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7. UNDERGROUND (Cont'd)

c. Stoping (Cont'd)

Subs above the 9th Level (Cont'd)
∠ 95' Sub Level

In the west and central stopes in the sulphurous deposit two separate areas were mined. In the west stope three small areas were mined separated by two pillars that were left in place when caving interrupted operations. In the middle stope three small areas were also mined separated by small pillars.

∠ 70' Sub Level

The mining on this sub was also confined to the stopes in the sulphurous deposit. In the west stope an area 130' x 25' was mined retreating the west face to the ore limits. In the central stope three small areas were recovered similarly as on the sub above and at the close of the year operations were nearing completion as the east face was approaching the mining limit. This is the bottom elevation at which mining was conducted during the year.

d. Timbering

There was more timber used than last year due to the larger mining program, in contrast to the previous year when operations were confined mostly on development. Factors that have affected timber costs favorably is the absence of a large repair program and the continued use of caving and stoping methods. There was a substantial increase in the price of some timber but the larger production compared with the previous year accounts for the lower cost per ton for all timber.

Only a small amount of timber repair work has been required on the 9th Level. No crushing conditions have been experienced and the only timbering required consisted of installing occasional lining sets in each of the crosscuts. Repairs to raises has comprised the major part of the repair program and it was necessary to reline the chute compartments of each of the long raises above the 9th Level with hardwood plank and steel wearing plates once during the year. The value of the steel wearing plates is proven by the fact that a year or more of service is realized from the chute compartments of the raises before repairs are needed.

During the idle period because of the strike a section of the 4th Level airway at the Section 6 Shaft end was repaired by the supervisory force. Steel sets made from 4" "H" beams were fabricated in the mine shop and these were installed replacing rotted timber.

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7. UNDERGROUND (Cont'd)

d. Timbering (Cont'd)

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

	Lineal Feet	Avg. Price Per Foot	Amount 1949	Amount 1948
6" to 8" Cribbing Timber	24,735	.0715	1,768.55	596.88
8" to 10" Stull Timber	5,035	.1469	739.67	923.79
10" to 12" " "	11,188	.1816	2,031.74	1,235.61
12" to 14" " "	6,579	.2505	1,648.09	1,152.18
Total Timber 1949	47,537	.1302	6,188.05	
Total Timber 1948	27,384	.1427		3,908.46
	Per 100 Feet			
7' Lagging	186,997	1.45	2,711.46	3,552.10
9½' Poles	62,818	2.50	1,570.44	1,618.44
Total Lagging & Poles	249,815	1.71	4,281.90	5,170.54
Product - Tons			207,954	98,284
Feet of Timber Per Ton of Ore			.229	.279
Feet of Lagging Per Ton of Ore			.899	2.058
Feet of Lagging Per Foot of Timber			3.934	7.388
Cost Per Ton for Timber			.0298	.0398
Cost Per Ton for Lagging			.0130	.0361
Cost Per Ton for Poles			.0075	.0165
Cost Per Ton for All Timber			.0503	.0924
Equivalent Stull Timber to Board Measure			95,614	50,352
Feet of Board Measure Per Ton of Ore			.4598	.5123

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

Year	Amount	Cost Per Ton
1945	37,553.85	.1150
1946	23,571.68	.0951
1947	12,291.85	.0484
1948	9,079.00	.0924
1949	10,469.95	.0503

e. Drifting and Raising

There was less footage driven than in 1948 when a major part of the 9th Level development was conducted. The development was again chiefly drifting and raising in ore in connection with the stoping and caving operations. There was no drifting done on the main levels and the work was confined entirely to mining areas above the 9th Level.

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7. UNDERGROUND (Cont'd)

e. Drifting and Raising (Cont'd)

Year	Drifting			Raising			Grand
	Ore	Rock	Total	Ore	Rock	Total	Total
1949	3470'	119'	3589'	1895'	15'	1910'	5499'
1948	3206'	2352'	5558'	2392'	382'	2774'	8332'

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

Year	Drifting			Raising			Grand
	Ore	Rock	Total	Ore	Rock	Total	Total
1949	884'	57'	941'	116'	-	116'	1057'
1948	991'	-	991'	354'	52'	406'	1397'

f. Explosives, Drilling and Blasting

The total amount of explosives consumed was considerably less than last year due to the absence of a large rock development program. A larger amount of explosives was used in the mining operations, however, because of the larger program but there was a corresponding decrease in the cost per ton for these supplies due to the larger production. There was a small increase in the price of one grade of powder used and also in the blasting caps employed. Hercomite 2-X and Gelamite 1-X powders have continued to be used almost exclusively in the mining and ore development work, the Gelamite powder being favored for use in the long holes employed in the caving and stoping methods due to its more plastic nature. Early in the year some Gelatin powder was used in the development when drifting in extremely hard ground but use of this powder was discontinued after this work was completed.

In the breaking of large chunks in the caving and stoping operations high pressure Gelatin powder in 5# cartridges has continued to be used and found to be quite satisfactory for this purpose. A small amount of Herculite No. 4 was again used in blasting the frozen stockpile ahead of the loading operations during the early part of the shipping season.

Tungsten carbide insert bits were used on a small scale in the development work in hard ground. Only a small amount of work was done in ground that called for this type of bit to speed the drilling and consequently there has been no need for its more general use.

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7. UNDERGROUND (Cont'd)

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

The explosives statements are shown in the following tables:

Breaking Ore	Quantity Lbs.	Average Price	Amount 1949	Amount 1948
Gelatin - 60% Ex.	13,792	16.75 C	2,310.20	83.75
Hercomite 2-X	15,214	14.50 C	2,206.06	10,740.82
Herculite No. 4 - 5 x 22	600	13.50 C	81.00	62.50
Hi-Pressure Gel. - 60% 5 x 5	4,969	20.00 C	993.80	250.00
Gelamite 1-X - 60%	56,410	15.25 C	8,602.50	76.25
Total Powder	90,985	15.60 C	14,193.56	11,213.32
Fuse - Feet	183,767	8.46 M	1,554.67	444.40
Tamptite Shells	-	- M	-	13.21
No. 6 Blasting Caps	41,340	14.70 M	607.70	361.02
Primacord - Feet	1,000	32.00 M	32.00	-
Tamping Bags	-	- M	-	4.50
Fuse Lighters	2,500	9.00 M	22.50	26.77
Fuse Cartridges	-	- M	-	10.01
Total Fuse, Caps, Etc.			2,216.87	859.91
Total Expense Breaking Ore			16,410.43	12,073.23
Product - Tons			207,954	98,284
Lbs. Powder Per Ton of Ore			.437	.126
Cost Per Ton For Powder			.068	.114
Cost Per Ton For Fuse, Caps, Etc.			.011	.009
Cost Per Ton For All Explosives			.079	.122
Development in Rock				
Hercomite 2-X			-	32.55
Fuse - Feet			-	5.23
No. 6 Blasting Caps			-	1.05
Total Fuse, Caps, Etc.			-	6.28
Total All Explosives			-	38.83
Rock Drifting - Feet			-	46
Cost Per Foot For Powder			-	.708
Cost Per Foot For Fuse, Caps, Etc.			-	.137
Cost Per Foot All Explosives			-	.844
Total Explosives - Breaking Ore & Rock Development			16,410.43	12,112.06
Cost Per Ton - All Explosives Breaking Ore & Rock Dev.			.079	.123
Average Price Per Lb. For Powder			.1560	.1560
E & A cc-159				
Gelatin - 60% Ex.			-	12,923.97
Electric Delay Caps			-	592.85
Fuse - Feet			-	1,381.54
No. 6 Blasting Caps			-	373.62
Hot Wire Lighters			-	21.60
Tamptite Shells			-	21.13
No. 8 Bare Wire			-	2.01
Powder Bags			-	18.18
Total Fuse, Caps, Etc.			-	2,410.93
Total All Explosives			-	15,334.90
Grand Total Explosives Used in Mine			16,410.43	27,446.96
Average Price Per Lb. For Powder			.1560	.1553

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7. UNDERGROUND (Cont'd)

g. Ventilation

Two fans operating in series, one on the 4th Level at Section 6 Shaft and the other on the 8th Level have continued to provide good ventilation throughout the mine. Installation of the second fan on the 8th Level was completed early in January and with both fans operating in series a volume slightly in excess of 18,000 C.F.M. is supplied to the 9th Level. During the summer months the fans are operated to exhaust up the Section 6 Shaft and in the freezing weather the direction of ventilating current is reversed for long periods each week to exhaust up the hoisting shaft and prevent serious ice formation.

In the mining areas above the 9th Level at the west end of the orebody a ventilation circuit exists through old workings so that some air exhausts to the 8th Level by this route maintaining good ventilation in two areas. At the east end of the orebody a Sturtevant #45 fan with metal pipe in a raise supplies ventilation to the contract working above the east crosscut. Ventilation in the stopes in the sulphurous orebody has been maintained by installing doors at suitable points in the crosscuts.

There were no new ventilation connections driven and the existing drifts and raises between the 4th and 9th Levels will continue to serve for this purpose until the reserves above the 9th Level have been depleted. On several occasions some repairs were made in the raise connections between the 4th and 8th Levels and on the 5th Level quite extensive caving has occurred in a section of the old haulage drift that serves as an airway but the drift has not been blocked by caving and consequently still serves satisfactorily as an airway.

8. COST OF OPERATING

a. Comparative Mining Costs

	1949	1948
Product - Tons	207,954	98,284
Underground Costs	2.058	2.887
Surface Costs	.507	.714
General Mine Expenses	.509	1.030
Cost of Production	3.074	4.631
Depreciation	.277	.281
Taxes	.031	.117
Loading and Shipping	.064	.236
Total Cost at Mine	3.446	5.265
Budget Estimated at Mine	3.355	4.086
No. of Shifts and Hours	2, 1-8 Hr.	2, 1-8 Hr.
	5, 2-8 Hr.	275, 2-8 Hr.
	237, 3-8 Hr.	24, 3-8 Hr.
Total Operating Days	244	301
Average Daily Product	852	327

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8. COST OF OPERATING (Cont'd)

b. Detailed Cost Comparison

	1949		1948	
	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine	1,265.79	.006	3,212.29	.033
3. Development in Rock			2,065.14	.021
4. Development in Ore	46,550.37	.224	57,568.95	.586
5. Stoping	134,528.08	.648	58,870.76	.599
6. Timbering	49,796.84	.239	53,847.07	.548
7. Tramming	101,737.05	.489	34,452.15	.351
8. Ventilation	4,462.68	.021	1,812.06	.018
9. Pumping	13,485.32	.065	13,203.84	.134
10. Compressors and Air Pipes	18,890.84	.091	20,232.38	.206
12. Underground Superintendence	17,065.66	.082	15,403.53	.157
14. Maint: Comp. & Power Drills	3,140.90	.015	796.80	.008
15. Scrapers & Mech. Loaders	17,551.82	.084	8,977.12	.091
16. Tramming Equipment	17,989.30	.087	12,577.54	.128
17. Pumping Machinery	4,050.80	.019	696.33	.007
Total Underground Costs	427,983.87	2.058	283,715.96	2.887
18. Hoisting	33,743.07	.162	27,069.35	.275
19. Stocking Ore	21,153.40	.102	9,716.17	.099
20. Screening-Crushing at Mine	186.03	.001	199.30	.002
21. Dry House	14,018.14	.067	13,134.99	.134
22. General Surface Expense	14,913.99	.072	13,600.32	.138
23. Maint: Hoisting Equipment	12,285.61	.059	2,879.07	.029
24. Shaft	4,933.61	.024	1,291.66	.013
25. Top Tram Equipment	2,830.92	.014	956.66	.010
26. Docks, Trestles and Pockets	412.75	.002	739.68	.008
27. Mine Buildings	974.28	.004	571.90	.006
Total Surface Costs	105,451.80	.507	70,159.10	.714
28. Geological	933.50	.004	882.13	.009
29. Mining Engineering	4,431.99	.021	4,955.90	.050
30. Mechanical & Electrical Engineering	1,591.02	.008	448.55	.005
31. Analysis and Grading	15,821.82	.076	10,904.74	.111
32. Safety Department	1,426.53	.007	1,230.93	.013
33. Telephones and Safety Devices	2,339.47	.011	2,374.14	.024
34. Local and General Welfare	1,692.43	.008	1,314.13	.013
35. Special Exp., Pensions & Allowances	4,049.33	.020	2,355.19	.024
36. Ishpeming Office	8,947.51	.043	7,984.27	.081
37. Mine Office	16,785.65	.081	18,260.52	.186
38. Insurance	9,679.79	.047	6,624.43	.067
39. Personal Injury	12,435.74	.060	18,814.84	.192
40. Social Security Taxes	9,141.76	.044	8,172.73	.083
41. Employees Vacation Pay	16,455.80	.079	16,917.27	.172
Total General Mine Expense	105,732.34	.509	101,239.77	1.030
Cost of Production	639,168.01	3.074	455,114.83	4.631

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8. COST OF OPERATING (Cont'd)

b. Detailed Cost Comparison (Cont'd)

	1949		1948	
	Amount	Per Ton	Amount	Per Ton
41. General Supplies	25,635.88	.123	8,650.89	.088
42. Iron and Steel	9,693.73	.047	2,687.20	.027
43. Oil and Grease	2,429.71	.012	1,025.80	.010
44. Machinery Supplies	13,302.60	.064	8,313.43	.085
45. Explosives	16,410.43	.079	12,112.06	.123
46. Lumber and Timber	22,528.30	.108	12,129.53	.123
47. Fuel	5,922.21	.028	4,589.11	.047
48. Electric Power	33,670.53	.162	26,672.54	.272
49. Sundries	10,591.87	.051	10,429.60	.106
Total Supplies	140,185.26	.674	86,610.16	.881

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

Month	Amount
October	16,100.78
November	7,032.08
Total	23,132.86

Due to the difference in the nature of operations in 1948 and 1949 an explanation of the variation in cost in each account is omitted. In 1948 operations were confined chiefly on development work while in 1949 the mine was on a production basis and consequently the operating costs are lower in nearly every account. An explanation of the following costs are given because of their significance.

1. Exploring in Mine

There was no drilling done and the credit in this account represents the salvage value on some bits that were used in the previous year's drilling program.

4. Development in Ore

A large decrease in the expenditure in this account is due to less development footage driven and because a major part of the new level development was done in 1948.

5. Stoping

There was an increase in the expenditure in this account due to the larger mining program and the purchase of some new equipment.

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8. COST OF OPERATING (Cont'd)

b. Detailed Cost Comparison (Cont'd)

5. Stoping (Cont'd)

	1949		1948	
	Amount	Per Ton	Amount	Per Ton
General Supplies	2,749.33	.013	925.17	.009
Iron and Steel	2,755.36	.013	1,312.69	.013
Oil and Grease	640.62	.003	92.39	.001
Machinery Supplies	2,497.30	.012	1,890.37	.019
Explosives	13,326.61	.064	6,082.43	.062
Lumber and Timber	13.50		21.81	
Electric Power	4,239.15	.021	3,619.14	.038
Sundries	958.94	.005	383.89	.004
Expense Accounts	1,861.99	.009	761.86	.008
Total Supplies	29,042.80	.140	15,089.75	.154
Payroll Labor	95,605.38	.461	39,773.81	.405
Gen. Sthse. & Gen. Shops Labor	441.83	.002	433.72	.004
Shops, Labor, Etc.	9,438.07	.045	3,573.48	.036
Total Labor	105,485.28	.508	43,781.01	.445
Grand Total	134,528.08	.648	58,870.76	.599
Production Tons Stoped	188,428		70,836	
Average Miners Rate Stoping	13.67		13.25	
Average Tons Per Man Stoping	29.44		26.25	

7. Tramming

The cost in this account shows a large increase due to the additional labor required in transferring cars between the 9th and 8th Levels through the winze.

8. Ventilation

The increased expenditure in this account is due to installing a second fan on the 8th Level to operate in series with the fan at the Section 6 Shaft.

9. Pumping

The pumping expense was slightly higher than last year due to an increase in the mine water. The volume of water diverted to the Morris Mine represents 47% of the total mine volume, the same as in 1948 and the charges by the Inland Steel Company for pumping this water dropped slightly due to the smaller proportion of Lloyd water to their total volume.

	Total Inland Steel Co.			C.C.I. Co. Proportion		
Year	Amount	Avg. G. P. M.	Percent	Amount	Avg. G.P.M.	Percent
1945	43,150.99	857.6	89.9	6,518.28	96.8	10.1
1946	43,090.37	887.4	91.4	5,600.69	83.5	8.6
1947	65,474.05	966.8	90.0	7,482.69	109.2	10.0
1948	84,077.89	1,076.3	93.07	5,855.38	80.2	6.93
1949	100,820.55	1,192.5	93.24	5,400.93	86.4	6.76

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8. COST OF OPERATING (Cont'd)

b. Detailed Cost Comparison (Cont'd)

9. Pumping (Cont'd)

The following table shows a distribution of the total Lloyd Mine water pumped:

	Average Gallons Per Minute	
	1949	1948
Second Level	7.8	24.1
Fifth Level	88.5	66.8
Seventh Level to Morris Mine	86.4	80.2
Total	182.7	171.1

12. Underground Superintendence

The size of the supervisory force has remained the same. A reduction was made in salaries effective July 1st when the operating schedule was reduced from 48 to 40 hours per week. A Christmas bonus of $100.00 was again paid each salaried supervisor.

15. Maintenance of Scrapers & Mechanical Loaders

The total expense was considerably larger compared to the previous year due to the purchase of new equipment and larger amount of repairs resulting from a larger mining operation.

16. Tramming Equipment

There was a large increase in the total expenditure due to the need of maintaining the tram cars in good condition at all times to realize the best efficiency in transferring cars through the winze.

19. Stocking Ore

There was an increase in this expenditure due to erecting more trestle and more new material was used in this construction.

23. Maintenance of Hoisting Equipment

The larger expenditure in this account is due to more maintenance on the auxiliary hoist at the winze and repairs to this unit caused by bearing trouble.

24. Shaft

The larger expense in this account is due to major repairs to the collar of the shaft after a bad washout of the fill material occurred during a heavy rainfall in July.

28. - 41. Inclusive

The total expense in direct charges was higher due to a larger underground operation but the cost per ton in each account was lower due to the larger production.

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9. EXPLORATION AND FUTURE EXPLORATIONS

There was no exploration drilling done during the year. On the basis of all the drilling that has been done in the search for new ore every possibility has been exhausted for an important new find above any of the present levels. A study and correlation of the geology in the area south and below the present levels has been completed by the Geological Department and the favorable fault structure developed in this area has led to definite plans to explore for possible deep orebodies. The program will comprise drifting approximately 1200' to the south from the 8th Level to reach a favorable location for drilling and thoroughly exploring an area that has not been reached by any previous drilling. Early in 1950 work was started on the drifting part of the deep exploration program.

10. TAXES

The following shows a comparison of the taxes paid in 1949 and 1948 in Ishpeming Township:

	1949		1948	
Lloyd & Section 6	Valuation	Taxes	Valuation	Taxes
SW¼ of NW¼ Sec 6, 47-27, 40 Acres)				
N½ of SW¼ Sec 6, 47-27, 81.67 ")				
N½ of SE¼ Sec 6, 47-27, 80 ")	150,000	2,285.45	230,000	4,900.63
Personal, Ore in Stock, Supplies and Equipment	330,000	5,027.98	300,000	6,392.13
Total by State Tax Commission	480,000	7,313.43	530,000	11,292.76
Collection Fee		73.13		112.93
Total Taxes		7,386.56		11,405.69
C.C.I. Co. Misc. Lands				
S½ of NE¼ Sec 6, 47-27, 80 Acres	550	8.38	320	6.82
SE¼ of NW¼ Sec 6, 47-27, except R/W	550	8.38	350	7.46
S½ of SW¼ Sec 6, 47-27, except R/W	900	13.74	700	14.91
SW¼ of SE¼ Sec 6, 47-27, except R/W	550	8.38	350	7.46
SE¼ of SE¼ Sec 6, 47-27, except R/W	600	9.14	575	12.25
Total	3,150	48.02	2,295	48.90
Collection Fee		.48		.49
Total C.C.I. Co. Misc. Lands		48.50		49.39
Total Lloyd Mine	483,150	7,435.06	532,295	11,455.90
West Ishpeming				
Lot 4 of Block 2	72	1.15	50	1.08
North Lake Location				
Houses on Sec 6, 47-27	10,075	155.04	4,000	86.08
Total Ishpeming Township	493,300	7,591.25	536,345	11,542.24
Rate		1.52363		2.13071

The large decrease in taxes is the result of the smaller valuation on reserves and a very favorable reduction in the tax rate. The lower tax rate is due to a 40% reduction in the Township school tax.

	1949	1948	1947	1946	1945
Taxes Per Ton Produced	.031	.117	.048	.056	.056
Taxes Per Ton Shipped	.044	.070	.029	.069	.054

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11. ACCIDENTS AND PERSONAL INJURY

The accident frequency rate was considerably higher than last year but the severity rate was much lower. There were 13 compensable accidents compared with 5 in the previous year but fortunately none of the accidents were very serious in nature. The total man days worked increased from 33,687 in the previous year to 34,544 in 1949 and the man days lost on account of all accidents was 348. For compensable accidents only there were 321 days lost. The following table shows a comparison of the severity and frequency rates:

Year	Frequency Rate	Severity Rate
1948	44.53	11.922
1949	79.65	1.259

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

The compensable accidents are listed in detail as follows:

Accident No. 886, January 6, 1949, Joseph Cominsoli, Miner. Cominsoli was breaking a large chunk over the grizzly rails with the chunk-breaker. He was standing on the chunk and when it broke he slipped and in trying to hold himself up he caught hold of a side plank at the loading slide and twisted his left arm - Strained left shoulder - Time lost - 9 days.

Accident No. 887, March 22, 1949, Waino Kangas, Brakeman. While loading cars at No. 921 Raise a chunk that apparently fell from the top of the raise came through the empty chute and bounced off the top of the loaded car and struck him in the chest - Bruised chest - Time lost - 48 days.

Accident No. 888, March 30, 1949, Joseph Perrault, Skip Tender. While pulling chunks over the measuring pocket grizzlies at the shaft with a hook he strained the right side of his chest - Strained muscles of right chest - Time lost - 15 days.

Accident No. 889, May 11, 1949, Victor Karkkainen, Miner. He and his partner were taking ladders out of an old travelling mill and his partner had loosened a ladder and let it drop to the bottom of the raise. Karkkainen reached out to grab the ladder at the bottom of the raise and in doing so his hand struck a nail in the ladder rail - Puncture wound of right hand - Time lost - 9 days.

Accident No. 890, May 12, 1949, William Billings, Jr., Miner. While breaking a chunk over the grizzlies with a chunk-breaker the moil point slipped off the chunk and punctured the instep of his right foot - Laceration of instep of right foot - Time lost - 10 days.

Accident No. 891, May 16, 1949, Romono Mariuzza, Timberman. While cleaning the spillage under a chute with the Eimco loader, one wheel ran over his left foot as he was standing on the side operating the loader - Bruised left foot - Time lost - 36 days.

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11. ACCIDENTS AND PERSONAL INJURY (Cont'd)

Accident No. 892, May 21, 1949, George Brighenti, Truck Driver. He was stooped over picking up a piece of wood to throw on the truck when his helper who was working on the other side of the truck threw a piece that rolled over the side of the truck striking Brighenti on the lower left side of the back - Bruised back - Time lost - 14 days.

Accident No. 893, April 26, 1949, Albert Poirier, Timberman. Poirier was using a wrench to put a scraper together and the wrench slipped while he was tightening a bolt causing him to strike his right elbow on a scraper arm - Bruised elbow - Time lost - 20 days.

Accident No. 894, May 17, 1949, Charles Suardini, Miner. While Suardini was helping to lift a cap in place his foot slipped causing a back strain - Strained back - Time lost - 81 days.

Accident No. 895, September 12, 1949, Isaac Lampsa, Scraperman. While Lampsa was barring a mill a chunk of ore rolled down the pile and struck him on the shin and foot - Fractured second metatarsal bone of left foot - Time lost - 68 days.

Accident No. 896, December 13, 1949, Emil Warlin, Motorman. He had taken a loaded car off the winze cage and it failed to couple to the last car of the train spotted on the track. Another motorman moved the train towards the winze to couple the car and in doing so the car was pushed back towards the winze. Warlin had his back to the train as he was placing the catches for an empty car on the cage and as he saw the car moving toward him he stood against the shaft gate and was squeezed between the car and the gate - Bruised chest and right wrist - Time lost to the end of the year - 16 days.

Accident No. 897, December 13, 1949, John Bozio, Miner. Bozio and his partner were caving back a transfer drift and some ore was also being scraped from an old mill just ahead of the cave and this blocked up. The miners started picking down the pile to get the tail block on an inside set and while doing this a small chunk dropped from the back striking Bozio on the head and knocking him down. A second chunk then dropped onto the pile and rolled over on his leg - Severe contusion of left foot - Time lost to the end of the year - 16 days.

Accident No. 898, December 13, 1949, Edward Aho, Company Account Miner. He was uncoupling cars and sending them down on the winze cage to the 9th Level. He pulled the handle on one car with such force that the coupling cable broke causing his hand to slip and strike the side of the car - Badly bruised right wrist - Time lost - 9 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was very little new construction in 1949 and the erection of wood trestle at the close of the shipping season comprised most of the work on surface. In the stocking area east of the shaft 17 bents of trestle were erected for stocking both Silica and Lloyddale grades.

On the top landing a small sheet metal frame addition was built on the east side of the shaft house for storing supplies and equipment.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION (Cont'd)

New construction underground consisted of installing a 250 G.P.M. centrifugal pump on the 9th Level. A 6" discharge line was installed for the pump in a raise extending to the 7th Level so that water could be pumped directly to this elevation from the 9th Level and thereby bypass the 8th Level pump station. A smaller capacity centrifugal pump was used on the 9th Level until the larger unit was installed and this pump now serves as a spare.

13. EQUIPMENT AND PROPOSED EQUIPMENT

There was less equipment purchased and a number of the items added to the inventory were used equipment purchased from other mines. In view of the short operating life remaining, there is no large equipment purchases anticipated.

Item	Number	Cost
Transformer	1	$ 45.00
I. R. Pickhammers	11	1,705.00
Alemite Power Grease Gun	1	293.50
I. R. Utility Hoist	1	690.00
5' Heavy Duty Sheave	1	586.90
Primary Contactor	1	25.00
Planovane Fan	1	225.00
Allis Chalmers 20 h.p. Motor	1	75.00
Westinghouse 25 h.p. Motor	1	375.00
Allis Chalmers Pump	1	50.00
42" Scrapers	2	78.00
Cleveland Sinker	1	595.00

14. MAINTENANCE AND REPAIRS

a. Mine

There were four breakdowns and damages to equipment as reported previously under delays that added materially to the maintenance cost. One of the drum shaft bearings on the winze hoist was the source of trouble until a new bearing was machined and hold-down supports placed on the bearing caps to reduce the thrust. A new cage for the winze was constructed in the General Shops to replace the one that was badly damaged when it fell to the bottom of the winze with a loaded car. Damage to the winze proper was slight and consisted of a broken runner and divider at the bottom of the shaft and a new 5' diameter head sheave was installed replacing the one that was broken when the cage was hoisted against it.

Major repairs were made near the collar of the shaft during the vacation period in August and it consisted of installing a number of new timber sets and divider pieces replacing badly rotted members. New casing plank was also installed in a section a short distance below the collar following a wash-out of the fill material around the shaft timber after a heavy rainfall. Major repairs were also made in the ladder compartment of Section 6 Shaft which serves as a second outlet and ventilation shaft. About 400' of new ladders were installed extending from the collar to a short distance below the 3rd Level. A number of stages in the ladder road were rebuilt replacing rotted stages and some new casing plank was installed in several sections to put the ladder road in good condition. Some settlement of the ground around the shaft collar has taken place over the years and this was back-filled to grade.

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14. MAINTENANCE AND REPAIRS (Cont'd)

a. Mine (Cont'd)

There has been no large timber repair program required underground although occasional repairs were made in a portion of each of the 9th Level crosscuts in ore. Some lining sets were installed for added support but the largest part of the underground repair work was confined to raises. Each of the long raises in the main deposit required repairs in the chute compartments and these were lined with hardwood plank and steel wearing straps. A portion of the 4th Level airway near Section 6 Shaft has been subject to crushing and a number of steel sets were installed in this section.

A large amount of maintenance and repairs has been required on the tram cars to realize the best efficiency in transferring them through the winze between the 8th and 9th Levels. Dumping catches and couplings on the cars have required a lot of attention to maintain them in good working order. Repairs to motors has consisted chiefly of occasionally replacing an armature and worn out wheel assembly.

During the summer a crew of steel workers was employed replacing a number of badly rusted steel members in the head frame. Numerous channel iron supports for the top landing on the north side of the shaft house were weakened badly by rusting and also a number of angle iron cross members, and these were replaced with new steel. New steel supports for the stairway to the top landing was also installed and a new fir decking laid in a section of the landing on the north side. Before pocket shipments were started in the spring the crusher chutes and pockets were lined with new plate and some worn out plate was replaced in the skip dump.

The Sullivan compressor has required considerable maintenance to keep it in good running condition. Some bearing trouble developed and it was necessary to install new connecting rod bearings for both the high and low pressure cylinders. A new safety valve was also installed replacing one that was giving faulty service. The smaller Ingersoll-Rand compressor has seen very little service during the year and consequently maintenance on it has been at a minimum.

The upkeep on surface buildings was low because practically no repairs were needed and the only maintenance consisted of some interior painting in the combined office, dryhouse and shop building.

b. Location

1. General Maintenance

There was no location maintenance expense since the water supply system was turned over to the Township in the previous year. A uniform monthly charge is now made to the Township for pumping water from the Morris No. 8 well and this charge will continue to be made until the Township receives their water supply from the City of Ishpeming under a pending proposal.

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14. MAINTENANCE AND REPAIRS (Cont'd)

b. Location (Cont'd)

2. Rented Buildings

There was a large increase in this expense due to major repairs and improvements on the store building. A new mule hide roofing was installed on the store and this project was let to a local contractor. Maintenance on the old roof was becoming excessive due to deterioration after many years of service. The front of the building was repaired and it comprised installing new timber sills under the display windows and also new supports in the doorway. Some minor repairs were also made to the superintendent's house which is the only other rented building still owned by the company in the location. The following is a comparison of the expenditure on rented buildings for the past five years:

Year	Amount
1945	$ 403.95
1946	92.22
1947	581.23
1948	455.91
1949	1,504.12

There was no maintenance expense on the club house which has been closed since 1946 excepting one basement room which has continued to be let for use by a local men's club.

15. POWER

The amount of power consumed increased due to the larger mining program compared to last year. There were no delays to operations due to lack of electric power other than several short periods which were of no serious consequence. The following is a five year comparison of the power cost:

Year	K.W.H.	Cost	Rate
1945	2,937,800	43,337.04	.0148
1946	2,011,200	29,830.08	.0148
1947	2,335,200	36,760.08	.0158
1948	1,994,400	31,640.64	.01586
1949	2,208,000	35,444.04	.01605

16. WATER SUPPLY

The water supply since June was obtained entirely from the Morris No. 8 deep well. Prior to June a portion of the supply was obtained from the 2nd Level but the amount from this source decreased over the years and because of the small volume and the need for maintaining and operating a second chlorinator this water was diverted to the regular mine discharge and is no longer used for mine or location purposes. The No. 8 well has a capacity of approximately 200 G.P.M. and is more than sufficient to supply the needs of both mines and the location despite the fact that the demand for water is increasing. During the peak demand in the summer months daily operation of the pumping plant is now required.

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16. WATER SUPPLY (Cont'd)

The Ishpeming Township has petitioned the City of Ishpeming to supply their water now that the two systems are connected. Until the City grants this request the only source of water for the location will continue to be from No. 8 well.

17. CONDITION OF PREMISES

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

18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total	Percent
Finnish	52	12	64	42.6
Italian	13	16	29	19.3
French	26	-	26	17.3
English	18	-	18	12.0
Swedish	9	1	10	6.7
Norwegian	1	-	1	.7
Austrian	1	-	1	.7
German	1	-	1	.7
	121	29	150	100.0

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1. GENERAL:

In spite of a six weeks strike, which occasioned an estimated loss of production and shipments of approximately 150,000 tons, and a reduction in the working schedule to five days per week, the Mather moved into first place as the largest underground producer and shipper in the Lake Superior District, if not the entire country. The production of 1,062,164 and shipments of 1,015,634 compare with 1,001,001 and 990,757 respectively during 1948, when the mine operated without interruption on a six-day, three-shift schedule.

Labor relations continued to be satisfactory, as evidenced by the fact that the employees overwhelmingly voted against the strike. Man-power was plentiful in both the skilled and unskilled classifications, due largely to the closing of the Negaunee Mine in April.

Shipments started before the end of March and continued without interruption, except for the strike, until the end of November.

The 5th Level continued as the largest producer throughout the year, with the 6th moving into second place, with the 2nd Level third and the 3rd Level fourth. The most important development project was the deepening of the shaft and the development of the 7th Level, which is being rushed as rapidly as possible in view of the ambitious production schedule over the next few years. Tentative plans are already being made for the 8th Level, an appropriation for which will be requested in 1950.

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2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1949 Product	1949 Stockpile Overrun	1949 Total	1948 Total
Mather	1,028,582	33,582	1,062,164	670,025
Mather Special	-	-	-	330,976
Total	1,028,582	33,582	1,062,164	1,001,001
Rock			122,012	116,655

b. Shipments:

	Pocket Tons	Stockpile Tons	Total Tons	Total 1948	Difference
Mather	542,969	472,665	1,015,634	617,131	398,503
Mather Special	-	-	-	373,626	373,626
Total	542,969	472,665	1,015,634	990,757	24,877

Stockpile shipments following the strike were sufficient to permit cleaning up the old pile and developing the overrun.

c. Stockpile Inventories:

	1949	1948
Mather	147,017 Tons	100,487 Tons

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

Months	Second (1600') Level	Third (1750') Level	Fifth (2050') Level	Sixth (2200') Level	Total	Rock
January	18,839	8,809	39,252	29,741	96,641	10,296
February	16,528	6,522	37,545	32,608	93,203	12,485
March	15,037	11,910	57,496	30,463	114,906	14,245
April	19,193	6,624	48,567	37,458	111,842	16,599
May	17,539	10,861	30,653	43,204	102,257	12,639
June	18,410	12,349	31,412	38,995	101,166	10,923
July	11,657	6,102	22,742	22,247	62,748	7,546
August	16,124	12,340	45,747	46,319	120,530	10,945
September	9,216	9,862	42,446	31,993	93,517	10,417
October	-	-	-	-	-	-
November	7,420	3,157	15,345	20,703	46,625	3,861
December	14,660	16,919	33,900	19,668	85,147	12,056
	164,623	105,455	405,105	353,399	1,028,582	122,012
Current Year Stockpile Overrun					33,582	
					1,062,164	

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

f. Ore Statement:

	1949	1948
On Hand January 1, 1949	100,487	90,243
Output for Year	1,028,582	983,570
Overrun	33,582	17,431
Total	1,162,651	1,091,244
Shipments	1,015,634	990,757
Balance on Hand	147,017	100,487
Increase in Output	61,163	271,332
Increase in Ore on Hand	46,530	10,244

Working Schedule:

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

1948 - 2-8 hr. shifts*, 6 days per week, Jan. 1st to Dec. 31st.

Practically a three shift operation by the end of the year.

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

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

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

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

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

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

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

g. Operating Delays:

Excluding the six weeks lost during the strike, there was only one important operating delay. This occurred on the 28th and 29th of July and was occasioned by a lack of electric power as the result of an electrical storm. In all, a delay of approximately two shifts was recorded on the afternoon and midnight shifts of the 28th and the day shift of the 29th. Damage at this property was comparatively slight as compared to others in the district.

In addition to the above, there was the usual number of small delays, minor in themselves, but aggregating a considerable loss of production, most of which was due to difficulties with the top tram larry cars.

The working schedule was changed during the first two weeks of March to transfer the heavy power load from the day to the midnight shift as a power conservation measure. An extremely wet spring, summer and fall have now removed any danger of a power shortage in the near future.

3. ANALYSIS:

a. Average Mine Analysis on Output (Dried):

Grade	Iron	Phos.	Silica	Sulphur
Mather	58.17	.114	9.26	.128

b. Average Analysis on Straight Cargoes:

All of the shipments during 1949 were in mixed cargoes.

c. High Sulphur Ore:

Continuing the successful experiment in the latter part of 1948, all of the product was mixed, hoisted and shipped as a Mine Run grade. The average sulphur on the year's output was held to .128% in spite of the fact that fairly large tonnages were obtained from the high sulphur areas above the 3rd and 5th Levels. Unless new high sulphur areas are encountered, this average should continue to decrease over the next several years.

d. Complete Analysis of Ores in Stock: (Dried)

Grade	Tons	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sulph.	Loss	Moist.
Mather	147,017	57.80	.120	9.37	.30	3.10	.72	.67	.148	2.38	11.86

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4. ESTIMATE AND ANALYSIS OF ORE RESERVES:

Because of the unpredictable length of the strike, the estimate of underground reserves was made as of September 1st and later brought up to date as of December 31st by deducting the production during that period and adding a small tonnage because of new information. Since large amounts of sulphurous ore are now being mined, mixed and shipped as Mather grade, considerable tonnages of this material are included in the current estimate which were not included in previous ones. The totals indicate approximately 7,000,000 tons available above the new 7th Level and some 5,000,000 tons estimated by the information obtained in the original surface drilling.

Assumption: 12 cu. ft. equal one ton.

	Mather Standard	Mather Sulphurous	Total Underground	Diamond Drilling	Total Tons
Reserves Indicated By Surface Diamond Drilling.....				5,733,318	
Reserves Indicated By Underground Development:					
Above 2nd Level.....	153,584	144,901	298,485		
Between 2nd & 3rd Levels.....	58,542	626,547	685,089		
Between 3rd & 5th Levels.....	1,357,180	852,550	2,209,730		
Between 5th & 6th Levels.....	3,165,984	95,208	3,261,192		
Below 6th Level.....	1,649,165	42,500	1,691,665		
	6,384,455	1,761,706	8,146,161	5,733,318	13,879,479
Less Production 9/1/49 to 12/31/49..	225,289	-	225,289	-	225,289
Total Gross as of December 31, 1949....	6,159,166	1,761,706	7,920,872	5,733,318	13,654,190
Less Loss in Mining and Rock.....	629,111	176,171	805,282	573,332	1,378,614
Net Total as of December 31, 1949....	5,530,055	1,585,535	7,115,590	5,159,986	12,275,576

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

A comparison with last year's estimate indicates a gross gain, including the production for the year, of 1,183,973 tons as compared with 1,926,253 tons in 1948.

	Total Tons
Net Total December 31, 1949	12,275,576
Net Total December 31, 1948	12,153,767
Net Gain in Reserves	121,809
1949 Production	1,062,164
Gross Gain in Reserves	1,183,973

It is now felt, however, that there are appreciable tonnages included in the above net total which cannot be mined economically under present day conditions. The bulk of this probable unavailable ore lies in the interbedded horizon, where, as a general rule, the ore is extremely hard, the hanging wall slate very soft and easily broken and the dips very unfavorable as regards the amount and cost of rock development. Currently, attempts to devise and adapt a mining method which can accomplish economical recovery of this ore without serious contamination indicate a definite operating loss when the cost of development, both in ore and rock, and the rate of production are considered. A definite recommendation will be worked out during the coming year to establish a policy regarding these reserves.

Expected Average Natural Analysis of Ore Reserves:

Grade	Total Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sulph.	Loss	Moist.
Mather by Surface Diamond Drilling....	5,159,986	53.15	.122	5.08	.25	2.62	.58	.60	.014	1.97	12.50
Mather by Undg. Development.....	7,115,590	51.50	.100	8.15	.20	2.45	1.00	.50	.110	2.25	11.85
	12,275,576										

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5. LABOR AND WAGES:

a. Comments:
The shortage of experienced underground labor was automatically eliminated by the closing of the Negaunee Mine in April and the responsibility of taking almost the entire crew. A few of these men elected to lose their Negaunee Mine Company seniority and take jobs in other Cleveland-Cliffs Iron Company mines in Negaunee. In all, 129 men were transferred to Mather "A" from Negaunee and a lesser number to Mather "B".

Number of Men 1/1/49.....	643
Added to Roll During the Year.....	216
Total.....	859
Separations.....	166
Total on Payroll 12/31/49.....	693
Net Gain.....	50

The above figure of 216 men "added to the roll during the year" includes 129 men transferred from Negaunee, 21 entirely new employees and 58 men who were called back between the large lay-off in April and the end of the year. The closing of the Negaunee Mine in April made it necessary to temporarily separate 98 men from the payroll, of whom 40 were transferred to other mines and 58 laid off. By the end of the year, with the exception of 9 surface men and 12 underground men, all of whom were working at other mines, the entire crew had been recalled. Of the original 98, 58 returned, 14 elected to keep other jobs, 21 were still at other mines, 4 had quit and one had been discharged.

Due to the fact that a large proportion of the men laid-off in April were World War II veterans, the number employed at the plant decreased from 251 at the beginning of the year to 218 by the end of the year.

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5. LABOR AND WAGES:

a. Comments: (Continued)
With few exceptions, the men transferred from the Negaunee Mine were capable and experienced. However, the abrupt change from top slicing to sub-level caving, sub-level stoping and block caving introduced a considerable problem of training and placing these men, particularly the miners. In line with the necessity for training these men and with the net increase of 50 employees, a number of additions were necessary in the supervisory staff. Captain Theodore Anderson retired as of January 1, 1950 due to ill health. As of the same date, H. H. Korpinen was promoted from Operations Engineer to Underground Superintendent; Assistant Captains Allen Hjelt and John Bjorne, Jr. were promoted to Captains, each in charge of approximately one-half of the underground operation. The rounding out of the third shift made it necessary to add three new Mine Foremen, two of whom were promoted to that position from the job of Shift Boss and one of whom was obtained from the Negaunee Mine by a transfer. Three new salaried Shift Bosses were obtained, two by promotion and one by transfer from the Negaunee Mine. Also as of the end of the year, three probationary bosses were nearing completion of their training period.

The very satisfactory labor relations which have always been enjoyed at this property were continued throughout the year, except for the six weeks strike period, when the employees were forced to remain away from work against their will. Just prior to the strike, a vote was conducted by the State Mediation Board in a completely illegal manner under protest that the first steps in the procedure had not been complied with. In addition, the vote was conducted at central polling places in Ishpeming and Negaunee, in spite of the definite wording of the law that the election is to be held on Company property. In spite of this, the vote at the Mather Mine, including "A" and "B", and a handful of men from the old Negaunee Mine totaled: Yes, 292; No, 386, a majority against the strike of 94. This compares with the Cleveland-Cliffs Iron Company mines: Yes, 1,385; No, 825; and a County wide vote of: Yes, 1,682; No, 947.

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5. LABOR AND WAGES:

a. Comments: (Continued)
In spite of the vote, and perhaps because of it, the union goon squads took particular pains to see to it that the operations at the two shafts were not continued. The mob scenes which were so familiar during 1946 were repeated, but on a somewhat smaller scale, since few attempts were made by the employees to enter the plant. There were a few instances when attempts were made to stop office and supervisory personnel. These attempts were not successful. Toward the end of October, some attempt was made to "talk up" a back-to-work movement, which did not materialize.

Throughout the six weeks idle period, the supervisory force did an excellent job of keeping up the repair work in most of the important areas. However, there were some mining places that suffered considerable damage because of the impossibility of removing and hoisting the material necessary for proper maintenance and repairs. Recovery to full production after the strike was not attained until December.

The contract with the C.I.O. was, of course, continued throughout the year and the percentage of union membership showed a marked increase from 70% to 89% by the end of the year. This increase is attributable partly to the tireless efforts of the organization's membership committee, and to a greater extent to the fact that practically all of the transfers from the Negaunee Mine were union members. With the exception of the grievance regarding the overtime pay for Christmas and New Years which was dropped by the union, there was only one formal grievance during the year in spite of frequent occasions when disciplinary measures were necessary. This grievance, which was signed by 18 of the 27 involved, concerned a disciplinary deduction of one-half hour's pay after repeated warnings about coming out to the shaft in advance of the usual quitting time. The union carried the grievance to Step 4, "Arbitration", where it was disallowed by the impartial umpire John J. Walsh, Attorney at Marquette.

The only important change in the working schedule was the reduction in the operation from six to five days per week effective June 27th. The basic wages remained unchanged, with a minimum rate of $1.18½ per hour for common surface labor, a minimum underground rate of $1.23 and a company-account miner's rate of $1.29 per hour, or $10.32 per day, exclusive of the $.05 per hour shift differential and overtime. The established contract miner's incentive pay rates remained unchanged, with judgment determining the difference in conditions, and the hourly increases added after calculating. The high contract pay for a single period during the year was $24.12 per day as compared with $26.16 the previous year.

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5. LABOR AND WAGES: (Continued)

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

		1949	1948
Product		1,062,164	1,001,001
Number of Shifts & Hours:			
Equiv. to		240-1/3 3-8 hr.	299½ 2-8 hr.
Average No. of Men Working:	Idle	Operating	
Surface	22-1/4	118	108-1/2
Underground	31-1/4	490	390-3/4
Total	53-1/2	608	499-1/4
Average Wages Per Day:			
Surface		$ 11.64	$ 11.01
Underground		13.12	12.66
Total		$ 12.83	$ 12.30
Wages Per Mo. of 23 Days:			(25 days)
Surface		$267.72	$275.25
Underground		301.76	316.50
Total		$295.09	$307.50
Tons Per Man Per Day:			
Surface		36.87	30.67
Underground		9.05	8.57
Total		7.27	6.70
Labor Cost Per Ton:			
Surface		$ .316	$ .359
Underground		1.448	1.476
Total		$1.764	$1.835
Average Product Stoping		34.89	37.48
Average Wages Contract Miner		$15.20	$15.40
Total No. of Days:			
Surface		28,810	32,640
Underground		117,317-3/4	116,749-3/4
Total		146,127-3/4	149,389-3/4
Amount for Labor:			
Surface		$ 335,441.47	$ 359,461.65
Underground		1,538,973.18	1,477,602.88
Total		$1,874,414.65	$1,837,064.53
Proportion Surface to Underground Men		1:4.2	1:3.6

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6. SURFACE:

a. Buildings:

Building maintenance was of a routine nature with one exception. The roofs on the engine house and both wings required a large amount of repair work due to poor original construction.

b. Headframe:

Headframe work, with the exception of the rebuilding of the north pocket, was confined to routine maintenance. However, a major change was designed, estimated and approved during the year for installation in 1950. This change includes the installation of a 60" pan feeder, a scalping screen of the same width, with a 36" x 24" jaw crusher reducing the oversize to 4" to 5".

c. Stocking:

Repairs to the three old larry cars were completed by the end of January, at which time stocking by truck was discontinued. It was, however, necessary to continue to use one of the Tilden Mine Euclid trucks for the handling of waste rock. Later, however, a used 20-ton unit was transferred from the Mesaba Range for this purpose.

The design of the new ore-handling larry cars was completed by the Design Service Company of Cleveland, Ohio, after which a number of proposals for the construction were received. The contract was ultimately let to the Lake Shore Engineering Company of Marquette for delivery sometime in 1950. These new, improved cars will be drawn by conventional trolley locomotives of 8-ton nominal weight, the purchase contract for which had not been let by the end of the year.

The final extensions to the permanent stocking trestles were designed by our Consulting Engineer, Mr. R. E. Boeck, Professor of Mechanical Engineering at Marquette University in Milwaukee, and a firm contract let with the Wisconsin Bridge & Iron Company of the same city. These extensions consist of a third 125' span extending the middle trestle (formerly the south) to the east. Also, the main structure is to be extended to the south a distance of 240' and the new south trestle built to the east a distance of 540' parallel to the other two trestles. The contract also includes widening the structure all the way from the headframe to permit a double track approach to the north and middle trestles. The concrete footings and piers were completed by the mine crew prior to September. However, the erecting company declined to attempt construction during the strike and, therefore, did not move in until December. Emphasis was placed on the fabricating and

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6. SURFACE:
(Continued)

c. Stocking: (Continued)
erecting of the double track portion, which was practically completed by the end of the year. In addition, the new tubular column extending the middle trestle was in place and concreted, with the four columns of the south trestle in place. Meanwhile, the mine crew had done considerable work in preparing the new stocking area and the permanent rock sollar. When completed, this enlarged stocking system will have an approximate capacity of 750,000 tons, after which additional tonnage can be stocked by means of scraping beyond the north and middle piles. A double drum winch has been installed on the D8 "Caterpillar" tractor specifically for this purpose. The grading for the new enlarged stocking area and the tracks to serve the new trestle was done by Lindberg & Sons, local contractors, early in the summer. By the end of the year, the major portion of the new tracks had been installed by the Lake Superior & Ishpeming Railroad Company.

d. Landscaping, Roads and Parking Area:
The water shortage continued throughout most of the summer, which made it impossible to use Municipal water for the maintenance of lawns and flower-beds. Accordingly, a small pump was installed to utilize the water from #1 Surface Well for this purpose. This system worked with complete satisfaction throughout the balance of the year.

A new parking area was graded immediately west of the main entrance and stabilized with underground waste rock. This additional parking capacity is needed particularly during the winter months when snow removal is a problem.

e. Timber Tunnels:
No additional enlargement was necessary in either of the timber tunnels or yards, both of which are proving adequate. The west tunnel is now used almost exclusively for specialty items, such as steel sets, backpoles and cribbing, with the major storing and handling of stull timber and the ordinary supplies concentrated in the east yard.

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6. SURFACE:
(Continued)

f. Surface Drainage:

Pumping in #1 Well was continued throughout the year, with the water being used for the lawns and flower-beds from the middle of June on. The volume handled varied from a maximum of 135 G.P.M. in May to 100 at the end of the year, with an average of approximately 118, without appreciably effecting the water table in the area.

Continued caving in Surface Hole #65 made it necessary to concrete it from its depth of 1,363' to 1,301'. Drilling was then resumed with the 4" bits for a short distance, after which the hole was tapered in the concrete to BX size (2-3/8") and continued to a total depth of 1,489', where it was stopped on March 14th. The lower portion of the hole was badly broken to the extent that it would not hold water. In fact, an actual down-draft into the mine could be felt. Water containing a dye was introduced into the hole and picked up in several places underground. For the next several years, the greatest advantage to be obtained from this hole involves the use of a geophone. Since this instrument can be used to its greatest advantage only when the hole is full of water, it was then necessary to concrete it back up to a depth of 1,309', at which point all of the leaks were apparently stopped. At the end of the year, it was still holding water satisfactorily, and plans are being made to install the geophone unit.

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7. UNDERGROUND:

a. Shaft Sinking:

Early in January, the drift south of the winze and the sump were completed at the new skip pit elevation, which inclined from elevation -1000 at the winze to -1015' at the shaft. During this month, the raise from this elevation to the bottom of the pentice was completed in the shaft section, as was a second small raise from the bottom of the pentice to the drift south of the cage compartment at the old shaft bottom. The stripping of the shaft beneath the pentice was started in February, with a set of bearers at that elevation, and continued through March, April and into May, when it was completed to the new skip pit elevation. A second set of bearers was installed below the pockets at the new 7th Level. Between that time and the removal of the pentice in the latter part of June, a considerable amount of work was completed at the level elevation and in the new skip pit. The pentice was removed starting June 26th and completed by the end of the month, with the steel sets installed, although not lined and concreted. This was completed and normal operations resumed on the 11th of July, at which time development of the new level was carried forward as rapidly as possible. Under the most difficult conditions and with the mine operating three shifts per day, six days per week, the cost per foot for 203' of winze of approximately $120.00, including several small drift connections and pockets, is not considered excessive. Under the same conditions, the finished cost for 125' of shaft of approximately $550.00 per foot is also thought to be quite satisfactory.

b. General:

By far the bulk of the production was obtained by sub-level radial stoping, block caving with and without grizzlies and adaptations of both methods, depending on the nature of the ore and the country rock. Most of the sub-level development was driven with 8' timber, although at times 9' material was used. There was some experimenting with 7' timbered openings, particularly where it was necessary to do the developing in the footwall rock. Also, there were numerous occasions where steel sets were used in sub-level work either where experience proved timber inadequate, or where the estimated life of the opening exceeded that practical for wood supports. A small amount of experimenting was done with arched steel sets, with every indication that something valuable would be developed. One major change in the usual block caving method was developed, with great success. Instead of the usual well-known method of undercutting a block by means of dog drifts over the mill openings, the whole operation is accomplished by radial drilling from a single drilling sub common to one or more transfer drifts. This greatly cuts the time and expense required to undercut a block and is much safer.

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7. UNDERGROUND: (Continued)

b. General: (Continued)

For long hole drilling, the use of 3" reverse-feed stoper machines mounted on pneumatic columns was continued successfully, although experiments indicate the possibility of returning to 3½" machines in some instances.

2nd Level

Operations above this level were confined to two distinct territories, one above and to the west of #1 Cross-cut and the other above and to the west of #4. The first area produced approximately 100,000 tons and declined from three working places early in the year to one at the end. These operations, which extended from the -10' elevation down to the -125', completed the recovery of practically all of the ore in the territory, with a small amount remaining to be recovered above the -125' sub-level. In all probability, all of the remaining ore will be completely mined out during the first quarter of 1950.

The second area above and to the west of #4 Cross-cut accommodated two mining and development crews throughout the year. This operation completed the recovery of all of the ore both north and south of #2 Dike from above the +50' sub-level down to the -100' and -110' sub-levels, where mining and development were being continued at the end of the year. This area produced approximately 70,000 tons, of which only a small portion was sulphurous.

The mining methods in both of these territories were a combination of radial sub-level stoping and sub-level caving.

Operations on the level were confined to a few new mining raises in the two territories, and two short drifts connecting ventilation and traveling ways from the 3rd Level workings below. Also a considerable amount of ore was recovered from the level elevation and the -110' sub-level above in the area between #4 and #6 Cross-cuts from operations above the 3rd Level. At the end of the year, the last remaining pillar was being mined in the vicinity of #5 Cross-cut from operations on the -140' sub-level below.

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7. UNDERGROUND: (Continued)

b. General: (Continued)

3rd Level:
Operations above the 3rd Level involved four specific areas, two of which were fairly substantial producers, with operations in the other two being confined to development.

A considerable amount of exploration and development work was done above #1 Cross-cut on most of the intermediate subs up to and including the 2nd Level, where a ventilation and traveling raise was connected. The bulk of the work was on the -160' sub-level, where a main transfer drift was driven in advance of stoping operations under the floor of the 2nd Level. Most of the recovery from this small area will be rather high in sulphur.

The largest producer above the 3rd Level was the area between #4 and #5 Cross-cuts, north and south of #2 Dike and under the area between #4 and #6 Cross-cuts on the 2nd Level. Mining and development operations recovered two large pillars up to the floor elevation of the -110' sub-level and down to the -140' and -160' subs, where mining and development were being continued at the end of the year. There was also a small amount of development and some mining on the -185' sub-level. The production from this area was approximately 70,000 tons, most of which was sulphurous. The mining method used was again a combination of radial stoping and subsequent caving of the transfer drifts. It is expected that this area will be pretty well mined out by the end of 1950.

Operations in the third area, which was also between #4 and #5 Cross-cuts but above the south footwall drift and much lower in height, were confined to development and mining from the -250' sub-level to the -185' inclusive, where development information indicated an extension of the ore upwards above the -160' elevation. Production was limited to approximately 30,000 tons, mostly of sulphurous grade.

Operations in the fourth area were limited to some rather extensive development work east of #7 Cross-cut and adjacent to the south line of the Jackson Strip, where drifting on the -225' sub indicated a fairly large deposit of sulphurous ore.

On the level, the largest project was the extension of the south footwall drift to the east some 290' in jasper and sulphurous ore. This drift, which went through #7 Cross-cut, was in advance of the development operations above the level and adjacent to the south boundary of the Jackson Strip. One main top timber transfer was driven to the north from this drift and several miscellaneous ventilation and traveling connections were completed from the workings above the 5th Level.

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7. UNDERGROUND: (Continued)

b. General: (Continued)

3rd Level (Continued)
In addition to the several miscellaneous mining raises and top timber transfer drifts, there was also a drift connection with a main traveling raise from the 5th Level below and a small amount of mining which reached the level elevation at the south end of #1 Cross-cut.

5th Level
Including the interbedded horizon, where there was rather extensive experimenting, there were seven natural mining territories above the 5th Level.

West of the Fault, North of #5 Dike
This area was one of the largest producers above the level, contributing approximately 95,000 tons of ore, most of which was sulphurous, with operations extending from a small stope opening a few feet above the 3rd Level to a fairly large stoping and caving area on the -360' and -390' subs, where mining was being continued at the end of the year. There was also a considerable amount of development work on the -410' sub, which is practically at the bottom of the trough at the intersection of the southward dipping footwall and the more or less vertical dike. This area employed a maximum of five crews throughout the early part of the year, with three still remaining at the end. There was still an appreciable tonnage yet to be recovered below the -360' sub-level.

West of the Fault, South of #5 Dike
Mining was continued in this area with the recovery of a small pillar on the -360' sub, and from that elevation down to the -535' sub-level, where development and mining were being continued at the end of the year. This territory employed two crews throughout most of the year and produced approximately 53,000 tons, most of which was Standard grade. The mining method employed was a combination of radial stoping, with a small amount of sub-level caving. Remaining reserves in this area are not extensive.

East of the Fault, North of #5 Dike
This territory, excluding operations in the interbedded horizon, was easily the largest producer above the level during the year. The bulk of the tonnage was produced by two bona-fide block caves, one of which was very successful and the other only moderately so due to extreme weight. There was also a considerable tonnage recovered by means of the usual radial stoping and caving of transfer drifts. Operations in the territory ranged from a height of a few feet above the -360' sub-level down to the -535' and -550' subs, where one contract was still stoping at the end of the year. Also at the end of the year, a small mining operation on the northwest corner was being completed on the -410' and -435' subs. There still remains a fairly large tonnage to be developed and mined in this area, in spite of the fact that the production for 1949 was in excess of 120,000 tons.

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7. UNDERGROUND: (Continued)

b. General: (Continued)

5th Level (Continued)

East of the Fault, South of #5 Dike
Operations in this territory above the 5th Level were confined to the recovery of two relatively small pillars, which produced approximately 18,000 tons of Standard ore. Later in the year, mining operations from above the 6th Level reached the -570' elevation.

In the fifth mining area lying between #5 and #6 Cross-cuts and south of #5 Dike, a single crew was employed throughout the year, with as many as three others at times engaged in development. Stoping operations extended from above the -460' sub down to the -570' elevation. Production from this one large stope was quite satisfactory, contributing approximately 71,000 tons, most of which was rather high in sulphur. At the end of the year, there still remained sufficient reserves in this area to make it an important producer throughout the first half of 1950. During the year, mining operations from above the 6th Level were continued in the area west of #5 Cross-cut under the jasper capping above the 5th Level elevation.

In the sixth main mining area, which lies above #7 Cross-cut, rather extensive development and mining operations were carried on throughout the year from the 3rd Level elevation down to the -435' sub. This territory employed two crews throughout most of the year and contributed approximately 35,000 tons of ore, most of which was somewhat high in sulphur. In this area, the ore and jasper capping are quite hard, with the result that the radial system of stoping worked quite satisfactorily. This area will continue to be a fair producer for some time to come.

Early in the year, the first real attempt to develop a satisfactory mining method in the interbedded ore was started. Development and mining operations were carried on between #4 and #5 Cross-cuts, where mining reached above the -485' sub, with a transfer drift on the -510' sub connecting rock raises which were put up some 60' from the 5th Level. There was also considerable activity in the interbedded horizon west of #4 Cross-cut, with operations reaching above the -500' sub from a long transfer drift on the -550' sub. These operations employed three mining contracts throughout the last half of the year and at times an additional three development crews, and produced approximately 28,000 tons of ore, which was very high in iron and low in sulphur. Several different methods were attempted involving transfer drifts in the ore parallel to the strike and cross-transfer drifts at right angles to the strike which, in spite of being put up on an incline, necessitated considerable rock work. Several stoping methods were

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7. UNDERGROUND: (Continued)

b. General: (Continued)

5th Level (Continued)

also tried, as was a modified form of sub-level caving. Due to the relatively narrow width, the flat dip and the very unstable slate which constitutes the hanging wall, this hard, rich ore is difficult to recover at a profit. Its hardness makes drifting and other development work considerably slower than average, but it is still not strong enough to stand without support. By the end of the year, several things had been definitely determined: (1) Recovery of this deposit will probably not average much more than 50%; (2) mining should be continued in it in spite of the small margin of profit because of its excellent grade and structure; and (3) the miscellaneous development should be done in the footwall rock to make available more of the ore and to avoid premature weight on the transfer drifts.

Operations on the level were confined to a considerable amount of mining from the 6th Level below, a few miscellaneous ventilation and travel ways and diamond drilling, which will be discussed later. During 1950, #7 Cross-cut will be extended to the southeast to the small ore body which was located in January 1950 in the extension of D.D.H. #35. It is also possible that the main drift will be extended to the east if the ore east of the Cambria fault can be located at this elevation.

6th Level

The 6th Level was the second largest producing level, contributing approximately 360,000 tons of Standard ore from three general mining areas. The most widely used mining method was radial sub-level stoping, which in a number of cases was changed to block caving by the expedient of undercutting the balance of the block when the jasper capping proved too weak for the other method. A small amount of recovery was also made by sub-level caving, particularly in the transfer drifts after the exhaustion of the stopes.

The main area lying northeast of the fault, northwest of #4 Dike and south of #5 Dike along the footwall, contributed approximately 230,000 tons of ore, or almost two-thirds of the production from the level. This area was naturally divided into two sub-areas, one to the west and one to the east. In both, mining operations reached above the 5th Level elevation. On the -615' sub under the jasper capping, the two operations were contiguous, in an area in excess of 1,000' long and 100' wide. Four contracts were employed in this area throughout the entire year and at times the number totaled eight. One of these, easily the most expert crew at the property, completed 687' of miscellaneous development work and, in addition, produced in excess of 100,000 tons. By the end

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7. UNDERGROUND: (CONTINUED)

b. General: (Continued)

6th Level (Continued)
of the year, the north central portion of the area had been completely mined out down to the -675' sub and operations were being continued in the west and east corners on and above the -650' sub. There still remains in this area a triangular block some 600' long by 200' at the apex from which the major portion of the 6th Level development must come during 1950.

The area southwest of the main fault was extremely disappointing. However, there was a small, fairly successful mining area developed west of #2 Cross-cut and completely mined out from above the -650' sub to the transfer elevation immediately above the level on the -700' sub, where development operations were being carried on at the end of the year just east of the cross-cut. The remainder of this small area, which contributed 44,000 tons during the year, is not expected to be an important producer in 1950.

In the fourth area, which lies northeast of the fault, between #4 and #7 Dikes and south of the latter, under the jasper between #4 and #5 Cross-cuts, the ore was limited in height to approximately the -620' elevation, from which the area was mined down to the transfer drift on the -725' sub by the end of the year, where development operations were being continued between #4 Cross-cut and the fault. This area, with its relatively low jasper capping, will also be developed to the east of #5 Cross-cut, but will not be an important producer in 1950. The two crews employed here throughout the year, together with several additional development crews when needed, produced approximately 86,000 tons of Standard ore.

Operations on the level included a considerable amount of development raises, top timber transfer drifts and a few feet of drifting in the interbedded ore east of #7 Cross-cut. The exploration diamond drilling will be discussed under a later heading. The cross-cut north between #5 and #6 Cross-cuts was stripped and a permanent battery charging station was completed. There was also a permanent ventilation connection from Raises #6801 and #6803, which were put up in the rock to the -700' sub. From this point, a 200' drift was driven to the north and the raise holed to the stub end of #9 Cross-cut on the 5th Level.

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7. UNDERGROUND: (Continued)

b. General: (Continued)

6th Level (Continued)
The major drifting program was also carried out on this level, with the main drift being extended to the east 435' to the "B" Shaft line and continued beyond it an additional 2,050' to a point 6,367' from "A" Shaft and 1,675' west of "B" Shaft. Switching turn-outs and a cross-cut increased this footage to 2,484'. Drifting conditions, particularly east of the line, were not favorable. The ground was very unstable, with the tendency to break off in large blocks, in spite of the fact that the original course was changed to put the drift an additional 200' deeper into the footwall. Support throughout was with steel sets and in some places were required at less than 2' intervals. In one area several hundred feet long in a fault zone, it was necessary to spile ahead with 12' holes drilled in advance of blasting, with the back and sides supported by a series of 1" reinforcing rods at times three tiers deep. This was the most expensive drift ever driven at the property. In general, switching turn-outs were put in every 600', with diamond drill cut-outs where indicated. The experience with the wide area at the turn-outs was so bad that the last one at Coordinate 8400 W. was put in as a cross-cut to the north, where the problem of support was made much easier. The results of the exploration program by diamond drilling to the south of this drift will be discussed under "Exploration".

6½ Level
There were no additional openings at this elevation during the year. This intermediate skip-loading level was very valuable in handling the rock from the 6th Level and from the shaft deepening project. Spillage from the skip pit, via the winze, was also handled at this level.

7th Level (Elevation -940')
This new level was cut out approximately 200' below the 6th Level and 50' below the old shaft bottom, which was the original skip pit. Progress during the first half of the year was of necessity limited to a small amount of work on both the cage and skip road sides, which were excavated, supported with steel and concreted prior to the completion of the shaft and the removal of the pentice. From July on, work progressed quite satisfactorily, in spite of very blocky ground, all of which required support. The original plan to install long, deep trenches both north and south of the skip compartments was abandoned in favor of the new plan of utilizing a single trench to the north served by three raises into which the material will be dumped by the conveyor. This eliminated a good part of the work to the south. By the end of the year, the excavation of the trench and the skip side of the plat had been completed, as was a good part of the concreting. The original

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7. UNDERGROUND: (Continued)

b. General: (Continued)

7th Level (Continued)

opening north of the cage road had been connected with the drift north of the trench, and the main drift to the southeast had been started. The excavation of the cage side of the plat and the installation of steel sets were nearly completed by the end of the year. There still remains a considerable amount of work to be done on the south in the excavation of a comparatively small sump and mud-settling drift, from which the water will be pumped by centrifugals to the main pumping station on the 6th Level. As soon as the main drift is turned on its permanent course, and has been advanced far enough to permit it, a small size conveyor drift will be started. This opening at the shaft will be 50' higher than the main level plat, or at the old skip pit elevation.

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7. UNDERGROUND:
(Continued)

d. Timbering:

In general, the use of 8' hardwood stull timber was continued in the sub-level mining openings, although occasionally a larger drift was needed, in which 9' timber was used. The use of steel was increased on both sub-levels and main levels, particularly the latter. In fact, less than 3% of the total main level footage driven during the year in rock was supported with wood. In all cases, steel sets were installed as the headings were advanced, the new system eliminating damage to the steel. Considerable quantities of concrete backpoles were used, although this product is gradually being replaced with the new Bethlehem "hat-shaped" sections, which are lighter and considerably stronger. Further, these steel backpoles can be installed as the heading is advanced, while the concrete slabs must be kept several hundred feet back of the heading.

The large, expensive program of replacing the original wood timber, carrying poles and blocking in the plats and main level drifts was continued throughout the entire year and practically completed. As a result, all plat openings are now supported with steel sets and fireproof carrying poles and blocking, with the exception of the 7th, where the original wood carrying poles have not yet been replaced. In addition, all main level drifts of a permanent nature are now supported with steel, with the exception of a few small areas which will be completed during 1950. There are fire-stops at irregular intervals in all of the main level drifts, and the areas around the powder magazines and important ventilation ways are now almost entirely fireproofed. Once again, the cost of this large replacement program was taken up on the operating cost sheet under the caption "Timbering".

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7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

Statement of Timber Used - All Operations

	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1949	AMOUNT 1948
5'4" Cribbing	166,093	.08349	$ 13,867.14	$ 17,507.10
8' & 16' Stulls	108,968	.26369	28,734.01	21,706.25
9' & 18' Stulls	32,229	.22101	7,122.85	9,795.80
Total	307,290	.16181	$ 49,724.00	
Total 1948	398,064	.12311		$ 49,009.15
		PER 100'		
7' Lagging	1,847,440	1.6265	$ 30,048.31	$ 31,451.40
9½' Poles	636,480	3.0227	19,238.83	19,431.16
Total	2,483,920	1.9842	$ 49,287.14	
Total 1948	2,637,663	1.9291		$ 50,882.56
		PER FOOT		
4" x 4" "H" Beam 13# Per Foot	71,658	.61701	$ 44,213.58	$ 34,777.35
4" x 8" "I" Beam 23# Per Foot	4,781	1.11445	5,328.17	2,623.37
3/8" x 2" x 2" Angle Iron	126,416#	.04345	5,493.47	4,439.70
Miscellaneous (Bolts, Plates, etc.)			3,209.92	3,481.76
Total			$ 58,245.14	
Total 1948				$ 45,322.18
2¼" x 8" x 6' Minecrete Poles	97,116	.22333	$ 21,689.24	$ 10,533.20
2¼" x 8" x 3' Minecrete Poles	1,068	.25	267.00	.00
4" x 8" x 12" Minecrete Blocks	1,326 pcs.	.18	238.68	168.60
6" x 8" x 12" Minecrete Blocks	1,310 pcs.	.22	288.20	169.10
8" x 8" x 12" Minecrete Blocks	1,803 pcs.	.26	468.78	314.18
Total			$ 22,951.90	
Total 1948				$ 11,185.08
GRAND TOTAL INCLUDING STEEL AND CONCRETE			$180,208.18	$156,398.97

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7. UNDERGROUND:
(Continued)

d. Timbering: (Continued)

Statement of Timber Used Under Operating Account "Timbering":*

	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1949	AMOUNT 1948
5'4" Cribbing	166,093	.08349	$ 13,867.14	$ 16,438.95
8' & 16' Stulls	108,968	.26369	28,734.01	21,621.37
9' & 18' Stulls	31,743	.22183	7,041.64	5,976.93
Total	306,804	.16181	$ 49,642.79	
Total 1948	363,011	.12131		$ 44,037.25
		PER 100'		
7' Lagging	1,609,219	1.6261	$ 26,168.18	$ 26,095.07
9½' Poles	556,456	3.0231	16,822.49	15,346.99
Total	2,165,675	1.9851	$ 42,990.67	
Total 1948	2,164,086	1.9150		$ 41,442.06
		PER FOOT		
4" x 4" "H" Beam 13# Per Foot	51,846	.61365	$ 31,815.45	$ 32,698.46
4" x 8" "I" Beam 23# Per Foot	3,077	1.22617	3,772.94	2,374.57
3/8" x 2" x 2" Angle Iron	94,319#	.04360	4,112.85	4,186.37
Miscellaneous (Bolts, Plates, etc.)			2,406.65	3,294.38
Total			$ 42,107.89	
Total 1948				$ 42,553.78
2¼" x 8" x 6' Minecrete Poles	86,460	.22333	$ 19,309.40	$ 10,533.20
2¼" x 8" x 3' Minecrete Poles	1,068	.25	267.00	.00
4" x 8" x 12" Minecrete Blocks	1,326 pcs.	.18	238.68	168.60
6" x 8" x 12" Minecrete Blocks	1,310 pcs.	.22	288.20	169.10
8" x 8" x 12" Minecrete Blocks	1,803 pcs.	.26	468.78	314.18
Total			$ 20,572.06	
Total 1948				$ 11,185.08
GRAND TOTAL INCLUDING STEEL AND CONCRETE			$155,313.41	$139,218.17

* Including large main level replacement program.

	1949	1948
Product for Year	1,062,164	1,001,001
Foot Timber per Ton of Ore	.2888	.3626
Foot Lagging per Ton of Ore	1.5150	1.6383
Foot Poles Per Ton of Ore	.5239	.5236
Foot Lagging per Foot of Timber	5.2451	4.5175
Cost Per Ton for Timber	.0467	.0440
Cost Per Ton for Lagging	.0246	.0261
Cost Per Ton for Poles	.0158	.0153
Cost Per Ton for Steel and Concrete Supplies	.0590	.0537
Cost Per Ton for all Timbering Supplies, Including Steel and Concrete Supplies	.1461	.1391

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7. UNDERGROUND:
(Continued)

e. Drifting and Raising:

The following table includes all of the miscellaneous development work on all operations throughout the year, including main level drifting on both the "A" and "B" Shaft sides of the line. The 48,168' were driven at an average rate of 4,600' per month for 10½ months, as compared with slightly less than 4,000' per month during 1948.

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Large Size	10,842'*	9,814'**	16'***	58'***	20,730'
Small Size	5,931'	2,107'	13,129'±	6,271'±±	27,438'
	16,773'	11,921'	13,145'	6,329'	48,168'

Grand Total Last Year..... 46,962'

* Timbered
** 8,831' Timbered
*** Cribbed
± 3,841' Cribbed
±± 4,162' Cribbed

The following table of main level drifting includes 2,484' in the so-called "B Shaft Connection". Steel supporting sets were installed as these drifts were driven, except for a very short length of drift on the 3rd Level, where timber was used.

	Timbered Ore Drift	Timbered Rock Drift	Naked Rock Drift	Total
NM-60 3rd Level	207'	81'		288'
NM-27A 6th Level ("A" Shaft)	9'	435'		444'
NM-44L6 6th Level ("B" Shaft)		2,484'		2,484'
NM-71 7th Level		141'		141'
Total	216'	3,141'	-	3,357'
Total 1948	1,037'	5,337'	162'	6,536'

In addition to the above, there were 265' of miscellaneous raising and drifting in a ventilation connection between the 6th and 5th Levels charged to NM-27A. Also, on the "B" Shaft side of the line there were 103' of naked rock drift and 35' of rock drift supported with steel sets driven for the specific purpose of providing diamond drill stations for exploring under "B" Shaft E&A NM-44L6-j.

MATHER MINE "A" SHAFT
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7. UNDERGROUND:
(Continued)

f. Explosives:

The average price paid for explosives during the year increased 7% from $14.32 to $15.34. The use of Hercomite #2 for most of the mining operations was continued in both the 1¼" x 8" and 2" x 24" sizes. The amount of high pressure 60% Gelatin 5" x 5# cartridges was more than doubled as compared with the previous year. This material is used extensively for reducing large size chunks in mills and ore passes, and was used experimentally in 1948.

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

	Quantity	Average Price	Amount 1949	Amount 1948
60% Gelatin 1¼" x 8"	39,056#	16.750 CWT	$ 6,541.95	$ 6,861.83
60% Gelatin 4" x 16"	-	-	-	180.00
60% Gelatin H.P. 5" x 5#	70,435#	20.000 CWT	14,087.00	6,710.32
80% Gelatin 1¼" x 8"	-	-	-	449.54
Gelamite 2x 1¼" x 8"	65,715#	15.250 CWT	10,021.61	.00
Gelamite 2x 1½" x 8"	1,750#	15.250 CWT	266.87	.00
Hercomite 2x 1¼" x 8"	324,264#	14.500 CWT	47,018.34	59,017.21
Hercomite 2 - 2" x 24"	127,750#	14.500 CWT	18,523.77	14,263.50
Total Powder	628,970#	15.336 CWT	$ 96,459.54	
Total Powder 1948	610,887#	14.321 CWT		$ 87,482.40
Blasting Fuse	1,245,521'	8.496 M	$ 10,582.54	$ 10,417.27
No. 6 Blasting Caps	164,349	1.456 C	2,393.12	2,229.79
No. 14 Lead Wire	59,500'	26.000 M	1,547.00	1,485.25
Electric Blasting Caps	33,434	20.080 C	6,713.62	9,090.44
7" Fuse Lighters	34,500	9.000 M	310.50	230.80
Paper Shells	13,710	7.061 M	96.81	139.52
#1 Powder Bags	-	-	-	29.79
#2 Powder Bags	148	4.627 ea.	684.81	765.00
Primacord	401,500'	3.200 C	12,848.00	7,264.00
Total Fuse, Caps, Wire, etc.....			$ 35,176.40	$ 31,651.86
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			$ 131,635.94	$ 119,134.26

MATHER MINE "A" SHAFT
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7. UNDERGROUND:
(Continued)

f. Explosives: (Continued)

The amount of explosives used per ton of ore in the stoping and development operations remained exactly the same as the previous year. The increase in the cost per ton for explosives is in line with the increased prices.

Explosives Used in Breaking 1,062,164 Tons of Ore in Stoping and Development in Ore

	Quantity	Average Price	Amount 1949	Amount 1948
60% Gelatin 1¼" x 8"	4,886#	16.750 CWT	$ 818.41	$ 1,418.10
60% Gelatin 4" x 16"	-	-	-	170.00
60% Gelatin H.P. 5" x 5#	69,275#	20.000 CWT	13,855.00	6,640.32
80% Gelatin 1¼" x 8"	-	-	-	107.92
Gelamite 2x - 1¼" x 8"	7,213#	15.250 CWT	1,100.01	.00
Gelamite 2x - 1½" x 8"	1,680#	15.250 CWT	256.19	.00
Hercomite 2x - 1¼" x 8"	241,669#	14.500 CWT	35,042.04	38,883.93
Hercomite 2 - 2" x 24"	125,923#	14.500 CWT	18,258.84	14,195.50
Total Powder	450,646#	15.385 CWT	$ 69,330.49	
Total Powder 1948	424,414#	14.471 CWT		$ 61,415.77
Blasting Fuse	973,685'	8.494 M	$ 8,270.85	$ 8,737.29
No. 6 Blasting Caps	130,357	1.456 C	1,898.47	1,848.83
No. 14 Lead Wire	11,750'	26.000 M	305.50	439.66
Electric Blasting Caps	5,928	20.288 C	1,202.68	2,074.26
7" Fuse Lighters	24,500	9.000 M	220.50	213.91
Paper Shells	10,040	6.923 M	69.51	139.52
#1 Powder Bags	-	-	-	26.65
#2 Powder Bags	96	4.642 ea.	445.67	585.00
Primacord	385,900'	3.200 C	12,348.80	7,049.14
Total Caps, Wire, Fuse, etc.....			$ 24,761.98	$ 21,114.26
GRAND TOTAL EXPLOSIVES & BLASTING SUPPLIES.....			$ 94,092.47	$ 82,530.03

	1949	1948
Product	1,062,164	1,001,001
Pounds of Powder per Ton of Ore	.424	.424
Tons of Ore per Pound of Powder	2.359	2.359
Cost per Ton for Powder	.065	.061
Cost Per Ton for Fuse, Caps, etc.	.023	.021
Cost per Ton for All Explosives	.088	.082

In addition to the above, explosives costing $16,992.53 were used in miscellaneous rock work which was charged to "Development in Rock". This compares with $11,804.80 in 1948.

MATHER MINE "A" SHAFT
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YEAR 1949

7. UNDERGROUND:
(Continued)

f. Explosives: (Continued)

Explosives Used in Driving 3,141' of Rock Drift Supported By Either Conventional Timber or Steel Sets - This Footage Includes All of the Rock on the "A" Shaft Side of the Line and the "B" Shaft Drifting on the 6th Level Done by the "A" Shaft Crew - E&A's NM-27A, 44L6, 60 and 71

	Quantity	Amount	Pounds of Powder Per Foot of Drift	Cost Per Foot
60% Gelatin 1¼" x 8"	3,310#	$ 554.44		
Gelamite 2x 1¼" x 8"	53,587#	8,172.04		
Hercomite 2x 1¼" x 8"	6,815#	988.18		
Total Powder	63,712#	$ 9,714.66	20.28	$ 3.09
Miscellaneous Blasting Supplies		4,389.43	-	1.40
Grand Total		$ 14,104.09	20.28	$ 4.49
Grand Total 1948 - 5,404'		$ 20,286.63	19.71	$ 3.75

"A" Shaft - 657'
"B" Shaft (6th Level) - 2,484'

Slightly stiffer ground on the average accounted for a slight increase in the number of pounds of powder per foot of drift. Only part of the increase in the cost per foot for explosives can be explained by the general price increases. The remainder of the increase is attributable to the return to the use of the more expensive Gelamite powder in the place of Hercomite, which was used extensively in 1948. The latter powder tends to absorb moisture far too rapidly for use in headings where wet drilling is the practice. The above average cost varied from $4.58 per foot and 21.07# per foot at "A" Shaft to $4.47 and 20.08# per foot on the "B" Shaft side.

MATHER MINE "A" SHAFT
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7. UNDERGROUND:
(Continued)

g. Loading and Tramming:

Most of the main level drifting was on the 6th Level in the so-called "B" Shaft Connection". Early in the year, the drifting program on the 3rd Level was completed and late in the year drifting on the new 7th Level was started. Most of the loading in these drifting projects was done by the original Model 125 Conway Goodman electric loaders which, in spite of the necessity for constant maintenance, still do a satisfactory job. However, the desire to cut maintenance expenses and lost time was responsible for the ordering of two Conway Model 120's and an Eimco Model 40 Hydro-electric. The Model 120 Conways are to be tested at "A" prior to delivery at "B", and the Model 40 is ordered on a trial basis. The Conways were not received by the end of the year, but a few trial runs with the Eimco 40 were possible. This machine is potentially an excellent one, although the hydro-electric design has yet to be perfected and is, therefore, not incorporated in the machine. By the end of the year, test results were inconclusive and the trial was being continued.

The use of the 100 cubic foot Lake Shore "Lohed" cars was continued with complete satisfaction, and all of the original 90 cubic foot cars were enlarged to the 100 foot capacity. The original ten "Loheds" were overhauled and rebuilt to permit their use on the up-to-date dumpers which handle the rest of the cars. The use of the ten cars purchased from the C. S. Card Iron Works of Denver was once again limited to rock tramming, since they are neither strongly enough built nor properly designed to handle the heavier ore. The rubber liners in the bottoms of the cars worked out very well in all makes of cars and, as nearly as can be determined, eliminate at least 75% of the hand labor formerly necessary to keep them reasonably clean. In addition, the rubber eliminates all of the abrasion on the car bottoms. After being used the better part of two years, the original "blankets" are still in use and none need replacement, although several are showing signs of cutting.

MATHER MINE "A" SHAFT
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YEAR 1949

7. UNDERGROUND:
(Continued)

g. Loading and Tramming: (Continued)

Three combination battery and trolley locomotives were received late in the year, one from the Goodman Manufacturing Company and two from the Jeffrey Manufacturing Company. These two supplying companies were chosen after lengthy and exhaustive studies of the merits of the equipment of a number of manufacturers. Primarily, these units were put into service at "A" to test them for "B" Shaft. By the end of the year, several important defficiencies had been discovered and the solutions to them were almost completed. In the case of the Jeffrey machines, the brakes were entirely inadequate, which made it necessary to redesign and replace the brakes on all five units at the expense of the manufacturer. Other than that, the machines were well designed and well built, with the exception of the engineering on the control grids and charging control equipment. In both makes, the grids were installed in such a position that they heated the battery cells to an undesirable degree. Also in both makes, the charging control apparatus was entirely inadequate and ineffective. By the end of the year, satisfactory solutions to both of these problems were in sight.

Tramming on the new 7th Level will be limited to short trains of "Lohed" cars and battery locomotives tramming to the crushing plant which will feed the 2,500' conveyor, an appropriation for which was being awaited at the end of the year.

h. Ventilation:

The newly installed intake air heating arrangement worked out perfectly, although the months of January, February and March were abnormally mild and, therefore, the tests were inconclusive. However, there was enough cold weather during December to prove that the installation was properly and adequately designed and engineered.

MATHER MINE "A" SHAFT
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YEAR 1949

7. UNDERGROUND:
(Continued)

h. Ventilation: (Continued)

There was, however, a considerable amount of difficulty experienced in properly maintaining the ventilation seal in the shaft as underground conditions required increasingly greater volumes of air at higher pressures. Particularly during the warm summer months, it was difficult and at times impossible to introduce sufficient quantities of new air into the system, due to the leaks in the shaft seal and the well-known fact that warm air does not travel down as readily as does cold air. With the increase in the total volume at the fan to over 100,000 C.F.M. and the subsequent increase in the static pressure to slightly over 2" water gauge, the numerous small leaks in the seal became more serious. Throughout the latter months of the year, a program was started to overcome these leaks if possible. During most of the week-ends in November and December, checks were made which determined the necessity for doing considerable amounts of concreting. This work was carried on throughout the balance of the year, with the prospect of it continuing throughout most of 1950.

Total volumes at the main fan on the 3rd Level varied from 100,000 to 112,000 C.F.M., with the percentage of recirculated air varying from a low of over 50% in cold weather to a high of somewhat over 80% in one of the hottest weeks in the summer. At this point, there was an inefficient, but not dangerous defficiency of oxygen in some of the working places. Part of the difficulty was due to the impossibility of properly maintaining the shaft seal during the excavation of the new 7th Level plat.

During the year, one additional ventilation connection was completed between the 6th and 5th Levels. Work in the connections between the other levels was confined to maintenance.

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7. UNDERGROUND:
(Continued)

i. Pumping:

There was very little change in the amount of underground water handled by the 3rd and 6th Level pumping stations, and only seasonal changes in the amounts on the 960' Level. This is the second consecutive year that the pumping has remained practically static following the flood early in 1947.

	960' Level	3rd Level	6th Level	Total
January	5	51	129	185
February	-	48	128	176
March	-	49	120	169
April	4	46	131	181
May	23	48	129	200
June	21	53	127	201
July	29	56	117	202
August	42	54	114	210
September	34	54	123	211
October	46	55	117	218
November	37	56	118	211
December	41	52	116	209
Total Gallons	12,390,160	27,095,658	64,780,500	104,266,318
Average G.P.M.	23	51	123	197
	12%	26%	62%	100%

MATHER MINE "A" SHAFT
ANNUAL REPORT
YEAR 1949

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

a. Comparative Mining Costs:

In spite of a higher average wage scale and a $0.03 per ton increase in the combined depreciation charge-offs, the operating cost was reduced from $3.43 to $3.27 "Total Cost at the Mine". This reduction was due partly to increased efficiency, which resulted in an increase in the average daily production of almost 1,100 tons per day from 3,342 to 4,420. In addition, there was a direct decrease of almost $0.07 per ton due to lower charges to "Cave-In" in Surface Hole #65.

	1949	1948
Product	1,062,164	1,001,001
Underground Costs	2.157	2.342
Surface Costs	.278	.273
General Mine Expense	.409	.409
Cost of Production	2.844	3.024
Depreciation: Plant & Equipment	.069	.044
Development after 12/31/44	.109	.109
Pre-Production Development	.042	.036
Movable Equipment	.005	.005
Taxes	.165	.162
Loading and Shipping	.039	.049
Total Cost at Mine	3.273	3.429
Budget - Estimated Cost Per Ton	3.337	3.485
Number of Shifts and Hours	240-1/3 3-8 hr.	299½ 2-8 hr.
Total 8 hr. Operating Shifts	721	599
Number of Operating Days	240-1/3 3-8 hr.	299½ 2-8 hr.
Average Daily Product	4,420	3,342

Proportion of Labor and Supplies

	Amount	Per Ton	Per Cent
Labor	$1,998,056.54	1.881	57%
Supplies	1,478,619.46	1.392	43%
Total Cost at Mine	$3,476,676.00	3.273	100%

MATHER MINE "A" SHAFT
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YEAR 1949

8. COST OF OPERATING: (Continued)

b. Detailed Cost Comparison (Operating):

	1949		1948	
	Amount	Per Ton	Amount	Per Ton
Exploring in Mine	1,050.23	.001	38,193.46	.038
Development in Rock	156,036.84	.147	105,047.80	.105
Development in Ore	22,898.36	.022	55,266.03	.055
Stoping	868,832.55	.818	755,231.88	.754
Timbering	631,256.04	.594	625,835.17	.625
Tramming	216,675.52	.204	258,172.81	.258
Ventilation	19,240.81	.018	18,658.51	.019
Pumping	15,344.30	.014	20,856.23	.021
Compressors and Air Pipes	67,611.90	.064	76,991.69	.077
Underground Superintendence	98,426.53	.093	93,820.12	.094
Cave-In	15,515.56	.015	81,167.86	.081
Maint.Comp. & Power Drills	1,566.83	.001	13,148.98	.013
Scrapers & Mechanical Loaders	119,498.51	.113	127,371.40	.127
Tramming Equipment	46,576.99	.044	60,672.81	.061
Pumping Machinery	10,659.66	.010	13,979.43	.014
Total Undg. Costs	2,291,190.63	2.157	2,344,414.18	2.342
Hoisting	89,147.77	.084	86,415.36	.086
Stocking Ore	37,662.15	.035	30,647.38	.031
Dry House	35,586.51	.034	38,853.62	.039
General Surface Expense	25,412.40	.024	25,320.34	.025
Maint. Hoisting Equipment	31,982.36	.030	35,816.20	.036
Shaft	13,113.68	.012	7,789.51	.008
Top Tram Equipment	22,784.33	.021	28,471.16	.028
Docks, Trestles & Pockets	31,215.23	.029	5,130.24	.005
Mine Buildings	8,483.36	.009	14,807.29	.015
Total Surface Costs	295,387.79	.278	273,251.10	.273
Geological	5,305.61	.005	4,941.81	.005
Mining Engineering	27,793.26	.026	25,924.16	.027
Mechanical & Elect. Engrg.	8,432.32	.008	7,087.99	.007
Analysis and Grading	46,612.63	.044	52,144.73	.052
Safety Department	5,586.19	.005	4,252.36	.004
Telephones & Safety Devices	19,310.40	.018	22,098.97	.022
Local & General Welfare	6,990.28	.007	7,239.90	.007
Spec. Exp. Pensions & Allow.	18,095.75	.017	14,119.02	.014
Ishpeming Office	46,945.62	.045	47,338.28	.047
Mine Office	53,321.65	.050	59,186.08	.060
Insurance	38,464.31	.036	28,960.30	.029
Personal Injury	50,023.73	.047	40,445.94	.040
Social Security Taxes	50,753.13	.048	46,391.08	.046
Employees Vacation Pay	56,057.46	.053	49,397.76	.049
Total Gen. Mine Expenses	433,692.34	.409	409,528.38	.409
COST OF PRODUCTION	3,020,270.76	2.844	3,027,193.66	3.024

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8. COST OF OPERATING (Continued)

Charges Distributed by Mine Office: (Operating)

	1949		1948	
	Amount	Per Ton	Amount	Per Ton
General & Electrical Supplies	117,510.57	.110	160,779.99	.161
Iron and Steel	129,004.33	.122	105,778.86	.106
Oil and Grease	9,626.78	.009	8,459.94	.008
Machinery Supplies	110,981.34	.104	131,910.24	.132
Explosives	126,995.77	.120	94,691.81	.095
Lumber and Timber	142,050.99	.134	134,595.47	.134
Fuel	15,435.35	.015	12,339.29	.012
Electric Power	154,368.01	.145	138,388.32	.138
Other Items of Expense	20,507.62	.019	29,076.90	.029
Rental	925.26	.001	2,245.78	.002
Total	827,406.02	.779	818,266.60	.817

MATHER MINE "A" SHAFT
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8. COST OF OPERATING: (Continued)

b. Detailed Cost: (Idle Expense Due to Strike)

	1949 Amount
Exploring in Mine	2.03
Stoping	95.16
Timbering	1,174.88
Ventilation	478.42
Pumping	812.51
Compressors & Air Pipes	755.46
Underground Superintendence	12,971.16
Scrapers & Mechanical Loaders	135.00
Tramming Equipment	550.16
Pumping Machinery	495.68
Total Undg. Costs	17,470.46
Hoisting	1,996.16
Dry House	2,147.90
General Surface Expense	1,857.51
Maint. Hoisting Equipment	443.30
Total Surface Costs	6,444.87
Geological	679.73
Mining Engineering	3,248.72
Mechanical & Electrical Engineering	1,143.61
Analysis & Grading	4,620.81
Safety Department	778.81
Local and General Welfare	751.36
Spec. Expense, Pensions & Allowances	2,330.39
Ishpeming Office	7,167.08
Mine Office	5,548.76
Insurance	5,295.19
Personal Injury	4,118.53
Social Security Taxes	635.96
Employees Vacation Pay	9,740.00
Total General Mine Expenses	46,058.96
TOTAL AS ABOVE	69,974.29
Depreciation - Movable Equipment	861.41
Proportion of Taxes	25,050.00
Miscellaneous Income & Expense	554.09
TOTAL IDLE EXPENSE	96,439.79

MATHER MINE "A" SHAFT
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8. COST OF OPERATING: (Continued)

Charges Distributed by Mine Office: (Idle)

	1949 Total
General & Electrical Supplies	70.68
Oil and Grease	11.00
Machinery Supplies	307.73
Fuel	523.32
Electric Power	2,421.04
Other Items of Expense	274.97
Total	3,608.74

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8. COST OF OPENING, EQUIPPING & DEVELOPING:

Capital account expenditures for the year amounted to $364,851.86, which brought the total at the end of 1949 to $5,885,260.77. This total figure does not include an additional $318,223.11 charged in a prior year to Negaunee Mine Company "Idle Expense". The inclusion of this amount brings the grand total to date to $6,203,483.88. "General Expense" and "Maintenance" for the past five years have been charged into "Operating".

Of the above expenditures, approximately $15,500.00 was charged against operating costs during the year and, in addition, the several depreciation accounts aggregated $239,538.96. A breakdown of these charges is shown below:

E&A NM-56.....	$ 302.16	-	"Cave-In"
E&A NM-61.....	15,213.40	-	"Cave-In"
E&A NM-62.....	53.72	-	"Maintenance: Compressors & Power Drills"
	$ 15,461.84	@	$.015 per ton
Combined Depreciation....	239,538.96	@	.225 per ton
Total.....	$255,000.80	@	$.240 per ton

Total Capital Account Charges as Above.....	$ 364,851.86
Total Charge-Offs.....	255,000.80
Actual Net Increase in Capital Account.....	$ 109,851.06

Capital account expenditures during 1950 and 1951 will probably be much greater due to the necessity for developing the 7th Level and sinking for the development of the 8th.

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8. COST OF OPENING, EQUIPPING & DEVELOPING: (Continued)

Shaft sinking, main level development, drifting and permanent ventilation connections accounted for approximately 61% of the capital account expenditures for the year, or approximately $222,000.00. The other large item was $70,000.00 for the extensions to the permanent stocking trestles and enlarging of the stocking areas. This amount was approximately 19% of the total. Of the balance, there were fairly large expenditures of $22,000.00 for mining, scraping and haulage equipment, and $15,000.00 for a spare armature for the motor generator set and hoist motors in the engine house.

8. COST OF OPENING, EQUIPPING, AND DEVELOPING:

	E&A REFERENCE	TOTAL AUTHORIZED	TOTAL EXPENDITURES TO DEC. 31, 1949 GROSS EXPENDITURES	CREDITS A/C ORE MINED IN DEVELOPMENT	NET EXPENDITURES	UNEXPENDED BALANCE	1949 EXPENDITURES
1. BUILDINGS AND EQUIPMENT:							
a. Main Buildings	(10-10&19 10-10&19A)	280,000.00	279,990.27	-	279,990.27	9.73	-
b. Change House & Shop Equip.	10-26	60,000.00	60,000.00	-	60,000.00	-	-
c. Initial Shop Equipment	(10-4/10-4A)	5,732.73	5,732.73	-	5,732.73	-	-
d. One 35 Ton Overhead Crane	(10-9/10-9A)	8,894.94	8,894.94	-	8,894.94	-	-
e. Temporary Equipment	10-18	15,000.00	14,079.62	-	14,079.62	920.38	-
f. Erecting & Equipping Storage Building	31	20,900.00	20,900.00	-	20,900.00	-	-
g. Compressor Plant	10-23/47	137,203.07	137,203.07	-	137,203.07	-	1,670.46
h. Hot Milling Equipment	43	2,871.20	2,871.20	-	2,871.20	-	-
i. Steam Boiler and Heating Equip.	52	58,958.60	58,958.60	-	58,958.60	-	-
TOTAL BUILDINGS & EQUIPMENT		589,560.54	588,630.43	-	588,630.43	930.11	1,670.46
2. SURFACE:							
a. Equipment:							
1. Temporary Surface Plant	10-3	31,130.00	26,506.28	-	26,506.28	4,623.72	-
2. Truck & Tractor	10-1	18,575.00	18,289.42	-	18,289.42	285.58	-
3. Electric Shovel	18	85,000.00	85,000.00	-	85,000.00	-	-
4. Top Tram Equipment	(10-24/10-24A/ 70	171,000.00	51,215.13	-	51,215.13	119,784.87	7,840.00
5. Timber Tunnel, Tracks, Pumphouse & Sump	(10-20/10-20A)	58,000.00	57,867.78	-	57,867.78	132.22	-
6. Timber Tunnel & Yards	29/29-1	124,800.00	114,750.20	-	114,750.20	10,049.80	174.36
7. Mechanical Additions - Headframe	32	27,500.00	27,500.00	-	27,500.00	-	-
8. Crawler Crane	51	12,000.00	12,000.00	-	12,000.00	-	-
9. Four Wheel Drive Truck	53	7,500.00	7,497.72	-	7,497.72	2.28	-
10. Spare Armature for Hoist Motors & Generator	49	14,747.00	14,747.00	-	14,747.00	-	14,747.00
11. Crawler Mounted Crane	58	12,500.00	12,524.01	-	12,524.01	24.01	847.85
12. International 4-Ton Truck.	64	6,000.00	6,381.41	-	6,381.41	381.41	147.25
13. Willys 3/4-Ton Pickup Truck	67	2,100.00	2,114.84	-	2,114.84	14.84	2,114.84
14. Euclid 20-T Dump Truck-Used	68	6,342.08	6,342.08	-	6,342.08	-	6,342.08
Total		577,194.08	442,735.87	-	442,735.87	134,458.21	31,918.88
b. General:							
1. Diamond Drilling	9	81,000.00	80,965.78	-	80,965.78	34.22	-
2. Moving Two Houses	10-2	3,458.00	3,458.00	-	3,458.00	-	-
3. Drainage Well	10-11/56	36,896.00	28,852.93	-	28,852.93	8,043.07	302.16
4. Road Bldg., Paving Parking Lot, etc	25	23,760.00	23,132.41	-	23,132.41	627.59	658.29
5. Surface Test Hole	61	80,000.00	70,253.82	-	70,253.82	9,746.18	15,503.34
Total		225,114.00	206,662.94	-	206,662.94	18,451.06	16,463.79
TOTAL SURFACE		802,308.08	649,398.81	-	649,398.81	152,909.27	48,382.67
3. SHAFT, HEADFRAME AND TRESTLE:							
a. Sinking in Sand	(10-15/10-15A)	16,302.44	16,302.44	-	16,302.44	-	-
b. Sinking in Rock (2,870')	(10-16/10-16A)	440,000.00	435,677.44	2,559.15	433,118.29	6,881.71	-
c. Shaft sets (2,870')	(10-5/10-5A)	160,975.45	159,754.21	-	159,754.21	1,221.24	-
d. Headframe Foundation & Ore Trestle	(10-21/10-21A)	78,000.00	77,417.73	-	77,417.73	582.27	-
e. Headframe & Trestle	(10-7/10-7A)	186,028.83	186,028.83	-	186,028.83	-	-
f. Extensions to Permanent Stocking Trestles	(36/42/42-1/66)	370,152.48	209,159.29	-	209,159.29	160,993.19	69,316.17
g. Headframe & Power Ho. Eqpt	(10-22/10-22A)	225,000.00	224,451.51	-	224,451.51	548.49	-
h. Elec.Equip.for Cage & Skp.Hsts.	10-8	221,783.00	221,783.00	-	221,783.00	-	-
i. 1 Cage Hoist & 1 Skip Hoist	10-6	143,000.00	143,000.00	-	143,000.00	-	-
j. Elevator for Headframe	(10-12/10-12A)	4,853.00	4,853.00	-	4,853.00	-	-
k. Double Deck Cage- Spare	37	7,000.00	3,134.75	-	3,134.75	3,865.25	-
l. Pinion Brake for Cage Hoist	45	4,000.00	4,000.00	-	4,000.00	-	-
m. Crushing & Screening Plant in Headframe	72	75,000.00	944.13	-	944.13	74,055.87	944.13
TOTAL SHAFT, HEADFRAME & TRESTLE		1,932,095.20	1,686,506.33	2,559.15	1,683,947.18	248,148.02	70,260.30

8. COST OF OPENING, EQUIPPING AND DEVELOPING (Continued)

	E&A REFERENCE	TOTAL AUTHORIZED	TOTAL EXPENDITURES TO DEC. 31, 1949 GROSS EXPENDITURES	CREDIT A/C ORE MINED IN DEVELOPMENT	NET EXPENDITURES	UNEXPENDED BALANCE	1949 EXPENDITURES
4. UNDERGROUND:							
a. Plant:							
1. Pumping - 3rd Level.....	10-25/10-25A	55,000.00	53,738.88	-	53,738.88	1,261.12	-
2. Pumping Plant-6th Level....	39	227,823.06	227,823.06	-	227,823.06	-	138.12
Total.....		282,823.06	281,561.94	-	281,561.94	1,261.12	138.12
b. Equipment:							
1. Mining Equipment.....	19	44,550.00	44,550.00	-	44,550.00	-	-
2. Mining Equipment.....	28	51,700.00	51,700.00	-	51,700.00	-	-
3. Mining Equipment.....	40	61,710.00	61,710.00	-	61,710.00	-	-
4. Mining Equipment.....	41	28,050.00	28,050.00	-	28,050.00	-	-
5. Mining Equipment.....	55	23,870.00	23,870.00	-	23,870.00	-	-
6. Mining Equipment.....	62	30,000.00	16,117.10	-	16,117.10	13,882.90	53.72
7. Mining Equipment.....	65	60,000.00	49,547.28	-	49,547.28	10,452.72	22,898.78
8. Haulage Equipment.....	10-29/10-29A	110,000.00	110,000.00	-	110,000.00	-	-
9. Haulage Equipment.....	23	90,420.00	89,732.02	-	89,732.02	687.98	-
10. Haulage Equipment.....	46	84,755.00	84,755.00	-	84,755.00	-	837.50
11. Haulage Equipment.....	59	46,000.00	45,372.88	-	45,372.88	627.12	1,000.00
12. Underground Substations....	38	14,300.00	14,300.00	-	14,300.00	-	-
13. Main Ventilating Fan.....	48	24,200.00	17,536.23	-	17,536.23	6,663.77	236.06
14. Twelve Scraper Hoists.....	50	33,000.00	32,980.80	-	32,980.80	19.20	-
15. Scraper Hoists.....	54	49,500.00	49,500.00	-	49,500.00	-	1,231.98
Total.....		752,055.00	719,721.31	-	719,721.31	32,333.69	22,011.64
c. Development:							
1. Main Level Development:							
Plats & Pockets.....	10-28/10-28A/26-26A/27-27A/57/63/71	395,500.00	344,625.55	-	344,625.55	50,874.45	87,305.97
Drifting.....	10-27/24/26-26A/27-27A/33/60/71	1,527,871.20	1,298,416.83	80,404.67	1,218,012.16	309,859.04	56,558.73
Vent. & 2nd Outlet.....	26-26A/27-27A	53,900.00	39,675.79	-	39,675.79	14,224.21	3,485.33
Excavation & Hoist Instal.	57/63	3,000.00	6,751.02	-	6,751.02	3,751.02	150.00
160' Winze.....	57/63	15,750.00	24,045.75	-	24,045.75	8,295.75	-
Preparation of Skip Pit	57/63	6,000.00	16,037.16	-	16,037.16	10,037.16	7,246.18
Shaft Sinking.....	57/63	65,000.00	69,217.48	-	69,217.48	4,217.48	67,942.46
Loading & Discharge Ends	71	50,000.00	-	-	-	50,000.00	-
2,500' Conveyor System..	71	200,000.00	-	-	-	200,000.00	-
Pan, Screen, Crusher....	71	50,000.00	-	-	-	50,000.00	-
Vent. Conn.1000' @ $25.00	71	25,000.00	-	-	-	25,000.00	-
2.Devel. & Mining Above Levels.	24/26-26A/27-27A/34	203,728.80	194,487.12	49,921.83	144,565.29	59,163.51	-
3. Underground Exploration....	21	35,000.00	34,838.62	-	34,838.62	161.38	-
Total.....		2,630,750.00	2,028,095.32	130,326.50	1,897,768.82	732,981.18	222,388.67
d. Dewatering Hematite Workings..	30	66,000.00	64,232.28	-	64,232.28	1,767.72	-
TOTAL UNDERGROUND.....		3,731,628.06	3,093,610.85	130,326.50	2,963,284.35	768,343.71	244,538.43
GRAND TOTAL BEFORE CONTINGENCIES.		7,055,591.88	6,018,146.42	132,885.65	5,885,260.77	1,170,331.11	364,851.86
Plus 10% for Contingencies.....		228,217.26	-	-	-	228,217.26	-
GRAND TOTAL INCLUDING CONTINGENCIES		7,283,809.14	6,018,146.42	132,885.65	5,885,260.77	1,398,548.37	364,851.86
General Expense.....	10-13	-	271,716.98	-	271,716.98)	-	1949 Expense
Maintenance.....	10-14	-	37,050.73	-	37,050.73)	-	taken up in "Cost
Building Roads & Landscaping...	10-17	-	9,455.40	-	9,455.40)	-	of Operating"
Total to Negaunee Mine Company Idle Expense.....		-	318,223.11	-	318,223.11	-	
GRAND TOTAL.....		7,283,809.14	6,336,369.53	132,885.65	6,203,483.88	1,398,548.37	364,851.86

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8. COST OF OPENING, EQUIPPING & DEVELOPING: (Continued)

Because of varying conditions, the cost per foot for main level drifting ranged from a high of $57.00 to a low of $42.00, with an average of $50.59 on the "A" Shaft side of the line and $55.04 on the "B" Shaft side, with an overall average for all drifting on all levels both "A" and "B" of $54.11. The difference of $5.00 per foot in the two sides of the line in the "B" Shaft connecting drift is easily explained by the fact that all of the pipe, track and other facilities in the "A" Shaft portion were used material which had already been charged out. On the "B" Shaft side, all new supplies and facilities were used. In addition, there was a portion of the drift on the "B" Shaft side which was extremely heavy and required a large number of lining sets. The above costs, which include a fair prorated proportion of tramming, hoisting and other general mine expenses, compare with last year's figure of approximately $40.00 per foot. Approximately 88% of the 5,337' driven during that year was supported with wood timber, carrying poles and blocking, with only 12% supported by steel sets and without any permanent carrying poles. As was previously mentioned, almost 98% of the drifting during 1949 involved the use of steel supporting sets and permanent carrying poles of either concrete or steel. The hydraulically operated Joy jumbo drill rigs were continued in use with the 3" drifters with 8' feeds, using tungsten carbide insert removable bits.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Diamond drill exploratory work on the "A" Shaft side of the line was not particularly extensive during the year. Five new holes, #60 to #64 inclusive, were drilled and an old hole, #35, was reentered and drilled an additional 100'.

5th Level

Holes #60 and #61 were drilled and Hole #35 was deepened from #8 Cross-cut in an attempt to locate at this elevation the ore found from #7 Cross-cut on the 6th Level below and southeast of #7 Cross-cuts on the 2nd and 3rd Levels above.

Hole #60 was stopped at 79'. The exploration was continued by Hole #61 from the same location on course S.16°E., dip +7°06'. This hole was stopped in jasper at a depth of 749'. No ore was encountered, but #8 Dike was definitely located.

Hole #35 was then reentered and continued on a southerly course from 511' to 611' by the end of the year without encountering the ore body. However, at this writing, the ore was successfully located from 690' to 818', a run of 128' at elevation -465, or approximately 100' above the level. Early in 1950, #7 Cross-cut will be advanced to the southeast toward this deposit, which is probably not very extensive, but which will add materially to the mineable reserves.

Future exploration on this level will probably include one or more holes 1,000' in depth from the end of the main drift beyond #9 Cross-cut toward the structure east of the Cambria fault which was successfully explored on the "B" Shaft side of the line on the 6th Level.

6th Level

Hole #62 was drilled to the southeast from a station in the interbedded ore a few feet east of #7 Cross-cut. The hole was drilled in an attempt to further outline the then little-known deposit in the vicinity of #8 Dike in this area. Only a small run of ore was encountered beyond the footwall contact and north of a small dike, probably #8A. The information obtained in this hole indicates that the deposit lies to the west along #8 Dike.

Holes #63 and #64 were drilled from the south end of #5 Cross-cut for two purposes. Primarily, it was important to definitely locate the footwall contact and to test the footwall slate prior to the final decision on the course of the main level drift on the 7th Level and the location of the excavation for the pan, screen and crusher at the loading end of the conveyor belt. Secondly, it was also important to test the extent of the ore below the 6th and above the

MATHER MINE "A" SHAFT
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9. EXPLORATIONS AND FUTURE EXPLORATIONS: (Continued)

6th Level (Continued)

7th. Hole #63 was put down vertically to a total depth of 172', the last 17' of which were in footwall slate. The hole showed a vertical extension of the main ore to 70', slaty lean ore for an additional 30', the interbedded slate from 100' to 126' and Standard ore in the interbedded horizon from 130' to 155'. This hole gave valuable and exact information for locating the 7th Level development.

Hole #64 was then drilled due south at a -60° dip from approximately the same location, and was stopped at a depth of 118' still in high grade Standard ore. Although all of the desired information was not obtained, the hole was stopped since it was caving badly, and the top of the interbedded slate would undoubtedly have been encountered in a short distance. The information obtained definitely proves a continuation of the ore for 100' vertically below the level.

Except for the possibility of a few exploratory holes from the present levels to outline ore bodies for mining purposes, there is no particular future program of exploration above the 6th Level. However, there is a very extensive program being planned for the area in the southwest quarter of the section, which up to now has not been explored. This program, which has been discussed at length over the past several years, involves either surface exploration or underground exploration, or a combination of both. At the present writing, all parties concerned lean toward the underground method as being possibly less expensive and certainly productive of more accurate information. Tentatively, the plan involves approximately 2,500'of main level drifting from the end of what normally would be #4 Cross-cut, first to the southwest a distance of 1,500' and then west an additional 1,000'. From each of these two points, several holes are planned to the south, probably involving 2,000' of drilling. The whole project, as presently outlined, will probably involve an expenditure of between $130,000.00 and $150,000.00, and will probably be definitely outlined and an authorization requested in 1950.

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1949

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL	FINISHED DEPTH
35	5th Level (2050') #8 Cross-cut	S.00°08'E	+2°29' Continued	7/30/47 11/28/49	9/22/47	511' - 611' Soft Ore Jasper	
60	5th Level (2050') #8 Cross-cut	S. 30°E	+15°	3/26/49	3/29/49	0 - 79' Slate & Graywacke	79'
61	5th Level (2050') #8 Cross-cut	S.16°41'E	+7°06'	3/30/49	5/9/49	0 - 158' Slate & Graywacke 158' - 206' Soft Ore Jasper 206' - 265' Interbedded Slate 265' - 301' Hard Blue Jasper 301' - 304' Slate 304' - 431' Hard Blue Jasper 431' - 621' Soft Ore Jasper 621' - 624' Dike 624' - 717' Soft Ore Jasper 717' - 718' Dike 718' - 749' Soft Ore Jasper	749'
62	6th Level (2200') #7 Cross-cut	S.52°53'E	+1°36'	5/14/49	6/3/49	0 - 11' Ore 11' - 19' Soft Ore Jasper 19' - 38' Lean Ore 38' - 44' Soft Ore Jasper 44' - 215' Slate 215' - 271' Transition Slate & Jasper 271' - 274' Dike #8 274' - 310' Transition Slate & Jasper 310' - 323' 1st Class Ore 323' - 327' Soft Ore Jasper 327' - 329' Dike 329' - 424' Soft Ore Jasper	424'

MATHER MINE "A" SHAFT EXPLORATION
YEAR 1949

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL	FINISHED DEPTH
63	6th Level (2200') #5 Cross-cut	Due South	-90°	11/25/49	12/13/49	0 - 70' 1st Class Ore 70' - 100' Slaty Lean Ore 100' - 126' Slate 130' - 155' 1st Class Ore 155' - 172' Slate	172'
64	6th Level (2200') #5 Cross-cut	Due South	-60°	12/15/49	12/21/49	0 - 118' 1st Class Ore	118'

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9. EXPLORATIONS AND FUTURE EXPLORATIONS: (Continued)

6TH LEVEL ("B" SHAFT):

An extensive diamond drilling program was started on the "B" Shaft side of the line as soon as the drifting crew had advanced sufficiently beyond the first cut-out. Hole #1 was started late in June and the program continued throughout the balance of the year, with two machines on a two shift schedule whenever possible. In all, seven holes were drilled to distances varying from 312' to 535'.

Holes #1 and #7

Hole #1 was drilled approximately 16° west of due south at a +9° dip from a cut-out a few feet east of the line. Later #7 was drilled almost due south from the same location, but at a +2° dip. Hole #1 failed in the attempt to explore the structure between the top of the interbedded slate and the Cambria fault, since the fault was encountered while still in footwall material on the east side. Accordingly, #7 was planned to explore the structure to the east. 125' of very high grade, low sulphur ore were encountered between the footwall contact and the fault contact, with a short unimportant run beyond the fault. The information gained in this area indicates an important deposit available to the "A" Shaft operation, in spite of the fact that it is immediately east of the boundary line. As soon as the "B" Shaft connection is completed, this ore will be further explored by drifting and raising preparatory to mining it for "A" Shaft. This deposit could very well be an important addition to the "A" Shaft reserves which is badly needed to keep up production during the development of the 7th and 8th Levels. It is entirely possible that this deposit will continue upward to the 5th Level and above, where additional exploration will be carried on in 1950.

Holes #2, #3, #4, #5 and #6

In general, these holes outlined the area from Coordinate 9700 W. (600' east of the "B" line) to Coordinate 8800 W. (1500' east of the "B" line), with very disappointing results as far as concerns mineable reserves above the level. Hole #2 at 9700 W. was a complete blank, including the interbedded horizon, which was unenriched jasper.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS: (Continued)

6TH LEVEL ("B" SHAFT) (Continued)

Holes #2, #3, #4, #5 and #6 (Continued)

Hole #3 at 9400 W. disclosed 40' of high sulphur ore in the interbedded horizon. In the main horizon, a 50' run of Standard ore was encountered, flanked on both the north and south by mixed lean ore and jasper. This hole could be important for 7th and 8th Level mining, but certainly has no value as far as the 6th Level is concerned. Hole #5 was drilled to the south from the same location as #3, but at a dip of +45°. Approximately 65' above the level, the interbedded had narrowed to 6', with the sulphur at this point almost 2%. The dip apparently was too steep to encounter anything of importance in the main horizon, although there was one short run of ore almost 200' above the level. In this area, also, the sulphur was disappointingly high.

Hole #4 at 9100 W. cut 16' of Standard ore in the interbedded horizon and nothing in the main formation. This was the longest hole in the series, being continued to 535', where it was stopped in unenriched jasper.

Hole #6 at 8800 W. encountered no ore in the interbedded horizon and was practically blank except for 7' of Standard ore in the main formation.

The disappointing results in this area were not too surprising in view of the information originally obtained in Surface Hole #144. There is, however, a strong indication that the 6th Level is in a high sulphur area, which suspicion has been definitely proved at this writing in Holes #8, #9, #10, #11 and #12. Further to the east, very large deposits were encountered in the main formation, but with sulphur at times in excess of 2%, particularly at height above the level. This information indicates an abrupt change in the original plan for any large immediate production from the level, since appreciable tonnages of the material available cannot be mined without a large production of low sulphur ore from other levels to mix with it. This indicates the necessity for not only pushing the development of the 7th Level, but for the starting of the 8th Level as rapidly as possible.

Future exploration on this level will be largely limited to completing the information in the area west of the shaft pillar, both as to the extent of the deposit and the sulphur content.

MATHER MINE "B" SHAFT EXPLORATION
YEAR 1949

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL	FINISHED DEPTH
1	6th Level (2200')	S.15°59'W	+9°47'	6/15/49	6/25/49	0 - 105' Transition Slate & Jasper 105' - 135' Soft Ore Jasper 135' - 161' Dike 161' - 172' Soft Ore Jasper 172' - 225' Transition Slate & Jasper 225' - 251' Transition Jasper & Slate 251' - 257' Soft Ore Jasper 257' - 260' Lean Ore 260' - 270' 1st Class Ore 270' - 277' Lean Ore 277' - 282' 1st Class Ore 282' - 308' Soft Ore Jasper 308' - 310' Dike 310' - 398' Soft Ore Jasper	398'
2	6th Level (2200')	S.00°27'W	+2°55'	7/14/49	8/9/49	0 - 93' Slate 93' - 95' Lean Ore 95' - 127' Slate 127' - 155' Soft Ore Jasper 155' - 303' Slate 303' - 339' Soft Ore Jasper 339' - 349' Slate 349' - 408' Soft Ore Jasper	408'
3	6th Level (2200')	S.1°13'W	+2°40'	7/15/49	8/18/49	0 - 156' Slate 156' - 161' High Sulphur Ore 161' - 168' Lean High Sulphur Ore 168' - 172' High Sulphur Ore 172' - 173' Slate 173' - 194' High Sulphur Ore 194' - 235' Slate 235' - 253' 1st Class Ore 253' - 263' Lean Ore 263' - 273' 1st Class Ore 273' - 288' Lean Ore 288' - 340' 1st Class Ore 340' - 343' Soft Ore Jasper 343' - 369' Lean Ore 369' - 378' Soft Ore Jasper 378' - 400' Lean Ore 400' - 415' Soft Ore Jasper	460'

(Continued)

MATHER MINE "B" SHAFT EXPLORATION
YEAR 1949

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL	FINISHED DEPTH
3 (Continued)						415' - 420' Lean Ore 420' - 427' Soft Ore Jasper 427' - 448' Lean Ore 448' - 460' Soft Ore Jasper	
4	6th Level (2200')	S.00°13'E	+1°57'	8/11/49	9/6/49	0 - 119' Slate 119' - 135' 1st Class Ore 135' - 164' Slate 164' - 167' Lean Ore 167' - 178' Slate 178' - 187' Lean Ore 187' - 222' Slate 222' - 285' Soft Ore Jasper 285' - 325' Lean Ore 325' - 420' Soft Ore Jasper 420' - 433' Lean Ore 433' - 535' Soft Ore Jasper	535'
5	6th Level (2200')	S.00°31'W	+45°32'	8/24/49	9/18/49	0 - 88' Slate 88' - 94' High Sulphur Ore 94' - 127' Slate 127' - 135' Soft Ore Jasper 135' - 143' Slate 143' - 223' Soft Ore Jasper 223' - 243' Lean High Sulphur Ore 243' - 253' Soft Ore Jasper 253' - 258' Lean High Sulphur Ore 258' - 263' High Sulphur Ore 263' - 269' Lean High Sulphur Ore 269' - 312' Soft Ore Jasper	312'

MATHER MINE "B" SHAFT EXPLORATION
YEAR 1949

NO.	LOCATION	DIRECTION	DIP	DATE STARTED	DATE FINISHED	MATERIAL	FINISHED DEPTH
6	6th Level (2200')	S.00°32'E	+2°	9/8/49	9/29/49	0 - 192' Slate 192' - 195' Dike 195' - 260' Slate 260' - 289' Soft Ore Jasper 289' - 296' 1st Class Ore 296' - 298' Lean Ore 298' - 499' Soft Ore Jasper	499'
7	6th Level (2200')	S.00°03'W	+2°	9/13/49	9/28/49	0 - 75' Slate 75' - 200' 1st Class Ore 200' - 220' Dike 220' - 345' Soft Ore Jasper 345' - 362' 1st Class Ore 362' - 366' Lean Ore	366'

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10. TAXES:

Taxes for both Section 2 ("A" Shaft) and Section 1 ("B" Shaft) were taken up on the "A" Shaft operating cost sheet. The valuations of Section 2, both real and personal, were substantially increased in the amount of $1,000,000. The rate in Ishpeming, however, decreased from $39.73 to $37.30 per thousand.

The increase in the valuation of Section 1 was nominal, but the tax rate was increased in the City of Negaunee from $44.76 to $52.89 per thousand.

	1949			1948		
	VALUATION	RATE	TAXES	VALUATION	RATE	TAXES
Section 2, 47-27, except the N 600' of NE of NE and the Rights of Way						
Real	$2,640,000		$ 98,475.70	$2,125,000		$ 84,435.60
Personal	1,660,000		61,920.32	1,175,000		46,687.92
Total	$4,300,000	$37.3014	$160,396.02	$3,300,000	$39.7344	$131,123.52
Coll. Fee	-	-	-	-	-	-
Total	$4,300,000	$37.3014	$160,396.02	$3,300,000	$39.7344	$131,123.52
Mather Mine Pipe Line, parcel in Section 3, 47-27	$ 650	$37.3014	$ 24.25	$ 250	$39.7344	$ 9.93
Total Mather Mine "A" Shaft (Sec.2, City of Ishpeming)	$4,300,650	$37.3014	$160,420.27	$3,300,250	$39.7344	$131,133.45
Jackson, Sec.1, 47-27						
Real	$ 605,000		$ 31,680.40	$ 550,000		$ 24,373.42
Personal	150,000		7,854.65	145,000		6,425.72
Total	$ 755,000	$52.3643	$ 39,535.05	$ 695,000	$44.3153	$ 30,799.14
Coll. Fee 1%	"	.5236	395.35	"	.4432	307.99
Total Mather Mine "B" Shaft (Sec.1, City of Negaunee)	$ 755,000	$52.8879	$ 39,930.40	$ 695,000	$44.7585	$ 31,107.13
GRAND TOTAL	$5,055,650		$200,350.67	$3,995,250		$162,240.58

	1949		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Operating	$175,300.67	$0.165	$0.173
Idle	25,050.00	0.024	0.024
Total	$200,350.67	$0.189	$0.197

	1948		
	TAXES	PER TON PRODUCED	PER TON SHIPPED
Total	$162,240.58	$0.162	$0.164

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11. ACCIDENTS AND PERSONAL INJURY

There were 28 compensible injuries during the year, which occasioned lost time of 1,047 days. There were also 51 non-compensible injuries, which added 105 days lost time, for a grand total of 1,152. This resulted in a severity rate of .896 days lost per thousand man hours, and a frequency rate of 61.44 injuries per million man hours, compared with company averages for underground mines of 2.031 and 58.43. The total hours worked were 1,285,830-3/4 as compared with 1,319,265-1/4, a decrease of approximately 2%. The following is a brief summary of the compensible accidents:

DATE	NAME	NATURE OF INJURY
1/22/49	George Korpi	Minor cut on the top of right foot.
1/28/49	Fred Vizena	Severe laceration of left ankle.
1/31/49	Angelo Moretti	Contusion of right leg below knee, with a complication of thrombosis of varicose veins.
2/1/49	Robert Drake	Contusion of right knee, with resulting bursitis.
2/25/49	James King	Uncomplicated fracture of the left os-calcis, without any displacement.
3/2/49	Domenico Andriacchi	Severe compound fracture of left wrist, complicated with a severe laceration, puncture wounds and a severed artery.
3/28/49	Toivo Lahde	Severe abrasion in the lower part of right leg, with hematoma below the abrasion.
4/4/49	Richard Stetson	Contusion of left foot and ankle.
4/8/49	Stanley Fredrickson	Distal 1/4" of left index finger excised by trauma.
4/11/49	Clifford Nelson	Puncture wound of right foot.
4/16/49	Rocco Meni	Multiple foreign bodies face and eyes.
4/21/49	William Thompson	Strain of the left wrist.
4/28/49	Henry Makela	Contusion and sprain of right ankle.
4/29/49	John Treloar	Severe laceration of the tip of right index finger with loss of the nail.
5/11/49	Walter Lakari	Laceration and bruise of left thumb.
5/24/49	Onnie Kostamo	Laceration of the tip of left thumb.
6/8/49	John Mattonen	Severe crushing wound and lacerations of several fingers, right hand, without amputation.
6/11/49	John Steve	Minor sprain right knee.
6/21/49	Chester Bignall	Lacerated right thumb.
8/3/49	Eino Koskela	Minor contusion left foot.
8/9/49	Charles Jordan	Minor lacerations of the face, ear and scalp.
8/22/49	Arne Andelin	Amputation of the tip of the 4th finger right hand.
8/26/49	Arne Luoma	Laceration of the index finger left hand.
9/6/49	Axel Pelto	Bruised left leg and foot.
9/23/49	Clarence Colombe	Contusion left leg above knee.
9/27/49	Arthur Parkonen	Contusion, left hand. No fracture.
12/8/49	William Kyrola	Dislocation of right shoulder.
12/14/49	Henry Pekkola	Fracture, compound, radius left proximal end. Mild wound upper left arm.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

The major items of new construction were the extensions to the permanent stocking trestles and the enlarging of the stocking areas, which have already been discussed.

The only new construction planned for 1950 is the completion by the railroad company of the new tracks serving the new stocking area.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

The only new items of equipment of any importance purchased for surface were:

(1) A used 20-ton Euclid truck transferred from the Mesaba Range at a total cost, including freight, of $6,342.08.

(2) A Willys Jeep Four Wheel Drive pick-up truck at a cost of $2,114.84.

(3) An Ingersoll-Rand "SF-27" drill steel heating furnace.

(4) A spare armature for the motor generator set and hoist motors in the engine house.

There is, however, a large amount of new equipment proposed for the surface plant in 1950. Some of the more important items are the three new larry cars for stocking and the feeder, screen and crusher for the headframe, which were on order by the end of the year. Proposed equipment to be ordered early in 1950 are three 8-ton locomotives for the larry cars, three skips of a new bottom dump design and a new "Caterpillar" D8 tractor.

The important items of underground equipment were the Eimco Model 40 loader, the three combination trolley and battery locomotives already mentioned, a Joy 3-machine Hydro-Jib, two 125 H.P. RF-211 Joy hoists and a small amount of miscellaneous equipment, such as, scraper hoists and drill machines.

The important pieces of proposed equipment for underground are the pan feeder, screen, crusher and 30" conveyor belt, the authorization for which had not been approved by the end of the year.

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14. MAINTENANCE AND REPAIRS:

The largest unusual repair and maintenance job during the year was the complete overhauling of the skip hoist motor generator set and the installation of the spare generator rotor. The large drive motor was taken out, thoroughly overhauled, cleaned and painted, as were the stators of both generators and the rotor of the north generator. The rotor of the south generator was replaced with the new spare and it in turn was overhauled and stored as a spare.

The rebuilding of the north railroad pocket was continued intermittently and nearly completed by the end of the year.

The three top tram larry cars required the usual constant maintenance and repairs. In general, it was possible to keep two of the three units in operating condition. However, at times it was necessary to truck part of the production, since only one car was in operation. By the end of the year, the newly designed larry cars were on order and, at this writing, the locomotives have also been ordered from the Westinghouse Electric Company.

15. POWER:

	CONSUMPTION K.W. HOURS	AVERAGE MAX.DEMAND	AVERAGE DEM. FACTOR	COST OF CURRENT	AVERAGE PRICE PER K.W. HOUR
1949 -	11,384,000	2,460 K.W.	53.5%	$171,034.60	$0.0150
1948 -	11,217,000	2,355	54	155,508.80	.0139
1947 -	10,059,000	2,160	53	140,078.60	.0139
1946 -	5,570,000	1,530	48	80,677.20	.0144
1945 -	4,720,000	1,245	43	69,566.20	.0148
1944 -	3,893,000	965	46	56,121.80	.0144
1943 -	2,785,000	600	48	39,725.80	.0142
1942 -	1,510,830	325	47	23,448.14	.0155

The total consumption of electric power was almost the same as for the previous year, due to the reduced working schedule and the time lost during the six weeks strike. The idle period had the effect of reducing the average demand factor. The average rate per kilowatt hour increased due to a general power rate increase, which was effective on July 1st.

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16. WATER SUPPLY:

	CONSUMPTION	COST	COST PER THOUSAND GAL.
1949 -	16,013,100	$1,993.74	$0.124
1948 -	20,068,100	1,662.64	.082
1947 -	17,241,600	1,436.52	.083
1946 -	10,620,100	928.41	.086
1945 -	7,628,800	710.71	.093
1944 -	5,205,200	481.82	.092
1943 -	4,868,000	446.64	.092
1942 -	2,487,000	231.36	.093

There was a substantial decrease in the consumption of City water, due partially to the six weeks strike, but to a greater extent to the use of water obtained from #1 Well for sprinkling the lawns and flower gardens. However, an increase of 50% in the water rate increased the amount expended substantially.

The amount of underground water available for use in the mine was adequate, all of it being obtained from the 960' Level. Piping from surface to this level was completed, although it was not necessary to use it during the year. This piping, however, serves as a fire standby in case of an insufficient supply on the 960' Level.

18. NATIONALITY OF EMPLOYEES:

	American Born	Per Cent	Foreign Born	Per Cent	Total	Per Cent
American	16	2.3%	-	-	16	2.3%
English	88	12.7	15	2.2	103	14.9
Finnish	253	36.5	42	6.1	295	42.6
Canadian	24	3.5	1	.1	25	3.6
Swedish	66	9.5	5	.7	71	10.2
Norwegian	20	2.9	-	-	20	2.9
German	17	2.5	2	.3	19	2.8
Irish	9	1.3	-	-	9	1.3
Danish	1	.1	-	-	1	.1
Italian	49	7.2	16	2.3	65	9.5
French	46	6.6	-	-	46	6.6
Manx	1	.1	-	-	1	.1
Dutch	3	.4	-	-	3	.4
Austrian	10	1.4	2	.3	12	1.7
Polish	4	.6	-	-	4	.6
Belgian	3	.4	-	-	3	.4
	610	88.0%	83	12.0%	693	100.0%

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1. GENERAL

Production from the Morris Mine of 256,245 tons showed a considerable decrease from the 348,633 tons out put of the year before. Part of this was due to a reduction of the working schedule from 5½ to 5 days per week and the six weeks strike, and the remainder to less favorable mining opportunities which reduced the average tons per man per day from 8.10 in 1948 to 6.48 in 1949. Shipments about kept pace with production in each of the last two years.

The single Morris Grade, a combination of the former standard and silica grades, was hoisted in 1949 with an average iron content of over 56% and a silica of 12.09%. Both these averages showed some improvement over the year before. The ore reserve position of better than 4,000,000 tons was more than maintained by finding 294,354 tons while mining 256,245 tons, most of this however being developed on Chase Lease #24 while the Fee Land reserves showed a small decrease beyond the tonnage mined, due to eliminating an area where the ore was mixed with dikes at the southwest end of #33 deposit, above the 9th Level.

Good progress continued by the surface deep well pumping in reducing the average water level above ledge until the heavy rainfalls started in July. Then for the last six months the trend reversed, due to the unusually heavy precipitation, and the underground pumping rate also showed a considerable increase due probably to a new (No.3) surface cave from the 1076.6 average gpm of 1948 to 1192.3 gpm in 1949. The heavy charges accompanying this pumping only point to the fact that Morris Mine ore production must be kept at levels above that of 1949 for proportionate absorption of these costs in relation to other mines in the district. The Inland engineering staff in cooperation with the U.S.G.S. ground water control experts were also considering the costs and advisability of drilling a new row of small diameter deep wells to intercept the surface water before it reached points over the ore bodies, and a decision on this program will probably be forthcoming in the spring of 1950. The mine water discharge settling pond continued in good use together with the diversion ditch which in 1948 transferred this water north directly to the Deer Lake Storage basin instead of into the Carp River.

Announcement was made shortly before the end of the year that R. W. Edwards, Superintendent of the Greenwood Mine, would replace E. W. Whitman as Superintendent of the Morris Mine on January 1st, 1950, with Whitman transferring to the Greenwood in Edwards' place.

2. PRODUCTION SHIPMENTS & INVENTORIES

a. Production

	Grade	Tons
1949	Morris	256,245
Total 1948	"	348,633

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

The 1949 production came from fee and leased lands in the following proportions:

Grade	Fee	Lease	Total
Morris	82,333	173,912	256,245
Percentage	32.2%	67.8%	100%

The percentage of ore from the fee lands compares with 26% in 1948. The maximum proportion of ore from the fee lands was 48.1% in 1936 and the minimum 11.4% in 1941.

A summary of fee and lease total production since Inland acquired the Morris Mine lease, starting with 1933 or over a 17 year period, is listed below:

	Tons	Percent
Lease ore produced 1933-1949	3,722,903	74.79%
Fee ore produced 1933-1949	1,255,115	25.21%
Total	4,978,018	100.00%

b. Shipments

Shipments from the Morris Mine reached a high of 442,199 tons in 1943. The nearest attainment of this figure was made last year with 347,134 tons, and this then dropped off to 256,749 tons which was divided as follows:

Grade	Pocket	Stockpile	Total
Morris	149,781	106,968	256,749

Grade	Fee	Lease	Total
Morris	81,350	175,399	256,749

A table showing shipments in each of the past five years follows:

Year	Grade		Total
1949	Morris		256,749
1948	"		347,134
1947	"		278,916
	Standard	Silicious	
1946	142,157	39,850	182,007
1946	175,688	69,480	245,168

Total shipments since Inland acquired lease in 1933 4,951,461

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

c. Ore in Stock

Grade	Tons
Morris	26,556

d. Production by Months

	Days Worked	Average Number of Men	Morris Grade Tons	Tons per man Per Day
January	23	161	20,592	5.80
February	22	166	22,496	6.44
March	25	170	22,340	5.57
April	23½	173	24,996	6.63
May	21	174	25,859	7.40
June	22	174	25,716	7.10
July	20	177	19,894	6.11
August	23	180	26,472	7.24
September	21	175	24,263	7.06
October	Strike			
November	12	169	11,198	5.66
December	21	176	21,908	6.29
Average	21	172		6.48
12 months production			245,735	
Current year overrun			10,510	
Total 1949 production			256,245	

The above tons per man per day compares with 8.10 in 1948. The decreased efficiency is due almost entirely to the loss of two sub level stopes on Chase Lease #9, dilution through caving requiring the change to sub level caving late that year.

The working schedule of 2 shifts 5-1/2 days per week continued from September 1, 1945 to May 1, 1949 when, in company with other Inland ore properties, the Morris Mine operating schedule was reduced to the normal 5 day or 40 hour week.

f. Delays

Aside from the 6 weeks strike, no operating or production delays were reported in 1949. The loss of production resulting from the strike may be estimated at from 35,000 to 40,000 tons, and this was of particular importance at the Morris Mine from the per ton pumping cost standpoint.

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3. ANALYSIS

The analysis of ore shipped by the Inland Steel Company from the Morris Mine in 1949 was as follows:

Shipments

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Sul.	Moist
Morris								
Dry	256,749	56.11	.089	12.09	.57	2.98	.017	11.41
Natural		49.708	.079	10.71	.50	2.64	.015	11.41

The C.C.I. laboratory on a weighted composite sample of Inland powders ran the remarkably close check of 56.10 iron dry, although the silica was somewhat higher at 12.48% compared to Inland's 12.09. Numbered cargoes were also checked during the year in confirmation of Inland's royalty payments.

Ore in Stock (Natural Analysis)

Grade	Tons	Iron	Phos.	Sil.	Mang.	Moist.
Morris	26,556	49.19	.076	12.50	.36	11.25

Ore Reserves - Expected Natural Analysis

	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Sul.	Moist.
Morris	3,628,893	49.40	.076	10.65	.47	2.80	.013	11.70
Morris Hi-Sulphur	482,242	52.17	.095	7.25	.40	2.27	.400	10.50

The expected iron content of the standard ore reserve was again decreased below that shown last year. The iron was reduced from 50% to 49.40 and the silica increased from 10.50% to 10.65%. It must again be pointed out, however, that the ore in place is expected to run about 8% silica and that if dilution occurs to the extent of the above indicated analysis, then the mineable reserve should be increased some 25% over and above the estimated reserve.

4. ESTIMATE OF ORE RESERVES

Exploration and development in 1949 added 294,354 tons to the engineers estimate after allowance for ore mined during the year. This addition to the ore reserves was made during the period from the 1st of January to the 1st of October, the new estimate date under the revised Michigan statutes, and was very close to the figure of approximately 286,000 tons which had been added by development during the year 1948.

Development on Chase Lease #24 accounted for a very high proportion of the 294,354 tons gained and most of this was of high sulphur grade in #79 deposit above the 9th Level, where development by #10 contract extended the length of the ore body east and west along the strike. Exploration in 1949 also

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4. ESTIMATE OF RESERVES (Cont.)

revealed the phenomenal width of about 200' near the center of this deposit on the -280' sub which is a distance of about 50' above the 9th Level. A smaller increase was shown in several portions of #33 deposit on Chase Lease #9. The latter was partially offset by the 27,423 ton decrease on the Fee Lands, most of which was accounted for by elimination from the estimate of the area mined in 1949 by #16 contract southeast of the triple boundary corner in #33 deposit because of inability to maintain grade due to the many intrusive dikes cutting this area. The summary of reserve ore estimate for the year 1949, and taking into account the fact that the engineering estimate date has been changed to October 1st, is shown in the following table:

Description	Estimate 12-31-48	Production 1-1-49 to 10-1-49	Estimate Deducting Product	Actual Estimate 10-1-49	Inc. or Dec. from 1948 Est.
Chase Lease #26	26,140	-	26,140	26,140	None
Chase Lease #25	33,273	-	33,273	33,273	"
Chase Lease #24	237,132	28,993	208,139	216,696	8,557
Chase Lease #24, Hi-S.	236,726	23,708	213,018	442,721	229,703
Chase Lease #9	2,238,788	97,801	2,140,987	2,224,504	83,517
Total Chase Leases	2,772,059	150,502	2,621,557	2,943,334	321,777
C.C.I.Co.Lands	1,228,104	72,401	1,155,703	1,128,280	27,423
C.C.I.Co.Lands,Hi-S.	39,521	-	39,521	39,521	-
Total C.C.I.Lands	1,267,625	72,401	1,195,224	1,167,801	27,423
GRAND TOTAL	4,039,684	222,903	3,816,781	4,111,135	294,354

5. LABOR & WAGES

The Morris Mine, together with all other iron ore operations in the Lake Superior Region, was closed by a strike October 1st of the United Steelworkers of America-CIO in support of increased insurance and hospitalization benefits together with the added demand for non-contributory pensions. The mine was idle from October 1st with production resumed on November 14th following settlement of the issues in dispute on November 12th. This settlement, again on an industry wide pattern, included non-contributory pension coverage for all workers having 15 or more years of service but provided for continuation of the policy of contributory group, life and hospitalization insurance, although the Inland insurance plan was changed to cover the employee only, with the option of the employee covering his dependents at his own expense.

The working force at the mine in 1949 showed an increase to an average of 172 men compared with 158 hourly rated employees in the previous year. It must again be pointed out that starting in 1947 the reporting of employees was changed to exclude all salaried personnel such as engineers, supervisors, captain and office force. This, of course, places the Morris Mine on a different basis than the other properties in the district with respect to comparison of the monthly tons per man figures.

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6. SURFACE

Very few changes were made to the surface plant in 1949, the principal improvement being listed as a change-over in surface piping which relieved the septic tank of the burden of the dry building, shower and washing water, reservoir tank overflow, and compressor cooling water by diverting these discharges directly to the settling basin. This provided a better bacteria action within the septic tank for the reduced amount of inflow to this tank.

A new rock trestle was erected providing additional dumping area for rock southwest of the shaft and the top tram car barn was completely dismantled and rebuilt from the ground up.

Surface Pumping

The water pumping from the surface sand and gravel above ledge, with the intent of reducing the water table over the ore bodies, averaged 1642 gpm in 1947, 1847 gpm in 1948 and 1511 gpm in 1949. The reduced pumping rate in 1949 was accounted for mainly by the repeated shutdown of the #10 well late in June with the intent of again studying its effectiveness in holding down the water table above ledge over the southwest portion of the area above the main ore bodies. The #10 well was down from June until the first of December when pumping was again resumed at a rate of 500 gpm.

The heavy rainfalls during the last six months of the year, combined with the shutdown of the #10 well, reversed the trend of the water table during the period from August to November inclusive when the level increased 1.2'. Upon the resumption of pumping in the #10 well, the water table for that month again showed a decline of .4 of a foot and this combined with the down trend in the first seven months of the year to show a net reduction for the year 1949 of 2.3' in the water table over the ore bodies. The following comparison shows the pumping rates in effect at the several wells at the beginning and end of 1949

Well Number	G.P.M. December 1948	G.P.M. December 1949
1	320	205
2	50	Down
3	80	82
3A	327	322
5	225	177
8	300	275
9	92	74
10	530	540
Average total	1924	1675

The month by month picture of the pumping and its effect on the water level is shown by the following tabulation:

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6. SURFACE (Cont.)

Month	GPM SURFACE PUMPING	Drop in Test Holes Feet
January	1899	0.6
February	1858	0.3
March	1818	0.9
April	1721	0.4
May	1729	0.4
June	1382	0.0
July	1180	0.6
August	1172	0.3
September	1237	0.3
October	1252	0.3
November	1212	0.4
December	1677	0.4
Average 1949	1511	0.2
Total 1949		2.3
Average 1948	1847	0.4
Total 1948		5.1

The average total drop in the surface material above ledge from the time pumping began April 25, 1937 to December 22, 1949 amounted to 39.8' as shown by the following readings at the test holes:

Test Hole	Drop 8-25-37 to 12-22-49	Depth Remaining to Ledge
501	67.0	26.1
503	86.4	113.4
504	64.5	84.6
505	62.9	67.3
506	58.6	28.7
507	(123.3)	
508	(60.4)	(72.7)
509	85.5	101.2
510	34.8	88.5
511	33.3	121.1
512	53.2	108.5
514	29.6	96.6
515	17.9	110.7
516	(36.1)	
517	23.2	88.9
518	38.7	69.7
519	54.6	102.9
520	(42.5)	
521	(28.5)	
522	26.0	80.0
523	(36.5)	

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6. SURFACE (Cont.)

Test Hole	Drop 8-25-37 to 12-22-49	Depth Remaining to Ledge
524	81.7	18.0
526	15.9	98.1
527	30.5	44.5
528	(1.7)	(101.2)
531	6.1	70.4
532	(5.8)	(78.2)
533	18.2	113.8
534	1.7	95.6
Peronto well	(9.4)	
Total	834.9	1728.6
Avg. drop to 12-22-49	39.8	82.3

The operating expenses in connection with surface pumping amounted to $14,733.00 compared to $19,137.00 in 1948 and $16,612.00 in 1947. The decrease is accounted for by the reduced power charge during the four month period when the #10 well was not operated. The following comparison however, brings out the fact that although the operating expense decreased from 1948 to 1949 this was more than off-set by the reduced ore production with the result that the surface pumping cost per ton of ore produced increased from $ .055 in 1948 to $ .057 in 1949.

	1948	1949
Average surface well pumping rate	1847 gpm	1511 gpm
Operating expenditures	$ 19,137.00	$ 14,733.00
Cost per ton of ore produced	$ .055	$ .057

7. UNDERGROUND

a. Pumping

The initial Morris surface cave occurred in March, 1939 and the following year the water entering the mine reached a high of 1157 gpm. Since 1940 the average has varied from a low of 844 gpm to 1077 gpm in 1948 but a new high was established in 1949 when the total rose to 1192.3 gpm.

Combined with the gradual extension of underground workings which tapped additional sources of water in the country rock in 1949 was the new surface cave which occurred in March. This new cave came through to surface near the original Morris Mine cave with only a thin ridge of ground separating the two. Its location was roughly over the center of #33 deposit workings projected northwest on the inclination of the footwall, and the new cave immediately lowered the water level in the original cave so at the end of March standing water was observed only in the Nos. 2 and 3 caves.

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7. UNDERGROUND (Cont.)

a. Pumping (Cont.)

The year 1949 showed a nearly steady increase in the average quantity of water handled from 1071 gpm in January to 1210 gpm in April following the surface cave and to 1224.6 gpm in December. The average quantities by levels are shown in the following table with comparisons during the past five year period:

Average Year	LEVELS 4th	6th	7th	8th	9th	Total
1945	158.4	42.8	146.1	244.0	266.2	857.9
1946	147.3	44.1	153.4	254.9	278.8	888.4
1947	149.9	34.7	144.7	287.3	352.8	969.4
1948	140.5	25.1	122.2	274.3	514.5	1076.6
1949	95.0	24.5	88.6	316.4	667.8	1192.3

The increased quantity of water pumped and the increased power cost for pumping the increased quantities, particularly from lower levels, combined to raise the underground pumping expense to a new high of $93,782.00. This record high pumping cost, together with the decreased ore production in 1949 had the effect of literally jumping the total pumping cost from $ .265 per ton in 1948 to $ .423 per ton in 1949. The last named figure, with the possible exception of the pumping cost at the Vicar Mine in Wakefield, seems to leave little room for argument that it must be the highest per ton pumping charge for iron mines in Upper Michigan or Wisconsin. The comparison of pumping costs for the five year period is shown in the following table:

Year	Surface Pumping Optg. Expense	Underground Optg. Expense	Total Pumping Optg. Expense	Cost per ton Ore Produced
1949	$ 14,733	$ 93,782	$ 108,515	$ .423
1948	19,137	73,168	92,305	.265
1947	16,612	65,862	82,474	.308
1946	13,960	46,143	60,103	.324
1945	22,105	61,036	83,141	.349

b. Development

Underground development carried over from 1948 with an average of four contracts in several sections of the mine but in 1949 was centered mainly in the west portion of the workings from the 7th to the 9th Levels. This underground development in general added to the program that was begun in 1945 with the opening of the 9th Level. Together with this development, one hole was drilled on the 9th Level in a northwesterly direction from No. 1 cross-cut and although the hole was unsuccessful in locating ore, the later extension of No. 2 cross-cut proved the downward extension of #87A ore body, which in fact may join with and actually turnout to be the westward extension of #84 ore body on the Fee Lands.

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7. UNDERGROUND

b. Development (Cont.)

The development, however, that was most important in adding to existing ore reserves was that by #10 contract in #79 deposit above the 9th Level and by #8 contract on the 9th Level in adding both to the length and width of this higher sulphur deposit. In fact the exploratory small drifts driven by #10 contract on the -280' sub showed a north-south width of this deposit of about 200', which is considerably in excess of the expected width based on prior exploration and outline of this deposit on sub levels above. In contrast to this success in adding to ore reserves on Chase Lease #24 was the disappointing development above the east end of the 8th Level, where development by #1 contract was intended to open a new stope at the east end of #76 deposit, which for years has been left unmined because of the large volumes of water encountered in prior development in this area. Development by #1 contract consisted of driving a transfer and water branch raise on the -100' sub level a short distance above the 8th Level plus manway and mining raises extending a distance of 100' above to the 0' sub. The ore body was found to narrow in size a short distance above the transfer with the result it will not be mined through to the 7th Level as first intended.

A third important development in 1949 was continued as part of the "insurance" water control project and consisted initially of a double compartment raise in rock inclining north on the 3200 W. coordinate from the 8th Level footwall drift. The raise was advanced to the 7th Level elevation and continued single compartment above about 45' with the objective of holing out finally on the +220' sub under another raise which extends from that point to the 6th Level. Simultaneously at the year end a connection was being driven to the 7th Level drift in the vicinity of the formerly mined #62 deposit, and all of this with the purpose of providing a raise through which material may be hoisted from the 8th Level to the 7th and 6th Levels with the final object of constructing new secondary concrete dams on those levels against any possible run from the Barnes Hecker property. These secondary dams when constructed will provide another opportunity for re-entry of the old workings east of the 3600 W. coordinate line and with the expectation of recovering some additional tonnage of ore from several uncompleted stopes above the 8th Level. It should be pointed out there is no indication of failure in the existing 6th Level dam but it was decided that the proposed additional protection would be good insurance.

Several other developments of perhaps lesser importance were the exploration and resulting eastward and upward extension of #79 deposit late in the year by #4 contract, who extended the old transfer drift on the -240' sub 80' east of #940 raise followed by the driving of the first 22' of the proposed stope raise to the 8th Level. The work early in 1950 will consist of advancing a branch inclined stope raise into the east ends of the two limbs of the ore body as indicated on the 8th Level estimate outline. The raise work, however, was suspended at the end of the year pending exploratory development on the 8th Level designed to prove or disprove the theoretical outline at that elevation. Also in connection with the establishment of the downward continuity

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7. UNDERGROUND

b. Development (Cont.)

of #87A deposit below the 8th Level was the development near the east end of #33 ore body on the -220' sub where an exploratory dog drift was driven southeast 85' through the dike which limits #33 deposit, and into 45' of ore in #87A deposit directly above the development already described at the 9th Level elevation in this area. Also at the -220' sub elevation were the drift and raise connections by #13 and #8 contracts to provide for the completion of mining under the former open stope in #75C deposit, where it was necessary to convert to sub level caving because of falls from the back with consequent dilution of the product. This development provided for the mining of the ore under the open stope and served the multiple purpose of providing ventilation, access for men and materials and proved up the estimated outline of the eastward extension of #75C deposit at this elevation. The third development in this central area was started to provide a new working place and to salvage an old ore body and consisted first of advancing a transfer drift east from the top of an unnumbered raise up from the 8th Level footwall drift to the -30' sub near the 1900 W. coordinate line. The drift was driven 75' east of the raise through a lean ore mixture and at this point a single compartment raise was underway to the 7th Level ore body at the end of the year. The raise entered ore immediately above the back of the drift and this, in Company with the proposed re-entry of #1 contract in #76 deposit, is known as an extremely wet ore body so that this first raise will probably serve only as a water tapper. A second companion raise above or near the raise from the 8th Level will undoubtedly be needed for mining.

Another development of consequence was the installation of a connecting scraper trench at the 9th Level shaft pocket which was under construction at the end of the year. This trench is intended to receive wet dirt from which it is hoped a good part of the water may be siphoned. A second and more important gain (as has been proved at our Maas Mine 6th Level) will be realized by enabling the trammers to quickly dump a train of wet ore and return to the mining areas rather than waiting to dump the wet cars, skip by skip.

c. Stoping

Mining operations continued on Chase Lease #24, Chase Lease #9 and the Fee Lands to the south and east. The vertical extent of mining in 1949 ranged from the -50' sub in the west portion of the property on Chase Lease #24 downward to the -290' sub a short distance above the 9th Level on the Fee Lands at the east end of the property. The mine product came from an average of 13 contracts, continuing about the same number as in 1948 and of this total during the greater portion of the year 3 contracts were sub level stoping and 10 sub level caving.

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7. UNDERGROUND

c. Stoping (Cont.)

The mining methods employed in 1949, except for the dropping of the top slicing method, were a carry-over from 1948 following the change of production to the single Morris grade with its lower average iron content and a silica content ranging from about 11% to 13%. The change to this single grade of ore was of great advantage in both the sub caving and sub stoping methods of mining, where the controlled dilution was varied within limits to maintain maximum mining efficiency. Production from the sub level stopes, however, in 1949 was not up to the level attained in 1948 by reason of the fact that several of these contracts spent a higher proportion of their time on development rather than straight mining operations.

During December there were three sub level stopes in production, one by #10 contract in #79 deposit on Chase Lease #24, and the second and third by #6 and #30 contracts on the Fee Lands at the east end of the property above the 9th Level. The remaining ten contracts, employing the sub level caving method of mining, were concentrated largely on Chase Lease #9, mainly in #33 ore body and with mining underway above both the 8th and 9th Levels. The detailed description of mining operations follows:

Chase Lease #24

Four contracts were mining on this lease up until June when #4 contract completed the sub caving operations in the bottom of #75A deposit on the -90' sub. #4 contract then in July joined #10 contract in the development of #79 deposit on the -240' sub. The uppermost workings on this lease was the mining of #21 contract on the -50' and -60' subs in #75B deposit, where a considerable area immediately west of the Chase Lease #9 and #24 boundary line was mined in 1949. #9 contract intermittently continued sub caving operations in #82 deposit in the southern portion of Chase Lease #24 with sub caving operations extending from the -170' to the -190' sub levels. The water which has always entered this territory somewhat hampered production as was the case with #16 contract's mining operations on the Fee Lands some distance east in #33 deposit.

The most productive operation on Chase Lease #24 was the mining of #10 contract in their large sub level stope in the higher than average sulphur #79 deposit. The stoping operations of #10 contract extended from the -230' to the -260' subs and development by this same contract was also carried on as low as the -280' sub, where as mentioned under development, a 200' north-south width in this ore body was disclosed in February. The largest area mined was on the -260' sub where blasting advanced the stope a distance of 70' on a north-south width of 90' between the jasper capping and a small dike forming the south boundary.

Fee Lands

Aside from the development of #1 contract, the highest workings on the Fee Lands were those of #7 contract in #87A deposit, the mining operations of this contract

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7. UNDERGROUND

c. Stoping (Cont.)

Fee Lands (Cont.)

extending both east and west of the east boundary of Chase Lease #9. Sub caving operations on the -60' sub by #7 contract mined the north half of #87A deposit in 1949 and in December the first caving drifts had been extended east and west of the new transfer sub south of the mining raise on the -90' sub. The sub caving operations of #16 contract southeast of the triple boundary corner extended from the -200' sub to the -220'. Mining in this southwest extremity of #33 deposit was beset ~~here~~ by excess water, combined with a lean ore product through an increasing number of dike stringers diluting the ore in place as compared with sub levels above. Three transfer drifts were driven and caved by #16 contract in 1949 and where in the words of the Inland superintendent the estimate of reserves in this area was reduced by the drawing in of the outline as shown by comparison of the 1948 and 1949 maps in the vicinity of the 2600 W. coordinate line. Much of the area that had previously been considered mineable was found to be so cut by a profusion of dikes as to be valueless.

Probably the largest single producer at the Morris Mine in 1949 was the stope of #6 contract near the east end of the Fee Lands, which extended from the -110' sub above the 8th Level to the -260' sub above the transfer south of the main 9th Level drift. #6 contract carried on development and mining in this area adjacent to the 400 W. coordinate line throughout the year with by far the largest mined area extending from the -240' to the -260' subs where the average advance of the stope face to the west amounted to 40' on a north-south width of approximately 140'. Mining operations in the north part of the stope were somewhat hampered by falls of jasper from the back late in the year, after which mining was restricted mainly to the southwest corner which was then opened on subs extending to the -110' sub above the 8th Level.

The sub stoping operations of #30 contract in 1949 carried westerly across the boundary line between the Lloyd and Morris Mines and by the end of 1949 ranged from the -170' sub downward to the transfer drift on the -290' but with a rather limited advance in 1949 due to a continuation of the single shift mining in this area in order to absorb the higher phosphorus content of this ore. The greatest advance occurred on the -200' sub where the stope face at the end of the year was 60' west of the boundary line between the two properties and had encountered the jasper capping along the south side of the stope.

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7. UNDERGROUND

C. Stoping (Cont.)

Chase Lease #9

As on the Fee Lands the highest workings on this lease were those of #7 contract in #87A deposit. A short distance west of #7 contract's operations was the sub caving of #3 and #5 contracts extending from the -70' to the -110' subs. #5 contract in 1949 sub caved an area approximately 50' x 120' on the -90' sub near the east end of #33 deposit, while #3 contract used the same mining method in recovering the ore west of #912 raise.

The main mining area on Chase Lease #9 was nearer the center of #33 deposit and in fact extended into #75C deposit where in the two ore bodies were concentrated five contracts using the sub level caving system of mining. The workings of #13 contract centered on the 8th Level and consisted mainly of a transfer drift driven south of #917 raise to recover the ore beneath the former large stope in which this contract mined in 1948. This "high back" mining operation, although not as productive as the sub level stoping in 1948, was again responsible for furnishing a large share of the product from Chase Lease #9. Farther east in #75C deposit #15 contract continued sub caving from the 8th Level to the -150' sub where, by means of the caving of four transfer drifts, an area some 70' x 80' in size was mined in 1949. Sub caving operations by #2, #11 and #14 contracts ranged from the 8th Level to the -170' sub level in the center of #33 deposit. The larger mining areas here were those of #11 contract adjacent to the former top slice workings to the west on the -140' sub and those by #14 contract in virgin ore south and west of their direct raise #915 to the 9th Level on the -170' sub. The development drift driven by #13 and #8 contracts on the -220' sub in order to provide a new traveling and ventilation connection for the contracts enumerated above was previously described under the development heading.

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1. GENERAL

The Tilden Mine operated from June 20th to September 20th in 1949, except during the week of August 14-20th when the men took their vacation. The operations were on a six day per week schedule until June 29th when a reduction to five days per week became effective.

The total product of only 88,503 tons was the lowest since 1938. Shipping of this small amount was very intermittent and therefore the time between cargoes was occupied in stocking ore of the silica grade to ensure sufficient amount for late fall or early spring deliveries. During 1949 there was 57,199 tons stocked and at the end of the season there remained 67,026 tons on hand.

A strike was called by the C.I.O. on October 1st, but as the pit had already been shut down, this only effected a few maintenance men who would have been repairing various types of equipment. However, most of the men had not been laid off and therefore were not able to receive unemployment insurance as would have been the case if they were not placed at some of the other properties.

Churn drilling was very light during 1949, there only being 13 holes completed and these were in the lower bench of the West Pit. A complete round of holes had been previously drilled on the upper bench of the East Pit but it was not necessary to blast them this year. There was also sufficient broken ore in the Summit Pit and it was not considered advisable to drill more holes there until requirements for the low phosphorus grade showed a tendency to increase. Drilling and blasting along the North side, East end of the West Pit, has been discontinued so as to preserve the road for transporting the drills and also to leave sufficient room for loading the ore remaining on the upper bench which was drilled several years ago but not as yet blasted.

There was only one blast put off during 1949 and that was on July 29th when 32 holes in the West Pit were exploded, resulting in an estimated 87,000 tons of broken ore. The back break was about normal and the fragmentation appeared very satisfactory.

On July 15th a fire occurred which almost completely ruined the main electrical switches at the mine and had it not been for several fortunate circumstances this would have resulted in the loss of the office, warehouse, shops, and dry, which are all under one roof. The fire occurred about fifteen minutes after the men had left and when the lightning hit the transformer and then shorted the main switch lines. The watchman was just about to enter the room where the switches are installed. If he had reached the switch he would no doubt have been knocked unconsious and burned with the building. It was also fortunate that the telephone line in the adjacent room was not put out of order, thereby making it possible to telephone the Ishpeming Fire Department. The loss was estimated to be approximately $5,000.00 but a final accounting is not possible as temporary installations are still in use. It is intended to erect a new building to the North of the office and house all of the switches away from the rest of the buildings.

There was no new equipment purchased at the Tilden Mine during the year nor were there any extensive surface improvements or stripping operations.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production by Grades

	1949	1948	Decrease
Tilden Silica	79,130	96,942	17,812
Tilden Low Phos.	9,373	43,750	34,377
	88,503	140,692	52,189