safety Devices	449.72	-
Local and General Welfare	485.00	111.00
Special Expense, Pensions and Allowances	2,034.00	164.00
Ishpeming Office	5,022.00	707.00
Mine Office	3,507.23	862.10
Insurance	3,667.12	695.63
Personal Injury	795.84	136.10
Social Security Taxes	-	148.97
Employees Vacation Pay	5,461.22	955.00
Research Laboratory	62.70	-
Depreciation - Movable Equipment	117.00	23.00
Taxes - Ad Valorem	9,774.00	2,520.00
Rental of Shaft Facilities	5,430.00	1,080.00
Total	65,873.13	11,957.94

In the comparison of costs it should be noted that, with but few exceptions, all items have increased over the previous year, due to a general increase in wages and adjustment of retroactive pay. In several instances, the increases have already been explained by the acceleration and amount of one type of work over another.

9. TAXES

	1952		1951	
Cambria Realty	Valuation	Taxes	Valuation	Taxes
$S\frac{1}{2}$ of $SE\frac{1}{4}$ of Sec. 35, 48-27) Lots 7 & 8 of Sec. 35, 48-27) Lots 5, 6 & 7 of Sec. 36, 48-27) - 222.09 Acres)	200,000	9,990.00	200,000	9,090.00

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9. TAXES (CONT'D)

	1952 Valuation	1952 Taxes	1951 Valuation	1951 Taxes
Jackson Strip N660' of N½ of NW¼ of Sec. 1, 47-27 - 40 Acres)	905,000	45,204.75	1,205,000	54,767.25
Personal Property Stockpiles, Supplies & Equipment	250,000	12,487.50	395,000	17,952.75
Tot. by Mich. State Tax Com.	1,355,000	67,682.25	1,800,000	81,810.00
Collection Fee		676.82		818.10
Total Taxes, Negaunee	1,355,000	68,359.07	1,800,000	82,628.10
Division of Payments				
Cambria-Jackson Taxes, Ishpeming*	100,000	3,735.00	100,000	3,760.56
Cambria-Jackson Taxes, Negaunee	1,355,000	68,359.07	1,800,000	82,628.10
TOTAL	1,455,000	72,094.07	1,900,000	86,388.66

*Cambria-Jackson Mine-Ishpeming
N660' of NE¼ of NE¼ of Sec. 2,)
47-27 - 20 Acres)

Tax Rate per $100 of Valuation

	1952	1951
City of Negaunee	4.99500	4.54500
City of Ishpeming	3.73500	3.76056
Total Taxes, City of Negaunee	856,059.08	696,031.85
Cambria-Jackson Percent of Taxes City of Negaunee	7.91	11.75

10. ACCIDENTS AND PERSONAL INJURY

The accident and personal injury record was very good during 1952, and the Cambria-Jackson Mine ranked second of the Michigan and Minnesota company mines, with a severity rating of .822. The following is a list of the number of compensable accidents classed as lost-time, where seven or more calendar days were lost by the employee through injury. The past five years have shown a continuing improvement, although the 1952 record shows one more compensable accident.

	1952	1951	1950	1949	1948
Fatal	0	0	1	0	1
Time lost - over 4 months	1	1	0	1	1
Time lost - 1 to 4 months	1	0	2	5	5
Time lost - less than 1 month	1	1	2	5	9
Total compensable accidents	3	2	5	11	16

On December 31, 1952, payments were being made on five cases which occurred prior to January 1, 1952. Three are death claims, one receives full compensation, and one occupational disease case is being paid.

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10. ACCIDENTS AND PERSONAL INJURY (CONT'D)

The accidents are listed in detail as follows:

Acc. No.	Date of Accident	Name	Injury	Days Lost
93	2-29-52	Emelio Gelmi	Multiple fractures, left radius and ulna. Fracture, left humerus. Comminuted fracture, right scapula. Contusions, chest and shoulders. Shock.	Home

The above employee fell down about 100 feet of cribbed raise, and the injury could have been fatal. At the present writing, this employee is recovering very satisfactorily and should be back to work near the middle of 1953.

94	3-24-52	Wilfred J. Mallett	Contusion and laceration of scalp. X-ray shows no evidence of fracture.	36

Captain Mallett received a severe head injury, resulting from a chunk striking him while crossing a raise opening, and this also could have been considerably more serious. Incidentally, this is the first time, to my knowledge, that the captain of an underground iron mine has received a lost-time injury.

95	10-29-52	Harlan Pirlot	Contusion, right foot.	9

This injury could have been considered minor in nature. The employee, who lived in Iron Mountain, did not return within the seven-day limit.

11. POWER

A fixed minimum charge of $.041 per K.W.H. is charged for the first 44,928 K.W.H. to provide facilities to meet a maximum demand load at any time. A charge of $.0096 per K.W.H. is made for any power consumed over the minimum rate. To the above charges, an additional charge is made based on the cost of operating the steam and diesel plants, which is listed as a fuel adjustment.

The following is a comparison of the power cost:

Year	K.W.H.	Cost	Rate
1952	4,676,800	$ 77,474.04	.01657
1951	5,214,400	$ 82,107.04	.01575

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1. GENERAL

The Maas Mine operated on a schedule of two 8 - hour shifts, six days per week from January 1st thru May 18th. On May 19th the schedule was reduced to a $5\frac{1}{2}$ day week with the same 2 - 8 hour shifts per day. On November 17th this schedule was further reduced to a 5-day-week which continued thru the end of the year. Production was interupted on the midnight shift of May 2nd due to a C.I.O. Labor Union strike which continued thru July 26th. During normal operations there was a small tramming and hoisting crew which worked on the midnight shift cleaning up ore which was mined but could not be hoisted on the previous two shifts.

There was a labor turnover of approximately 10% which was due largely to men quitting and also to men being drafted or enlisting in the armed forces. The group of men leaving our employ was mostly of the lesser skilled jobs so replacements were readily available. By agreement of July 26th, the Company agreed to a general wage increase of $12\frac{1}{2}$ cents per hour to be effective March 1, 1952. There were other increases which occured under the job evaluation program.

The total production for the year amounted to 497,867 tons which was considerably below that of 1951, due largely to the prolonged strike period of June 2 to July 26. Following the strike period it took some time before the crews got into full production as it was necessary to cut out raises and develop new sub caving drifts. Shipments for the year totaled 486,360 tons leaving a balance on hand of 75,125 tons. Monthly production during the first quarter of the year was somewhat below normal due to the lack of working places. Following the strike period it took some time before all of the existing working places were into full production.

Development during the year was confined largely to the 6th and 7th Levels totaling approximately 2,876 feet. The 6100 cross cut was completed on 6th Level in order to develop for mining the pillar of ore left in the Baldwin Kiln Road Lease and adjacent ore in the Maas and Race Course Leases. Development on 7th level was continued steadily and a new block cave area was under initial development to the west of mining areas on 6th level.

There were two programs of exploration to the west and southwest extending into the Pioneer & Arctic property. Tonnages proven amounted to approximately 1,200,000 tons of which 660,000 tons are located south of dike No. 81 which has been set as a mining limit for the next few years. Indications are that there is a gradual increase in sulphur content as we proceed west going up to .500 or .600 per cent. Part of the explorations indicated some low sulphur ore in the lower half of the section near the north footwall.

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2. PRODUCTION:

a. Production by Grades and Months

Month	Maas	Race Course	Total	Rock
January	41,386	8,774	50,160	3,495
February	44,582	7,082	51,664	3,495
March	43,222	9,446	52,668	5,145
April	38,945	12,558	51,503	5,735
May	46,692	11,386	58,078	3,455
June	1,181	411	1,592	155
July	5,793	1,712	7,505	425
August	40,902	4,984	45,886	2,800
September	43,395	8,477	51,872	3,170
October	43,701	7,711	51,412	4,130
November	27,225	8,711	35,936	2,060
December	30,918	8,673	39,591	1,750
Total	407,942	89,925	497,867	35,815
Stockpile Overrun	- - -	- - -	- - -	- - -
Grand Total	407,942	89,925	497,867	35,815

The product was distributed by leases as follows:

	1952	1951
George Maas Lease	407,942	547,019
Race Course Lease	89,925	165,455
Total Ore	497,867	712,474
Rock	35,815	35,280
Total Hoist	533,682	747,754

b. Shipments

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Maas	110,524	295,510	406,034	619,684
Race Course	30,553	49,773	80,326	169,844
Total	141,077	345,283	486,360	789,528
Total last year	375,963	413,565	789,528	
Decrease	234,886	68,282	303,168	

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2. PRODUCTION - Continued

c. Ore Statement

	Maas	Race Course	Total	Total Last Year
On Hand 1-1-52	53,792	9,826	63,618	140,672
Product for Year	407,942	89,925	497,867	712,474
Total	461,734	99,751	561,485	853,146
Shipments	406,034	80,326	486,360	789,528
Balance on Hand	55,700	19,425	75,125	63,618
Decrease in Output			214,607	

Schedule of Operations 1948 - 52

Days	Shifts	Hours	
6	2	8	1-1-48 to 6-26-49
5	2	8	6-27-49 to 8-26-50
6	2	8	8-26-50 to 5-18-52
5½	2	8	5-19-52 to 11-16-52
5	2	8	11-17-52 to 12-31-52

d. Division of Product by Levels

	1952	%	1951	%
Fourth Level	107,143	21.5	204,958	28.8
Fifth Level	96,869	19.5	164,504	23.1
Sixth Level	284,980	57.2	340,451	47.8
Seventh Level	8,875	1.8	2,561	.3
Total	497,867	100.0	712,474	100.0

e. Production Delays

	Tons
June 2nd to July 26th incl. (Strike)	92,000
July 27th to Aug 31st - Rehabilitating the mining places - - -	3,300
Sept. 18th, 6:00 AM to Sept 19th, 7:30AM (Skip broke runners and dividers in shaft)-	2,200
Total Loss	97,500

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3. ANALYSIS:

a. Average Mine Analysis on Output

	1952				1951			
Grade	Iron	Phos.	Sil.	Sul.	Iron	Phos.	Sil.	Sul.
Maas	58.30	.109	9.10	.158	59.07	.106	8.88	.095
Race Course	58.54	.093	8.97	.234	58.86	.093	8.59	.166

b. Average Mine Analysis on Ore Shipped

Grade	Iron	Phos.	Sil.	Mang	Alum	Lime	Mag.	Sul.	Loss	Moist.
Maas & Race Course	58.00	.110	9.56	0.25	3.02	0.87	0.35	.172	2.18	13.25

c. Average Natural Analysis of Ore in Stock - December 31, 1952

Grade	Tons	Iron	Phos	Sil.	Mang	Alum	Lime	Mag.	Sul.	Loss	Moist.
Maas	55,700	50.49	.090	8.05	0.22	2.62	0.75	0.30	.142	1.89	13.25
Race Course	19,425	50.58	.075	7.97	0.26	2.83	0.58	0.17	.187	1.83	13.25

d. Straight Cargo Shipments

	Tons	Iron	Phos.	Sil.	Sul.	Moist.
Paint Ore	17,765	58.47	.107	8.93	.172	13.12

4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

The main source of new reserves in the Maas Lease in 1952 was the west end of the 6th Level where the first sub levels were developed above the 6800 cross-cut. Two diamond drill holes proved the further extension of the ore to the west. Nearly one million tons were added between 5th and 7th levels in this area. An additional 175,000 tons of Maas Ore were proven by the exploration program into the Pioneer & Arctic Lease. A small increase was shown in the Race Course Lease reserves due mainly to the mining of some marginal ore not included in previous estimates.

Practically the whole of the additional reserves noted above was formerly considered "probable" but, until proven during 1952, was not carried on the report to the Tax Commission.

Exploration by diamond drilling in the Pioneer & Arctic Lease showed a substantial block of first-class, high sulphur ore extending south from the 6th Level workings. However, its extension to the west appears unlikely as the body was well delineated in the program.

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4. ESTIMATE AND ANALYSIS OF ORE RESERVES - Continued

Statement of Reserves

	Maas Lease	Race Course Lease	City of Negaunee Lease	Total Mine
Reserves 12-31-51	3,113,873	388,549	31,538	3,533,960
Produced 1952	407,942	89,925	- - -	497,867
Former Reserves 12-31-52	2,705,931	298,624	31,538	3,036,093
Added to Reserves	1,016,718	31,482	- - -	1,048,200
Total Reserves 12-31-52 (Based on report to the Tax Commission 8-31-52)	3,722,649	330,106	31,538	4,084,293

Expected Average Natural Analysis of Ore Reserves

(Based on report to Tax Commission 8-31-52)

Grade	Tons	Iron	Phos	Sil.	Mang	Alum	Lime	Mag.	Sul.	Loss	Moist.
Maas	3,754,187	51.00	.092	8.10	0.18	2.45	0.57	.120	.200	1.43	13.50
Race Course	330,106	51.00	.092	8.10	0.18	2.45	0.57	.120	.200	1.43	13.50

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5. LABOR AND WAGES

Labor Relations

In general, labor relations within our unit were good. However, during the first half of the year there was a feeling of insecurity because of strike rumors which resulted in a higher accident rate. By the end of the year this situation was over and normal conditions prevailed again.

The labor supply was not too plentiful during the year with very few skilled miners available. Fortunately the Maas Mine requirements were for the unskilled group.

There was one grievance which grew out of the job evaluation program involving the classification of a carpenter. This is being continued and the final result has not been reached.

Employment	1952
No. Employed at Begining of Year	398
Added During Year	33
Separations	39
No. Employed at End of Year	392

Labor Statement - December 1952

Average No. Employed	390
Average Absenteeism	20
Average No. Men Working	370

The separations reported above were for the following reasons:

Quit	18
Transferred to other C.C.I. mines	6
Drafted or enlisted	9
Retired for medical reasons	5
Fátal Mine Accident	1
Total	39

Of the above, 7 men had worked less than 3 months and 12 others less than a full year. There were 8 men who did not return after the strike.

There was no specified vacation period at the mine. A total of 377 men received vacation pay for an average of 2.01 weeks based on a 6-day-week. The average total pay for one holiday amounts to approximately $5,000 .

The average age of mine employees is 43 years. There are 14 men still working who are 65 or more years of age.

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5. LABOR AND WAGES - Continued

Statement of Wages

	1952	1951	Increase	Decrease
Average Wages Per Day				
Surface	15.22	13.43	1.79	- -
Underground	17.54	15.32	2.22	- -
Total	17.16	15.01	2.15	- -
Average Wages Contract Labor	17.90	16.30	1.60	- -
Average Wages Per Month (24.5 Days Per Month) (11 Shifts Per Week)				
Surface	370.80	335.75	35.05	- -
Underground	431.78	383.00	48.78	- -
Total	421.48	375.25	46.23	- -
Product Per Man Per Day				
Surface	33.34	40.74	- -	7.40
Underground	6.48	7.60	- -	1.12
Total	5.42	6.40	- -	.98
Labor Cost Per Ton				
Surface	.449	.320	.129	- -
Underground	2.714	2.019	.695	- -
Total	3.163	2.339	.824	- -

6. SURFACE

Construction

No major construction was undertaken on the mine property during the year 1952. The only project of note was the dismantling of the old crusher plant beside the L.S.& I. right-of-way. It was of no further use and the structure constituted a hazard as it deteriorated. The salvageable parts were removed for further use by the mine and the general warehouse.

Drainage

No change was made in the disposal of the mine discharge water. At the end of the year, the settling area northwest of the Carp River was still effectively clearing the water before it entered the river.

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6. SURFACE - Continued

Purchase and Disposal of Dwellings

The second house of the Amonino Estate, purchased in 1951 under E & A #CC-471, was sold and moved during the year. It was on ground that has started to subside.

The Emmanuel Lutheran Church, formerly situated on a company-owned lot, was moved at company expense to a location north of highway US - 41 . Installation work on the new site was still being carried out at the end of the year. The former site will be caved when mining is carried to the boundary of the Pioneer & Arctic Lease. The expense is covered by E & A CC-526 .

The areas of new subsidence that will be affected by mining carried out in 1953 have been cleared with the exception of three houses on the Kelland Estate and the Park Street School. Negotiations have been attempted for some time to clear the estate without an agreement being reached. The school has been closed and the City of Negaunee is required to move it upon notice.

7. UNDERGROUND

Underground operations were carried on during 1952 without any great changes from the procedures of the previous year. The 4th Level block cave was mined out in January and the first of the 7th Level block caves was still being readied for production at the end of the year. About 95% of the production was recovered by sub level caving and the remainder by sub level stoping. Main level development was carried out on both the 6th and 7th Levels with all work being devoted to the development of proven ore pillars.

Drift repairing, particularly on the 6th Level, occupied the efforts of four to six crews steadily throughout the year and this promises to be a continuing feature of Maas operations as long as production is drawn from the west end of the 6th Level. During the strike the salaried supervisors were able to keep the main level drifts in readiness for operations but it was impossible to carry out sub level repairs as well and damage to the stopes during the strike was considerable.

A number of factors contributed to a lower production per man-day, these being the exhaustion of the 4th Level block cave in January, the uneasiness of the men during the pre-strike period, the considerable amount of rehabilitation necessary after the strike, the lack of new areas in readiness for mining and the increased congestion on the 6th Level accompanying the concentration of mining on that level.

During an average month in the year, there were 31 mining contracts working, 18 of which were on production, 9 were on sub level development and 4 were on main level development.

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7. UNDERGROUND - Continued

A breakdown of the underground roster by occupations shows the following apportionment of labor:

	1952	1951
Supervision	19 men	17 men
Development - Main Level	11 "	11 "
Primary Mining	134 "	147 "
Transportation - Main Level	40 "	45 "
Transport. -Shaft & Trestle	25 "	25 "
Mech. & Elect. Maintenance	10 "	8 "
Drift & Stope Maintenance	80 "	80 "
Pumping	8 "	8 "
Total	327 men	341 men

The greatest change was the decrease in the number of men employed in primary production which reflected the shortage of available mining areas.

Activity above the 4th and 5th Levels was confined to sub level development and caving. Nine mining crews recovered ore from pillars along the north and northeast foot walls. As the footwall is generally very flat in this section, long transfers and considerable low-grade drifting were necessary. The two levels provided 40% of the total mine product but this percentage will decrease sharply in 1953.

On the 6th Level an important development program was completed during the year when the 6100 crosscut, at the east end of the level, was driven 623 feet in footwall material. In the program three raises were brought up to a pillar of ore lying along the eastern boundary of the Race Course Lease. The pillar also includes all known reserves in the Baldwin Kiln Road Lease and a small tonnage in the Maas Lease.

Mining in the Race Course Lease was carried on in four working places, two along the north footwall and two in the central portion. Steady inflows of water hampered one section and finally a narrow pillar was left to hold back the flow. Other conditions were normal and production amounted to 18% of the total.

In the central section of the 6th Level, one raise was driven to develop a previously untouched area near the Pioneer & Arctic boundary. Mining operations were started here and also continued in three other areas in this section during the year. Along the north footwall, four contracts continued sub level caving and had practically exhausted the sub level 70 feet above the main drift at year's end.

In the western end of the 6th Level, mining was started from three newly completed raises at the begining of the year. The sub level was opened up a short distance below the hanging wall but, as the hanging is very irregular in contour, caving was often difficult and production was low throughout the year. It should improve considerably during 1953 when mining will commence on a lower sub level.

7. UNDERGROUND - Continued

In all, 57% of the mine production was obtained from the 6th Level workings compared with 48% in 1951. This concentration of mining combined with the continual repair of the main haulage way made it very difficult to service the contracts efficiently. It is expected that this situation will be alleviated in the coming year when production starts from 6100 Crosscut and the 7th Level.

The greater portion of the development of 1952 took place on the 7th Level where a total of 1461 feet of drifting was carried out on a single shift basis. The 7100 and 7200 Crosscuts were connected at the south end and then continued west near the Pioneer and Arctic Line a distance of 223 feet. The 7000 Drift was extended west a distance of 456 feet and from that point the 7400 Crosscut was driven 267 feet to the south. The 7300 Crosscut was started but was not carried further as it will not be needed until the 6th Level mining is completed above. The 7400 Crosscut encountered only 15 feet of 2nd class ore compared with 105 feet of 1st and 2nd class ore in the 7200 Crosscut. This indicates that the footwall is pitching slighly upward to the west and that practically all ore developed to date remains above the 7th Level.

An area was chosen east of the 7200 Crosscut for the first block cave and three raises were put up to develop it. Circular steel scraper drifts were driven just above the footwall and undercut drilling drifts above them. At the end of the year the block was ready for undercutting.

The amount of main level development carried out in 1952 is summarized below:

6th Level Drifts	623 feet	
6th Level Raises	577 feet	
Total 6th Level		1200 feet
7th Level Drifts	1461 feet	
7th Level Raises	215 feet	
Total 7th Level		1676 feet
Total Mine		2876 feet

Exploration

Two programs of exploration by diamond drilling were carried out. The first consisted of three holes drilled from the extreme west end of the 6000 Drift. The drilling proved the continuation of ore west from the 6800 Crosscut and showed the hanging wall to be higher than anticipated. Some standard ore was found in this normally high sulphur zone.

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7. UNDERGROUND - Continued

Exploration - Continued

The logs of the holes follow:

U. H. #65 - drilled S 46° 38' W at minus 15° 26' dip.

0-91	1st Class sulphur ore
91-165	2nd Class standard ore
165-345	argillaceous iron formation

U. H. #66 - drilled S 45° 33' W at plus 13° 41' dip.

0-196	1st class sulphur ore
196-252	iron formation
252-345	1st class high sulphur ore
345-350	dike (#82)
350-410	1st class standard ore
410-478	iron formation

U. H. #67 - drilled N 45° 14' W at plus 2° dip.

0-10	2nd class standard ore
10-100	argillite

The second program of drilling was undertaken to explore the southern extension of the 6th Level ore body into the Pioneer & Arctic Lease. The extension had been indicated by U. H. #53 drilled in a previous year. Seven holes were drilled to cross-section the area and a substantial body of ore was proven. The last drill holes showed, however, that the ore contact returns northward to a point near the Maas Lease boundary on the western side of the body. The program was covered by E & A CC-552.

The logs of the holes follow:

U. H. #68 - collar S. 1057.82 & 2072.63 W. Elev. -102.27
drilled S 5° 34' E at plus 10° 07' dip.

0-275	1st class high sulphur ore
97	Maas - Pioneer & Arctic boundary
275-292	dike (#81)
292-340	1st class high sulphur ore
340-370	iron formation
370-420	1st class high sulphur ore
420-428	2nd class high sulphur ore

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7. UNDERGROUND - Continued

Exploration - Continued

U. H. #69 - collar S. 1057.12 & 2072.76 W Elev. -103.94
drilled S 4° 50' E at minus 4° 30' dip

0-10	2nd class high sulphur ore
10-70	1st class high sulphur ore
70-160	1st class sulphur ore
96	Maas - Pioneer & Arctic boundary
160-245	2nd class sulphur ore
245-270	1st class sulphur ore
270-288	dike (#81)
288-335	1st class sulphur ore
335-413	2nd class sulphur ore
413-464	ferruginous argillite

U. H. #70 - collar S. 1056.03 & 2073.36 W Elev. -100.08
drilled S 6° 03' W at plus 25° 45' dip

0-95	1st class high sulphur ore
95-170	iron formation
105	Maas - Pioneer & Arctic boundary
170-205	1st class high sulphur ore
205-224	iron formation
224-250	2nd class high sulphur ore
250-285	1st class high sulphur ore
285-296	1st class sulphur ore

Hole caved.

U. H. #71 - collar S. 1186.18 & 1933.12 W. Elev. -108.14
drilled S 0° 15' E at plus 20° dip

0-9	2nd class high sulphur ore
9-44	dike (#81)
44-175	1st class high sulphur ore
50	Maas - Pioneer & Arctic
175-190	iron formation
190-350	1st class high sulphur ore
350-387	iron formation

U. H. #72 - collar S. 956.34 & 2125.85 W. Elev. -109.74
drilled S 29° 50' W at minus 0° 50' dip

0-26	2nd class sulphur ore
26-35	dike (#82)
35-40	2nd class high sulphur ore
40-54	iron formation
54-118	1st class high sulphur ore
118-130	2nd class high sulphur ore
130-145	1st class sulphur ore
145-155	1st class high sulphur ore
155-165	1st class standard ore
165-225	1st class sulphur ore
168	Maas - Pioneer & Arctic boundary
225-371	iron formation

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7. UNDERGROUND - Continued

Exploration - Continued

U. H. #73 - collar S 957.18 & 2126.25 W Elev -112.94
drilled S 31° 57' W at minus 9° 50' dip

0-26	1st class sulphur ore
26-38	dike (#82)
38-61	iron formation
61-155	1st class sulphur ore
155-164	argillaceous iron formation
164-215	2nd class sulphur ore
172	Maas - Pioneer & Arctic boundary
215-219	1st class standard ore
219-315	argillaceous iron formation
315-345	argillite

U. H. #74 - collar S 956.60 & 2125.90 W Elev -109.62
drilled S 28° 56' W at plus 15° 30' dip

0-10	1st class high sulphur ore
10-20	iron formation
20-24	1st class sulphur ore
24-45	dike (#82)
45-70	2nd class sulphur ore
70-300	1st class high sulphur ore
175	Maas - Pioneer & Arctic boundary
300-370	iron formation

The classification of ore in the preceding logs is according to the following table:

1st class ore	- over 57.50 iron
2nd class ore	- 50.00 to 57.50 iron
standard ore	- below .050 sulphur
sulphur ore	- .050 to .250 sulphur
high sulphur ore	- over .250 sulphur

Timber Statement

		1952		1951	
Kind	Lineal feet	Avg. Price Per Ft.	Total Cost	Avg. Price Per Ft.	Total Cost
Cribbing	88,262	.0873	$ 7,703.01	.0796	$ 4,136.69
Stulls	128,776	.2298	29,590.36	.2057	34,219.35
Lagging	1,451,817	.0217	31,553.15	.0177	28,080.01
Poles	431,928	.0390	16,841.91	.0299	18,326.19
Steel	35,519	.6993	24,837.98	.2919	3,826.54
Total			$110,526.41		$88,588.78

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7. UNDERGROUND - Continued

Timber Statement - Continued

The purchases of timber during the year were in line with previous years after considering an increase in unit cost on all items. The large increase in the amount of steel used was due in part to the use of steel sets in main drifts instead of the timber used previously. It is expected that maintenance costs will be greatly reduced as a result. The remaining increase in quantity and the rise in unit cost of steel is the result of the use of circular steel sets in the block cave scraper drifts. The delivered cost of these sets after fabrication was $1.77 per lineal foot of steel.

Explosives Statement

Kind	Quantity	1952 Avg. Price Per Lb.	1952 Total Cost	1951 Avg. Price Per Lb.	1951 Total Cost
1¼" Gelamite IX	218,248 lbs	.1706	$37,238.86	.1674	$43,468.76
1¼" 60% Gelatin	- - -	- -	- - - -	.2049	2,069.00
Hercomite 2" x 24"	3,800 lbs	.1635	621.32	.1600	80.00
Hercomite 5" x 5"	5,750 lbs	.2241	1,288.75	.2200	506.00
Total	227,798 lbs	.1719	$39,148.93	.1692	$46,123.76
Other blasting supplies			10,711.20		13,646.46
Total All Explosives			$49,860.13		$59,770.22
Cost Per Ton Product			.1001		.0839

Ventilation

One major project concerning Maas ventilation was carried out during the year. The collar of the Negaunee Mine #2 Shaft, through which is taken in all the air entering the Maas airways, was found to be deteriorating to such an extent that quicksand could possibly break through into the shaft above the ledge. Also tests had shown that 10,000 to 15,000 c.f.m. of air was leaking through the sides back up to surface. To remedy the condition, steel sets were placed inside the old timber in the 90 feet between the collar and ledge. A concrete lining was then poured flush with the inside of the steel. In order to ventilate the mine while these operations were being carried out, the auxillary fan was moved to the 14th Level, Negaunee Mine where it was permanently installed to draw air from the #3 Shaft during periods of repairs or breakdowns in the #2 Shaft.

Further work will be necessary in 1953 to rehabilitate the remainder of the shaft. It is expected that timber replacements where required will be sufficient below the ledge. The project is covered by E & A CC-527 .

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7. UNDERGROUND - Continued

Ventilation - Continued

The main airways through the Negaunee Mine drifts have proven adequate for handling the Maas air supply. However the drifts suffered several breakdowns during the strike. Since the end of the strike, a small crew has been employed daily in the repair of the drifts, installing steel sets wherever possible for longer life. It is expected that this work will not be completed before the summer of 1953.

In the Maas Mine itself, one main change was made in the air courses. A top timber connection was completed between the 600 Drift and the 6800 Crosscut and air doors were placed to force about half of the air entering the 6th Level to pass to the west end of the level first, returning through the 6000 Drift. Two small auxillary fans were placed to assist the flow of air as considerable resistance is met through the heavily timbered drifts. A great improvement in the ventilation of the mining contracts at the west end was noted when the connection was made.

Late in the year, a start was made on rehabilitating the 600 Drift east and west of the main air raise from the Negaunee Mine. This section had suffered several partial breakdowns during the strike. Steel sets were being installed and the work should be completed in April 1953.

Pumping

One major change was made in the underground pumping set-up during the year. The 7th Level pump station was put into operation in January and the pumps formerly placed on the 6th Level were moved into it. Three pumps are installed, any two of which can pump the drainage water from the 6th and 7th Levels to the 5th Level sump.

One surface well pump was operating throughout the year. The volume of water pumped from the underground was slightly greater than in 1951, being reported as averaging 1,241 g.p.m.

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

Comparative Mining Costs:

	1952		1951	
Product	497,867		712,474	
Underground Costs	3.768		2.732	
Surface Costs	.315		.223	
General Mine Expense	.692		.495	
Cost of Production	4.775		3.450	
Depletion - Original Cost	.026		.024	
Depreciation - Plant & Equipment	.031		.027	
Development	.024		.015	
Movable Equipment	.005		.005	
Taxes	.328		.206	
Loading and Shipping	.067		.066	
Total Cost at Mine	5.256		3.793	
Budget - Estimated Cost Per Ton	5.065		3.888	
Number of Days Operated				
1-8 Hour	18		2	
2-8 Hour	235		289	
Total	253		291	
Proportion of Labor and Supplies	1952	%	1951	%
Labor Cost Per Ton	\$3.367	64.1%	\$2.494	65.8%
Supplies	1.889	35.9%	1.299	34.2%
Total Cost Per Ton	\$5.256	100.0%	\$3.793	100.0%

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8. COST OF OPERATING

Detailed Cost Comparison	1952 Amount	1952 Per Ton	1951 Amount	1951 Per Ton
Underground Costs:				
Exploring in Mine	7,188.89	.014	32.56	.000
Wage Adjustment	129,468.27	.260	73,639.12	.103
Development in Rock	26,225.15	.053	- - - -	-
Development in Ore	5,225.81	.010	20,003.36	.028
Stoping	528,020.16	1.061	618,739.21	.868
Timbering	551,646.97	1.108	593,924.97	.834
Tramming	159,183.64	.320	195,993.19	.275
Ventilation	51,296.71	.103	32,129.92	.045
Pumping	115,768.96	.233	112,164.06	.157
Compressors and Air Pipes	60,657.62	.122	72,878.57	.102
Underground Superintendence	73,399.36	.147	61,247.58	.086
Fire in Mine	16.35	-	- - - -	-
Maintenance, Compr. and Drills	6,310.18	.013	2,517.24	.004
Scrapers	74,583.78	.150	82,701.72	.116
Electric Tram Equipment	56,666.49	.114	43,939.19	.062
Pumping Machinery	30,229.79	.060	36,832.47	.052
Total Underground Costs	1,875,888.13	3.768	1,946,743.16	2.732
Surface Costs:				
Hoisting	48,194.23	.097	53,458.72	.075
Stocking Ore	33,454.59	.066	30,190.64	.043
Screening - Crushing at Mine	- - - -	-	- - - -	-
Dry House	23,896.63	.048	20,960.19	.029
General Surface	14,755.69	.030	14,991.87	.021
Maintenance - Hoisting Equipment	14,803.07	.030	12,757.44	.018
Shaft	14,594.79	.029	14,138.74	.020
Top Tram Equipment	3,835.20	.008	2,532.78	.004
Docks, Trestles, and Pockets	1,270.95	.003	8,033.01	.011
Mine Buildings	1,918.75	.004	1,694.41	.002
Total Surface Costs	156,723.90	.315	158,757.80	.223
General Mine Expense:				
Geological	2,912.69	.006	1,763.51	.002
Mining Engineering	14,509.02	.029	11,649.35	.016
Mechanical and Electrical Engineering	4,441.74	.009	6,328.50	.009
Analysis and Grading	35,716.88	.072	46,085.76	.065
Safety Department	4,512.10	.009	4,787.60	.007
Telephones and Safety Devices	7,177.19	.014	5,570.16	.008
Local and General Welfare	4,665.03	.009	5,615.14	.008
Sp. Exp. , Pensions and Allowances	14,224.47	.029	9,248.48	.013
Ishpeming Office	41,372.60	.083	44,844.48	.063
Mine Office	58,703.69	.118	45,748.13	.064
Insurance	28,186.54	.057	29,668.66	.042
Personal Injury	24,900.84	.050	24,189.49	.034
Social Security Taxes	32,940.91	.066	37,725.79	.053
Employees Vacation Pay	70,390.00	.141	78,957.80	.111
Research Lab.	25.40	-	- - - -	-
Inventory Adjustment	23.43	-	- - - -	-
Total General Mine Expense	344,702.53	.692	352,182.85	.495
Total Cost of Production	2,377,314.56	4.775	2,457,683.81	3.450

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8. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING - Continued

Wage Adjustment

The increase is due to the average retroactive pay rate as agreed upon in the new union contract being greater than that estimated and charged in 1951 and the first half of 1952.

Development in Ore

The ore development in 1951 was much greater, being on 6th Level where long sections of cross cutting were entirely in ore. Development in 1952 was mostly in footwall material.

Development in Rock

This is the cost of driving the 6100 Crosscut and Raises which were charged entirely to operating expense.

Ventilation

The increase is almost entirely the amount of the #2 Air Shaft repairs, covered by E & A CC-527 which was charged out to operating at the end of the year.

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8. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING - Continued

E & A CC-285 - December Summary

E & A CC-285 was opened late in 1948 for the development of 7th Level. Practically all of the charges in 1952 were attributed to 7th Level drifting and raising. Following is the Detailed Statement of Expenditures for December 1952:

Detail	Amount Authorized	Labor	Supplies & Expense	Total	Total To Date	Unexpended Balance
Strip 6th Level at Winze	10,500.00	- - - -	- - -	- - - -	5,902.04	4,597.96
3 Sheaves and Bearings	2,500.00	- - - -	- - -	- - - -	766.72	1,733.28
2 Cages	7,000.00	- - - -	- - -	- - - -	7,309.04	309.04
Installation of Hoist	7,600.00	- - - -	- - -	- - - -	7,822.29	222.29
Sinking Equipment	2,000.00	- - - -	- - -	- - - -	233.46	1,766.54
100' Double Compartment Winze	27,500.00	- - - -	- - -	- - - -	25,446.45	2,053.55
Rock Drifting - 7th Level 4,000 feet	191,000.00	3,554.76	288.63	3,843.39	173,857.84	17,142.16
Rock Raising - 7th Level 1,000 feet	16,500.00	- - - -	- - -	- - - -	9,660.25	6,839.75
Sump	12,000.00	- - - -	- - -	- - - -	12,113.03	113.03
Power House	1,250.00	- - - -	- - -	- - - -	- - - -	1,250.00
Rails, Frogs, Switches, etc. etc.	10,000.00	- - - -	15.60	15.60	6,911.51	3,088.49
Trolley, Clamps etc.	4,000.00	- - - -	285.56	285.56	2,373.89	1,626.11
Air & Water Lines	6,000.00	- - - -	.31	.31	9,798.69	3,798.69
Social Security Taxes (1)	7,500.00	- - - -	92.49	92.49	4,176.86	3,323.14
Total	305,350.00	3,554.76	682.59	4,237.35	266,372.07	38,977.93
(1) Charged To: Cost of Production (Soc. Sec. Taxes)				92.49	4,176.86	
Development Account				2,931.39	91,579.78	
Development Section 309				3,843.39	149,116.71	
Plant and Equipment					18,220.88	
Total					263,094.23	
Balance in Uncompleted Contstruction				2,629.92	3,277.84	
Total					266,372.07	

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8. COST OF OPENING, EQUIPPING, DEVELOPING, AND OPERATING - Continued

Analysis of Supplies Used	1952 Amount	1952 Per Ton	1951 Amount	1951 Per Ton
General Supplies	$97,017.09	.195	$70,218.68	.098
Iron and Steel	36,672.45	.074	26,081.54	.037
Oil and Grease	6,385.16	.013	7,214.47	.010
Machinery Supplies	57,815.38	.116	47,705.25	.067
Explosives	53,320.67	.107	60,112.75	.084
Lumber and Timber	95,490.88	.192	102,432.37	.144
Fuel	15,149.28	.030	15,946.25	.022
Electric Power	139,784.59	.281	162,940.16	.229
Inventory Adjustment	23.43	- -	- - - -	- -
Total	$501,658.93	1.008	$492,651.47	.691

Idle Expense - Strike Period	Labor	Supplies	Total
Total Underground Costs	$17,245.78	$16,539.83	$33,785.61
Total Surface Costs	6,739.08	1,073.55	7,812.63
Total General Mine Expense	24,666.82	16,029.83	40,696.65
Depreciation and Taxes	- - - -	26,607.00	26,607.00
Total Cost	$48,651.68	$60,250.21	$108,901.89

9. TAXES

	1952 Valuation	1952 Taxes	1951 Valuation	1951 Taxes
Maas Mine	$2,920,000	$145,854.00	$2,120,000	$96,354.00
Race Course	415,000	20,729.25	340,000	15,453.00
Stockpile & Equipment	395,000	19,730.25	830,000	37,723.50
Miscellaneous Parcels	17,750	886.68	17,750	806.79
Total Oprtg. Maas Mine	$3,747,750	$187,200.18	$3,307,750	$150,337.29
Collection Fees		1,872.00		1,502.22
Total		$189,072.18		$151,839.51
Tax Rate		4.995		4.545
Total City of Negaunee Tax		$856,059.08		$696,031.85
Maas Mine % of City Tax		22.1%		21.8%
Maas Mine Rented Houses	$109,725	$5,480.83	$115,675	$5,257.53
Mineral Lands etc.	13,230	660.85	11,350	524.07
Total Houses and Lands	$122,955	$6,141.68	$127,025	$5,781.60
Collections Fees		61.42		57.82
Total		$6,203.10		$5,839.42

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10. ACCIDENTS AND PERSONAL INJURY

One fatal accident occurred at the Maas Mine during the year. At about 9:30 A M on April 2, 1952, William R. Copley, age 26, suffered severe internal injuries when a car full of wet ore unexpectedly dumped its load at a point where he was sitting down. He died two hours later in the Ishpeming Hospital. He was married with one child.

Copley had been assigned with others to clean up a spillage of wet ore that had partially buried a car beneath a chute on the 6th Level. The car was pulled out and was being pushed by motor to another crosscut. Copley had gone ahead to throw switches and, after doing this, had sat down on a bench with the shift boss and sub trammer boss. As the car passed them, it overturned partially burying all three but only Copley was injured. It appeared that he had been struck in the chest by the edge of the car or a rock contained in the car. The loaded car was partially defective in that one of the two safety catch levers was missing. Apparently the other had been lifted from its catch as the car was pulled clear of the spillage.

There were 16 compensable accidents reported in 1952, compared with 10 in 1951. Brief descriptions of each follows:

Jan	11	Thomas Guidebeck	Lacerated foot and fractured toe.
Jan	16	Arvo Laytymaki	Bruised side.
Feb	1	Theodore Peterson	Bruised and sprained foot.
Feb	3	Thomas Sparnoll	Sprained muscles in hip.
Feb	8	Frank Bollero	Bruised lower back.
Apr	1	Ettore Vecellio	Sprained left knee.
Apr	21	Rudolph Laitinen	Fractured index finger.
May	9	William Jalonen	Laceration over eye.
Aug	6	Gust Toyra	Fractured bone in foot.
Aug	30	Albert Johnson	Hernia.
Sep	4	Donald Larson	Lacerated little finger.
Nov	7	George Aro	Strained back.
Nov	28	Edward Roberts	Fractured little finger.
Dec	11	Carl Johnson	Bruised side and back.
Dec	12	Francis King	Fractured bone in hand.
Dec	29	Arne Pesola	Muscle strain in back.

11. POWER

The total Kwh used during the year amounted to 9,206,400 . Total cost including the fuel adjustment amounted to $143,134.20 . The resulting average rate per Kwh is $.01555 .

The rate for power is 4.1 cents per Kwh for the first 72 Kwh per KW of demand, 0.96 cents per Kwh for all additional Kwh.

The demand used for billing purposes is the lowest of the average KW supplied during the three fifteen minute periods of maximum use during the billing month.

To the rate above is added a fuel adjustment which is applied to that portion of the Kwh taken during the month by consumer determined by multiplying the total Kwh taken during the month by the ratio of total Kwh generated by fuel burning equipment and purchased to the total Kwh furnished to the company's system from all sources.

The rate applied to the fuel adjustment is $.00018 per Kwh for each 1 cent above 29 cents in company's cost per million British Thermal Units of fuel.

MATHER MINE "B" SHAFT
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1. GENERAL:

The very smooth operation of the plant during the past year is a manifestation of the excellent judgement in selecting methods and materials along with top-notch workmanship in constructing the Mather Mine "B" Shaft plant structures. It is commendable that after a year and one-half of operation no repairs to buildings have been necessary. The culmination of the capably planned and executed program for beautifying the grounds has resulted in an outstanding plant site as was evidenced by the many favorable comments from local residents and visitors during the summer season.

During the year the production increased from a yearly low of 50,916 tons in February to the October high of 78,582 tons. The yearly production, including 65,421 tons of stockpile overrun, was 686,139 tons.

Fortunately, the shipping season, due to clement weather, continued until late in November and the complete stockpile of 470,108 tons was loaded out just before the season closed.

Had it not been for the C.I.O. strike of fifty-five days during June and July the tonnage mined for the year could easily have surpassed 825,000 tons.

Production for the year, including the stockpile overrun, was 207,896 tons above the production in 1951.

The high daily hoist for the production life of the property, of 4,404 tons was attained on December 8, 1952.

Of the yearly tonnage mined 82% of the ore came from the 6th Level and 18% came from the 7th Level.

A steady increase of tonnage in the ore reserves was noted at Mather "B" during the year as exploration and development work of 7th and 8th Levels progressed. The proven reserves on 7th Level more than doubled, and the 8th Level reserves increased considerably. Although the generalized structure of the major ore bodies on 7th Level had been outlined by the end of the year, a large amount of detailed exploration still remained. There is an indication that large tonnages will be added to the reserves on 8th Level as development and exploration progress.

Labor relations on the whole during the year were satisfactory with the exception of one grievance which went to arbitration. This incident was the result of a penalty for smoking underground involving Lawrence Rankinen, which resulted in a walkout of all employees for two shifts. The grievance went to arbitration and was decided in the Company's favor.