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7. UNDERGROUND

c. Stoping

Detail (Cont.)

-75' Sub Level

About the middle of the year it was found necessary to supplement the present ventilation from the Negaunee Mine and therefore a permanent connection in the South footwall was started by putting up a raise from the 600 footwall drift and cutting out at this elevation. By December about 300' of inclined drift had been completed, reaching an elevation of -50' at the breast. A raise has been started which will hole into the bottom of a rock raise on the 20' elevation. This raise holes to the Negaunee Mine 14th Level and after the connections are made, the course of the main ventilation will be reversed on the 6th Level, putting that level under pressure and exhausting on the 5th Level at the shaft.

6th Level

The only development accomplished on this level during the year has been at the shaft plat, where a trench is being excavated into which the wet ore will be dumped and either mixed with dry ore or allowed to drain sufficiently to be scraped into the measuring pocket and thus obtain a full skip. This trench will be about 150' long, 8' wide on top and inclined away from the shaft from 3½' deep at the shaft to 12' at the extreme end. Two auxiliary measuring pockets have been installed above the original ones, thus enabling the use of the present system of storage pockets as well as the trench. The trench will be concreted and a pump installed at the lower end. A raise will also be put up from the skip pit so that this spillage can be hoisted and dumped into the trench at any time. It is felt that the use of the trench will greatly facilitate the handling of ore on the 6th Level by cutting out the delays incurred when a train of wet ore has to be held at the shaft until a skip is available and even then only one can be dumped per skip. Another advantage will be the movement of wet ore near the end of the afternoon shift, as this is the time when there is the most ore accumulated at the shaft and thus nearly all the pockets are full with no direct opening to the skip. With the trench available, the wet ore can be dumped into it and allowed to drain until the start of the day shift, thus maintaining a reserve to be hoisted on the early hours of that shift, which at present is the lightest hoist of the 24 hours. When there is an overflow of dry ore, this also can be placed in the trench and mixed with the wet ore sufficiently for handling the entire amount in the skips.

Another advantage of the trench will develop by putting up a raise from the skip pit and then hoisting the ore which is spilled when loading directly into the trench. This will eliminate the present practice of hoisting this ore in cars in the cage and relieve two out of the three men now employed one shift per day on this work.

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7. UNDERGROUND

d. Timbering

TIMBER STATEMENT FOR THE YEAR 1947

Kind	Lineal Ft.	Avg. Price Per Ft.	Amount 1947	Amount 1946
6" x 8" Cribbing Timber	39,752	.0563	2,238.09	3,694.70
8" x 10" Stulls	54,392	.1189	6,468.14	4,526.72
10" x 12" Stulls	84,660	.1783	15,098.78	13,762.02
12" x 14" Stulls	44,001	.2441	10,741.38	6,872.71
Treated Timber	5,128	.3822	1,960.28	3,165.20
Total 1947	227,933	.1602	36,506.67	
Total 1946	240,181	.1333		32,021.35
		Per 100 Ft.		
7' Lagging	1,539,027	1.571	24,171.60	14,262.86
9½' Poles	800,806	2.568	20,562.72	23,863.03
Total 1947	2,339,833	1.912	44,734.32	
Total 1946	1,959,459	1.946		38,125,89
Grand Total 1947			81,240.99	
Grand Total 1946				70,147.24
Product, Tons			722,401	476,348
Feet of Timber per Ton of Ore - Stulls & Cribbing			.3155	.5042
Feet of Stull Timber Only per Ton of Ore			.2604	.3628
Feet of Lagging per Ton of Ore			2.13	2.06
Feet of Poles per Ton of Ore			1.109	2.049
Feet of Lagging per Foot of Timber			6.7521	4.0937
Feet of Poles per Foot of Timber			1.1085	4.0645
Cost per Ton For Timber			.0505	.0673
Cost per Ton for Lagging			.0335	.0299
Cost per Ton for Poles			.0285	.0501
Cost per Ton for All Timber			.1125	.1473

Total Cost for Timber, Lagging, Poles, Etc. and Cost per Ton

Year	Amount	Cost per Ton
1947	81,240.99	.1125
1946	70,147.24	.1473
1945	85,769.70	.1535
1944	100,622.46	.1740
1943	111,613.33	.1565

Although the average price of timber increased .027, or 20%, as compared with 1946, the cost per ton for timber used during 1947 showed a decrease of .0348, or 24%, and this was due almost entirely to the change in mining system, whereby mining of 15% of the product required little or no timber, and the mining of 50% of the product required only 25% of the amount that would have been needed for top slicing.

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7. UNDERGROUND

f. Explosives, Drilling and Blasting

EXPLOSIVES STATEMENT FOR THE YEAR 1947

Stoping and Ore Development

Kind		Quantity	Average Price	Amount 1947	Amount 1946
1¼" 60% Amonia Gel. Powder	lbs.				1,822.50
1¼" Gelamite #1	"	25,750	.1411	3,633.77	2,955.43
1¼" Hercomite 2X	"	257,983	.1346	34,716.45	19,320.55
Total Powder 1947		283,733	.1352	38,350.22	
Total Powder 1946		196,250	.1228		24,098.48
Fuse	M'	1,042,431	6.93	7,227.87	3,720.58
#6 Blasting Caps	M	123,892	13.29	1,646.81	1,223.39
Electric Blasting Caps	C	3,383	15.99	540.95	279.16
Powder Bags	Ea.	38	4.42	167.93	279.45
Tamping Bags	M	5,000	5.00	25.00	25.00
Fuse Lighters	"	30,000	6.75	202.54	101.28
Primacord	"	39,000	32.00	1,248.00	352.00
Miscellaneous				74.89	19.38
Master Fuse Lighters	M				9.93
Total Fuse, Caps, Etc.				11,133.99	6,010.17
Total All Explosives				49,484.21	30,108.65
Product, Tons				722,401	476,348
Pounds Powder per Ton of Ore				.3927	.4120
Cost per Ton for Powder				.0531	.0506
Cost per Ton for Fuse, Caps, Etc.				.0154	.0126
Cost per Ton for All Explosives				.0685	.0632

Rock Development

Hercomite 2X	lbs.	3,732	.1350	503.82	156.95
1¼" Gelamite #1					163.87
Total Powder 1947		3,732	.1350	503.82	
Total Powder 1946		2,820	.1138		320.82
Fuse	M'	7,740	7.48	57.89	20.33
#6 Blasting Caps	M	860	13.26	11.41	5.37
Electric Blasting Caps	C				40.96
Total Fuse, Caps, Etc.				69.30	66.66
Total All Explosives				573.12	387.48
Total Explosives Used at Mine				50,057.33	30,496.13
Average Price per Pound for Powder				.1352	.1227

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7. UNDERGROUND

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

Statement showing cost per ton for explosives, exclusive of rock development, for the period 1943 to 1947, is as follows:

Year	Cost per Ton	Production
1947	.0685	722,401
1946	.0632	476,348
1945	.0624	558,633
1944	.0562	578,307
1943	.0528	713,069

The cost per ton for explosives showed an increase over 1946 of .0053, which did not reflect the total increase in price of powder and supplies. Powder increased .0124 per pound, or 10%, while the price of other blasting supplies increased nearly 20%. Here again the new system of mining produced more ore with less powder, although more Gelamite had to be used, as the Hercomite is too dry and granular to be used in charging holes very much above the horizontal.

h. Mining & Loading

The ore produced in 1947 was mined by three different systems of mining, in the following proportions.

	Percentage Based On Number of Contracts	Percentage Based On Product
Sub Level Stoping	5%	15%
Sub Level Caving	45%	50%
Top Slicing	50%	35%

From the above table it is clearly seen that either of the first two systems are more economical than top slicing, especially when it is realized that there is practically no timber used in sub level stoping and only approximately one-fourth of the timber required for sub level caving, as compared with top slicing. By the end of the year, the mine was almost 70% in the first two systems. It is intended to develop more sub level stopes as the present ones become exhausted, so that it will be possible for some time to have at least three in production at once.

The chief difficulty in both mining and loading operations continues to be the large amount of water that enters the workings. Extensive and costly plans have been tried from time to time to control the water, but it still remains the greatest drawback to high production and corresponding low costs. As has been mentioned elsewhere in this report, a trench is being installed on the 6th Level, and it is hoped that all the advantages that are being anticipated will be achieved.

With the exhaustion of the standard grade ore now in sight and the larger proportion of penalty ore being produced, it is all the more necessary to strive in every way to reduce the costs with new systems of mining, and eliminate water troubles as far as possible.

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7. UNDERGROUND

h. Mining & Loading (Cont.)

A new style of bits, for drilling the very hard quartzite near the shaft in the development of the trench, was introduced, with extremely gratifying results. These bits, fitted with tungsten carbide inserts, are attached to a special type of rod, both developed by the Ingersoll Rand Company. Where formerly it was often necessary to change a bit after several inches of drilling and always before one foot depth had been reached, these new bits have averaged over 200', not only cutting down the cost by half, as the bits cost only 100% more, but also speeding up the drilling. They drill a hole only 1 5/8" in diameter, as against having to start with 2 1/8" to allow the hole to be large enough for powder at the bottom, and this of course increase the speed of drilling. Again, the hole is bottomed with the one drill instead of having to stop and change bits innumerable times, as was the past practice. The bits have also been tried out in the hard slate and jasper encountered in some of the main level drifts near the ore body, and there also they effect considerable saving.

With the mine on a six-day operation, it has been necessary to put in quite a large amount of time on Sundays to maintain the levels in an operating condition, and of course this is all at overtime rates, thus increasing the cost. It is impossible to do this work efficiently when the motor trains are operating, and also the large amount of water causes considerable spillage that also has to be cleaned up when the mine is idle.

i. Ventilation

One contract, working on single shift, has spent the entire year in making a permanent connection in rock between the 6th Level and the 14th Level Negaunee Mine. When this is completed, it will be possible to obtain a large amount of air, which will be entirely free from contamination, when the Negaunee Mine ceases mining, that can be used to ventilate all of the 5th and 6th Level workings, exhausting on the 5th Level. Another connection on the 4th Level was completed early in the year, and this passes through the workings to the 5th Level. When all this work is completed, it should be possible to have adequate ventilation throughout the mine, and this in turn will help to increase the efficiency. Auxiliary fans are used whereever necessary to increase the volume into workings that are not in the direct line of the air current.

j. Pumping

The average gallons per minute pumped from underground showed only a slight increase in 1947 over 1946, but there was considerable more coming through the workings and less from the old footwall drifts, and this was more of a detriment. Almost one quarter of the product was too wet to handle in the underground pockets or to ship direct from the surface pocket. Water also came in under the new hanging when opening the stopes on 5th and 6th Levels. The pump in No. 1 Well had to be removed and repaired while No. 2 Well had to be shut down temporarily in December, as either the seal at the bottom of the well has broken or the shutter screen has torn, as there was too much sand being pumped. This causes trouble in all the pipe lines and boiler, and therefore pumping will not be resumed until this trouble has been investigated and remedied if possible.

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7. UNDERGROUND

j. Pumping (Cont.)

The number of gallons per minute pumped underground is shown below:

Month	1947	1946	1938*
January	1,084	1,104	1,240
February	1,030	1,082	1,442
March	1,017	1,091	1,367
April	1,069	1,139	1,379
May	1,168	1,165	1,545
June	1,087	1,110	1,372
July	1,048	1,137	1,433
August	1,087	1,271	1,391
September	1,222	1,222	1,434
October	1,080	1,225	1,644
November	1,114	1,135	1,408
December	1,075	1,106	1,496
Total Average	1,169	1,149	1,496

*Before surface wells were in operation.

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8. COST OF OPERATING

a. Comparative Mining Cost

	1947	1946
Product	722,401	476,348
Underground Cost	1.972	2.061
Surface Cost	.205	.174
General Mine Expense	.377	.361
Cost of Production	2.554	2.596
Depletion - Original Cost	.060	.094
Increment	.000	.000
Depreciation - Plant & Equipment	.044	.047
Development	.048	.051
Depreciation - Movable Equipment	.002	.003
Taxes	.173	.194
Loading & Shipping	.069	.059
Total Cost at Mine	2.950	3.044
Budget, Estimated Cost per Ton	3.040	3.037
Number of Days Operated	300	218
Number of Shifts & Hours:		
1 8-hour	4	3
2 8-hour	296	215
Average Daily Product	2,408	2,185

Cost of Production

	1947	%	1946	%
Labor	1.807	70.8	1.819	70.1
Supplies	.747	29.2	.777	29.9
Total	2.554	100.0	2.596	100.0

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8. COST OF OPERATING

b. Detailed Cost Comparison

	1947 Amount	1947 Per Ton	1946 Amount	1946 Per Ton
Underground Costs				
1. Exploring in Mine	43.34	.000	477.43	.001
2. Development in Rock	3,521.05	.005	2,387.46	.005
4. Development in Ore			3,343.33	.007
5. Stoping	485,621.92	.672	330,664.94	.694
6. Timbering	441,963.31	.612	307,747.50	.646
7. Tramming	196,648.89	.272	122,971.96	.258
8. Ventilation	23,284.14	.032	9,500.60	.020
9. Pumping	69,305.88	.096	51,342.15	.108
10. Compressors & Air Pipes	62,928.79	.087	39,848.27	.085
12. Underground Superintendence	43,514.97	.060	29,229.60	.061
14. Maintenance, Compr. & Drills	2,822.43	.004	1,287.03	.003
15. Scrapers & Mechanical Loaders	46,531.66	.064	41,107.30	.086
16. Electric Tram Equipment	32,806.92	.045	28,798.35	.060
17. Pumping Machinery	15,953.39	.022	12,963.84	.027
Total Underground Costs	1,424,860.01	1.972	981,669.76	2.061
Surface Costs				
18. Hoisting	52,447.29	.073	32,944.98	.070
19. Stocking Ore	22,159.01	.031	16,427.12	.035
21. Dry House	15,343.32	.021	12,358.60	.026
22. General Surface	13,004.44	.018	8,302.33	.017
23. Maintenance Hoisting Equipment	23,744.22	.033	5,682.17	.012
24. Shaft	11,783.84	.016	4,371.72	.009
25. Top Tram Equipment	3,345.43	.005	2,070.13	.004
26. Docks, Trestles, & Pockets	4,517.17	.006	636.21	.001
27. Mine Buildings	1,522.39	.002	142.29	.000
Total Surface Costs	147,867.11	.205	82,935.55	.174
General Mine Expense				
Geological	897.14	.001		
28. Insurance	13,049.66	.018	4,402.92	.009
29. Mining Engineering	7,072.97	.010	5,348.85	.011
30. Mechanical & Electrical Engineering	3,662.33	.005	1,727.17	.004
31. Analysis & Grading	31,644.03	.044	23,472.46	.049
32. Personal Injury	48,965.89	.068	27,958.31	.059
33. Safety Department	4,051.97	.006	2,298.22	.005
34. Telephones & Safety Devices	4,407.40	.006	2,093.65	.004
35. Local & General Welfare	5,459.17	.008	3,466.17	.007
36. Sp. Exp., Pensions & Allowances	8,460.59	.012	6,185.89	.013
37. Ishpeming Office	30,292.89	.042	21,934.85	.047
39. Mine Office	30,559.68	.042	20,981.91	.044
Social Security Taxes	30,311.55	.042	17,130.02	.036
Employees' Vacation Pay	53,473.80	.074	34,340.43	.072
Group Annuity Premiums			620.08	.001
Total General Mine Expense	272,309.07	.377	171,960.93	.361
Cost of Production	1,845,036.19	2.554	1,236,566.24	2.596

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8. COST OF OPERATING

b. Detailed Cost Comparison (Cont.)

(1) Days and Shifts

Year	Days Worked	Shifts & Hours	Men Employed	Total Days Worked
1947	300	1 & 2-8	368	112,162 3/4
1946	218	1 & 2-8	297	81,253 3/4
Increase	82		71	30,909

Total Men Employed in December of Each Year

	1947	1946	1945
Surface	59½	57	63
Underground	301½	304	286
Total	361	361	349

While the above statement shows the same number of men employed for 1946 and 1947, a new system, using statistical men, was used this year, in which all the extra time is added and then divided by the operating days. There were actually 24 less men on the payroll in December, 1947.

(2) Wages

There was an increase of 12½¢ per hour to the daily wage earners, effective May 9th, and at the same time there was a comparable raise in salaries, and the bosses' pay was also adjusted further to compensate for their working schedule of 48 hours per week..

(3) Comparison of Production

Year	Production	Average Daily Product
1947	722,401	2,408
1946	476,348	2,185
Increase	246,053	223

(4) Comparison of Number of Men & Wages

Year	No. Men	No. Days	Amount	Rate Per Day
1947	368	112,162 3/4	1,254,829.31	11.19
1946	297	81,253 3/4	832,387.31	10.24
Increase	71	30,909	422,442.00	.95

(5) Tons Per Man Per Day

	1947	1946	Increase
Surface	35.88	28.23	7.65
Underground	7.85	6.94	.91

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8. COST OF OPERATING

b. Detailed Cost Comparison (Cont.)

(6) Cost of Production

Year	Amount	Cost Per Ton
1947	1,845,036.19	2.554
1946	1,236,566.24	2.596
Increase	608,469.95	
Decrease		.042

	Amount				Cost per Ton		
Year	Labor	%	Supplies	%	Labor	Supplies	Total
1947	1,305,236.64	70.8	539,799.55	29.2	1.807	.747	2.554
1946	866,705.33	70.2	369,860.91	29.8	1.819	.777	2.596
Increase	438,531.31	.6	169,938.64				
Decrease				.6	.012	.030	.042

The cost of production showed a decrease despite the raise in wages and cost of supplies, due to the increased production. While the expenses during the strike in 1946 did not appear on the cost sheet, yet the cost was high last year during the period of readjustment after the strike, and considerable extra repairing had to be accomplished. Another factor that influenced the decrease was that of more contracts mining by sub level caving and sub level stoping in 1947.

A few of the accounts where more explanation is necessary are listed below:

(7) Detail of Accounts

UNDERGROUND COSTS

3. Development in Rock

	Drifting	Raising	Total Feet	Cost Per Foot
1947	195'		195'	18.06
1946		156'	156'	15.30
Increase			39'	2.76

There was very little development in rock required in 1946, and during 1947 the development was held back until shipping season was over so as to deliver as much ore as possible.

4. Development in Ore

	Drifting	Raising	Total Feet	Cost Per Foot
1947	0'	0'	0'	
1946	147'	255'	402'	10.96
Decrease	147'	255'	402'	10.96

Since only main level development is now used in this account, there will be very little new work in ore, outside of raises, none of which were put up in 1947. The upper levels are all developed, and there will be only two more drifts in ore on the 6th and none on the 7th Level.

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8. COST OF OPERATING

b. Detailed Cost Comparison

(7) Detail of Accounts (Cont.)

5. Stoping

	Labor	Cost Per Ton	Supplies	Cost Per Ton	Total
1947	416,667.70	.577	68,954.22	.095	.672
1946	286,320.02	.601	44,344.92	.093	.694
Increase	130,347.68		24,609.30	.002	
Decrease		.024			.022

The decrease in cost per ton for stoping was entirely due to more contracts sub level caving and sub level stoping during 1947.

6. Timbering

	Labor	%	Cost Per Ton	Supplies	%	Cost Per Ton	Total Cost Per Ton
1947	342,529.93	77.5	.474	99,433.38	22.5	.138	.612
1946	224,799.20	73.1	.472	82,948.30	26.9	.174	.646
Increase	117,730.73	4.4	.002	16,485.08			
Decrease					4.4	.036	.034

Despite the raise in wages and the cost for timber, there was a decrease in the total cost for timbering, due to a larger proportion of the ore being produced by systems requiring less timber. Sub level stoping uses practically no timber, while sub level caving uses only one-fourth of that required for top slicing.

9. Pumping

	Surface Gallons Pumped	Gals. Per Min.	Underground Gallons Pumped	Gals. Per Min.	Total Cost for Power
1947	420,480,000	800	614,426,400	1,169	45,610.58
1946	486,180,000	925	603,914,400	1,149	43,794.51
Increase			10,512,000	20	1,816.07
Decrease	65,700,000	125			

Nos. 1 and 2 Wells were both idle for a short time during the year, due to repairs to the pumps, but the amount of water pumped from underground was practically the same for both years.

17. Pumping Machinery

	Amount	Cost Per Ton
1947	15,953.39	.022
1946	12,963.84	.027
Increase	2,989.55	
Decrease		.005

The cost for this account has been unusually high both years, due to repairs to the pumps. A new Worthington pump has been purchased for the 5th Level, and this should help to reduce the cost next year and also effect further protection against a break-down of other units.

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8. COST OF OPERATING

b. Detailed Cost Comparison

(7) Detail of Accounts (Cont.)

Total Underground Costs

	Labor	Cost Per Ton	Supplies	Cost Per Ton
1947	1,082,512.55	1.498	342,347.46	.474
1946	719,412.59	1.511	262,257.17	.550
Increase	363,099.96		80,090.29	
Decrease		.013		.076

While the labor cost per ton was practically the same despite the raise in wages, the increase in product resulted in a much lower cost per ton for supplies, as some of them, such as pumping, are constant, and as mentioned before, there was less timber used.

SURFACE COSTS

21. Dry House Expense

	1947	1946	Increase
Coal Used in Heating Plant, Tons	1,031½	935½	96
Cost per Ton for Coal	7.95	7.10	.85
Cost of Coal	8,197.72	6,646.39	1,551.33

23. Hoisting Equipment

	Amount	Cost Per Ton
1947	23,744.22	.033
1946	5,682.17	.012
Increase	18,062.05	.021

A new steel shell was installed on the skip hoist during 1947 at a cost of practically $13,000, and this was charged to operating.

Total Surface Costs

	Labor	Cost Per Ton	Supplies	Cost Per Ton
1947	79,674.72	.110	68,192.39	.095
1946	50,950.35	.107	31,985.20	.067
Increase	28,724.37	.003	36,207.19	.028

It was possible to keep the labor cost for surface down, despite the raise in wages, but the supply cost increased, due mostly to the repairs to the skip hoist.

32. Personal Injury

	Amount	Cost Per Ton
1947	48,965.89	.068
1946	27,958.31	.059
Increase	21,007.58	.009

The increase in amount of practically $21,000 was due to the two fatal injuries in October of 1947.

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8. COST OF OPERATING

b. Detailed Cost Comparison

Analysis of Supplies Used

	1947		1946	
	Amount	Per Ton	Amount	Per Ton
General Supplies	40,407.92	.056	23,448.28	.049
Iron & Steel	14,090.56	.020	9,434.47	.020
Oil & Grease	4,001.09	.006	3,181.94	.007
Machinery Supplies	32,283.01	.045	27,200.03	.057
Explosives	51,915.00	.072	30,559.08	.064
Lumber & Timber	92,987.06	.129	75,124.46	.158
Fuel	8,197.72	.011	5,793.89	.012
Electric Power	147,663.68	.204	101,602.51	.213
Sundries			32.19	.000
Other Mines & Accounts	25,167.28	.035		
Total	416,713.32	.577	276,376.85	.580

Although there were more supplies used, due to a larger operating schedule in 1947, and there was considerable increase in price, the cost per ton remained practically the same, due to the increased product.

10. TAXES

	1947		1946	
	VALUATION	TAXES	VALUATION	TAXES
Maas Mine	$ 1,525,000	67,506.26	$ 1,790,000	79,016.51
Race Course	400,000	17,706.56	585,000	25,823.83
Stockpile & Equipment	860,000	38,069.10	490,000	21,630.22
Miscellaneous Parcels	8,665	383.56	8,665	382.50
Total Oprtg. Maas Mine	2,793,665	123,665.48	2,873,665	126,853.06
Collection Fees		1,236.66		1,268.53
Total		124,902.14		128,121.59
Tax Rate		4.42664		4.41433
Total City of Negaunee Tax		526,260.15		523,650.90
Maas Mine % of City Tax		23.7%		24.2%
Maas Mine Rented Houses	82,800	3,665.07	97,065	4,284.84
Mineral Lands, Etc.	15,035	665.55	15,035	663.69
Total Houses & Lands	97,835	4,330.62	112,100	4,948.53
Collection Fees		43.31		49.49
Total		4,373.93		4,998.02

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11. ACCIDENTS AND PERSONAL INJURY

	1947	1946
Fatal	2	0
Time Lost, over 4 months	1	3
Time Lost, 1 to 4 months	12	5
Time Lost, less than 1 month	10	4
Total Compensable Accidents	25	12

On December 31, 1947, payments were being made on five accidents which occurred prior to January 1, 1947. One is a death claim, three are receiving full compensation, and one partial compensation.

The total amount paid out for accidents in 1947 was $3,084.50, as compared with $2,201.50 in 1946.

The following is a brief description of the more serious accidents.

Date of Accident	Name of Injured Man	Description of Accident
10-16-47	Richard Hill	Richard Hill, a miner, was attempting to move the electric scraper hoist, to align it better with a new slice. He had moved it part way with an auxiliary air hoist and then intended to move it ahead by its own power. His partner was drilling in the breast some 25' away and did not see the accident; therefore it is only conjecture as to what actually happened. Hill apparently got caught between the hoist and a cap about 3' above. The base of the hoist was caught by a piece of angle iron, causing the hoist to rise upward, instead of moving ahead when the power was applied. Whether Hill unconsciously applied the power when he was reaching for the starting switch or whether he was knocked off balance by the upward movement of the hoist, it is impossible to state. His head was crushed, and he died when reaching the hospital. He was 32 years of age, had worked 10 years for the Company, and leaves a wife and three small children. The accident occurred on the 5th Level elevation at #6410 Raise, at 9:45 p.m.
10-31-47	Sam Jacobson	Sam Jacobson, a miner, was struck by the last car of an ore train as he was about to climb the raise to his working place above the 5th Level. Jacobson and his partner, Donald Hahka, were just starting the afternoon shift and had walked in from the shaft to their raise. A motor train which had waited at the 5300 switch until all the men had passed, then started to back into the 5300 drift, with the brakeman walking ahead to warn anybody of the train's approach. He had warned two men whom he had

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

Date of Accident	Name of Injured Man	Description of Accident
		passed and also called to two others whom he saw ahead of him, when he reached the raise where he was to start loading. The train continued past him so that they could start loading the car nearest the motor, as is the usual custom. As Hahka started up #5327 Raise, 65' from where the brakeman stopped, he saw the tail light of the approaching train and called to Jacobson, who was still at the bottom of the raise, two or three times. Jacobson had apparently not looked up when he stepped onto the track from the bench on which they had been seated, and also did not hear his partner in time to avoid being hit. He was knocked down and received a basal spine fracture, of which he died in a very short time. Jacobson was nearly 58 years of age and very slow in his movements. He had worked 21 years for the Company and is survived by a wife, there being no children.
1-18-47	Evert Anderson	Anderson was preparing to hoist an air tugger through a dog raise in the sub level stope, when he was struck on head and leg by a chunk. This could well have been a more serious injury, and was due to the miner failing to trim the raise first, working from the top where it was covered and could be entered from a dog drift. Time Lost - 31 days.
2-13-47	Jack Aho	Aho was drilling when a piece of ore fell from the breast, striking him on the foot. This should have been avoided by more careful trimming. Time lost - 44 days.
4-5-47	Arne Maki	Maki was sitting on top of the timber, blocking the back, when he slipped and fell, hurting his knee. He should have been working from a stage. Time lost - 36 days.
7-8-47	Louis Ghiringhelli	Ghiringhelli walked under a raise when poles were being hoisted although he had been warned. He thought there had been time for the poles to be landed and the miners had failed to signal. They were lowering drill steel and dislodged a pole that had evidently caught in the raise, which struck him on the arm. There should have been a signal that they were lowering material. Time lost - 52 days

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

Date of Accident	Name of Injured Man	Description of Accident
8-7-47	Oscar Karhi	Karhi, a brakeman, was riding on the motor when, through a misunderstanding, the train collided with another train parked on a switch. The collision threw Karhi against the following car, fracturing his nose. He should have been walking ahead of the motor, as the train was past the first cross-cut. Time lost - 68 days.
11-20-47	Russell Pascoe	Pascoe was climbing a raise when he was struck by a piece of wood and fractured his pelvis bone. This could also have been a very serious accident, and could have been prevented if some one had not placed this piece of wood near the top of the raise. Pascoe is still home.

The accidents, their causes and classification as to responsibility, are tabulated as follows:

Causes	
Falls of Ground	6
Falling Material	8
Slipping	4
Motor Trains	2
Dirt in Eye	1
Caught Between two Objects	4

Responsibility	
Trade Risk	2
Injured Man	8
Injured & Others	3
Others	2
Injured & Supervision	10

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

E & A CC-170

Total Estimate	$5,200.00
Total Expended in 1947	210.99
Balance December 31, 1947	$4,989.01

The purpose of this E & A is to replace the shaft cable installed in 1913, and no longer reliable to provide adequate service. This cable will be placed in the shaft as soon as received.

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

E & A CC-184

Total Estimate	$6,500.00
Total Expended in 1947	4,531.09
Balance December 31, 1947	$1,968.91

The purpose of this E & A was to provide additional pumping capacity on the 5th Level. This pump, a Worthington plunger type, has been received and will be installed early in 1948.

E & A CC-194

Total Estimate	$13,000.00
Total Expended in 1947	13,077.73
Balance December 31, 1947	$ 77.73

The purpose of this E & A was the installation of a steel drum shell on the skip hoist to replace a cast iron drum that had become dangerously thin in one section. This E & A has been completed, and was charged to operating in October.

E & A CC-198

Total Estimate	$25,719.00
Total Expended in 1947	.00
Balance December 31, 1947	$25,719.00

The purpose of this E & A was the erecting of a steel trestle, using the girders salvaged from the Athens Mine trestle, which was on settling ground. The columns and other material which had to be ordered was not finished in time to do any of the work of erecting in 1947.

E & A CC-200

Total Estimate	$29,000.00
Total Expended in 1947	11,467.65
Balance December 31, 1947	$17,532.35

The purpose of this E & A was the purchase and installation of a synchronous motor, D.C. generator set, D.C. hoist motor and control to replace the present skip hoist motor, which will be transferred to the Cambria Mine. This new equipment has not as yet been installed, and therefore this E & A will carry over into 1948.

Proposed New Construction

The following E & A's have been approved for 1948:

E & A CC-222 to cover the purchase of a 1½-ton dump truck to replace the present truck purchased in 1936, and on which the repairs to put it in shape would be prohibitive.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

Proposed New Construction (Cont.)

E & A CC-231 to cover the purchase and installation of a 2000 ampere, 250-Volt, D.C. circuit breaker for the main haulage system, as the present equipment is not adequate to carry the load.

13. EQUIPMENT AND PROPOSED EQUIPMENT

a. Steam Shovels

There were two shovels in use during the loading season, the #27 or railroad type, and the #45, which is a caterpillar type. The #45 required considerable repairs, as the boiler and some of the operating gear are in poor shape. There is a 54B diesel electric shovel on order, which is intended for use at the Maas Mine next year, but as it is necessary to have two shovels, on account of loading the two grades at the same time, the cats on the #45 should be transferred to one of the railroad types that is in better condition. With two caterpillar type shovels, it should be possible to decrease materially the loading cost next year.

b. Stocking Trestles

At present there is one double-track steel trestle East of the shaft and two single-track wooden trestles, one Southeast and one Southwest of the shaft. The steel girders were salvaged from the Athens trestle, which had to be dismantled on account of the nearness of the cave, and brought to the Maas Mine. Six steel columns were ordered and will probably be received in March of next year, and as soon as the weather permits, this single-track trestle will be erected due West of the shaft. It will then be possible to dismantle one of the wooden trestles and thus decrease the cost of maintenance.

c. Scraper Hoists

There was only one new scraper hoist unit purchased during 1947, a 25 h.p. Ingersoll Rand, for use in the trench on 6th Level. The number of contracts has decreased due to limited areas, and therefore no more hoists should be needed until some of the older hoists become too worn for economical repair.

d. Skips & Cages

There were only minor repairs made to the skips and cage during 1947, and the estimated skip weight of 5.5 tons was continued throughout the year.

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15. POWER

The following is the rate charged per K.W. hour by months in 1947.

January	$ .0136
February	.0132
March	.0134
April	.0132
May	.0134
June	.0136
July	.0134
August	.0132
September	.0140
October	.0132
November	.0132
December	.0134
Average 1947	.0134
Average 1946	.0135

17. CONDITION OF PREMISES

The usual care of lawn and shrubbery was maintained, with the result that a very favorable appearance was presented. There were two improvements made during 1947, when the North end of the old coal dock was dismantled, and the road leading into the mine was paved from the alley North of Prince Street to the gate just West of the office.

18. MAAS CRUSHER

The Maas Crusher was not operated during 1947.

MATHER MINE "B" SHAFT
ANNUAL REPORT
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1. GENERAL:

A tentative location for the Mather Mine "B" Shaft was agreed upon in late 1946 and investigative studies were made to determine the efficient, fastest and most economical method of establishing a completed shaft. Variations of the bore hole and raising methods in conjunction with a connecting drift from a hoisting shaft were studied. These studies, supplemented by actual testing of typical material to be encountered in the shaft penetration, indicated conclusively that of the methods suggested, sinking was the only one not possessing an element of doubt in attainment of depth required for the shaft.

Clearing away of overburden was started January 6th, 1947, at the shaft site at coordinates 700 South and 6600 West, approximately 1750 feet southwest of the section corner, and also roughly 8000 feet east of Mather Mine "A" Shaft. The records of D.D. Hole No. 138, 200 feet to the east of the proposed shaft site afforded basis for rough planning of the shaft collar and foundation. Bulldozer work uncovered diorite ledge at an average depth of 16 feet. The diorite was encountered at the thin north edge of the intrusion and three shallow diamond drill holes were put down in the shaft outline to prove the absence of dikes, fault zones and other rock conditions that would be unsatisfactory for the establishment of a shaft collar and shaft house foundations.

Re-routing of a Cliffs Power & Light transmission line which had traversed the shaft site was underway while the preliminary surface excavation was being done, as was also a Michigan Gas & Electric Company's high pressure gas line. Completion of the tower line and tie-in was necessary before the L. S. & I. R.R. Company could bring in a track to the mine area. The track as brought in, the permanent running track, was needed to provide entry for a steam crane needed in the assembly of the temporary hoisting equipment and compressor.

Early in April, the power line job was finished, the railroad grade placed and blasting work then undertaken at the shaft and tunnel sites.

Using a clam shell, the shaft was put down to a depth of 87 feet and the side walls concreted in conjunction with the permanent head frame foundations and tunnel entrances to the shaft. Temporary equipment was ready for operation, with power brought in, head frame and landing completed by October 20th, at which time sinking was resumed on a 3-shift basis.

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4. ESTIMATE OF RESERVES:

A Geological Department estimate of the ore reserves in Section One, as indicated by diamond drilling, places the tonnage assured as 2,864,000 and prospective as 8,650,000 tons for a total of 11,514,000. These tonnages were calculated using a 100 and 200 foot radius cylinder in the drill hole ore contacts and have been, as such, presented to the Tax Commission.

5. LABOR AND WAGES:

Some difficulty was encountered in obtaining skilled carpenters for form work and construction during the summer. Sufficient general surface labor was available, as were shaft miners when full scale sinking was inaugurated. It is expected that the supply of carpenter labor will again be scarce for the concreting work to be done for the 1948 season.

Statement of Wages

Average No. Men Working	
Surface	39
Underground	18
Total	57
Average Wages per Day	
Surface	$ 10.17
Underground	14.40
Total	$ 11.54
Wages per Mo. of 25 Days	
Surface	$ 254.25
Underground	360.00
Total	$ 288.50
Total No. Days	
Surface	6,829
Underground	3,279
Total	10,108
Amount for Labor	
Surface	$ 69,442.52
Underground	47,221.71
Total	$ 116,664.23

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6. SURFACE:

Because of the scarcity of competent carpenter help and the over-all importance of completing form work for the shaft, collar and foundations and tunnels, the temporary buildings were put up at times when labor could be spared from shaft work. The temporary drys, warehouse, office and cement sheds were constructed in 8 x 16' sections. Because of the open side hill location, insulation was placed in the change rooms and office, and, despite intensely cold weather at the year's end, the men were fairly comfortable.

The temporary structures were placed approximately 250 feet North of the shaft, parallel to the permanent running track into the property. With the exception of the engine house and temporary shops building, all were of frame construction on concrete footings. A study of several types of buildings 40' x 80' to house the hoisting equipment and compressor indicated an over-all saving in the use of a pre-fabricated steel building. A "Quonset" type structure was used for the temporary shops to provide a non-inflammable structure, inasmuch as a shop building should be as close to the shaft as practicable, and provide adequate protection against the hazards present from oil furnaces and forges.

Temporary water and sewer lines were brought up to the area from Teal Lake Avenue on the north. Meanwhile, the City of Negaunee Public Works Department started laying a permanent 8" water main, tapped into the central 16" main from the pumping station, south and west approximately 1000 feet toward the mine area proper. An additional stretch of 1000 feet will be required to bring the 8" main west along the main line railroad track ditch to the take-off for the permanent engine house.

Heat for the temporary buildings and hot water for the change rooms was provided for by the installation of a Kewanee 20 h.p. boiler brought from the Princeton property in Gwinn.

The permanent buildings, as laid out in general plan, will follow the same pattern as developed for Mather Mine "A" Shaft. Some improvements were incorporated in the "B" Shaft layout as perceived by "A" Shaft personnel from their experience at that property. For topographical reasons, the U-shape pattern of "A" Shaft could not be followed. The main buildings, to consist of two parallel wings, the shops and warehouse and dry wings, will be built in an east-west position at the eastern entrance to the property with the office at the front. An excellent location was obtained for the engine house west of the shaft, on the east edge of a diorite outcrop.

MATHER MINE "B" SHAFT
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6. SURFACE (Cont'd)

A contract was let to move four dwellings east of the shaft to a new location on Teal Lake Avenue, along the north edge of the property. Basement excavation, water and sewer lines into the lots were done by "B" Shaft men and equipment. One of the houses was moved in late summer, and it is expected that the moving of the remaining three will be accomplished during the summer of 1948.

Construction of the permanent tunnels in the immediate vicinity of the shaft kept pace with progress of the shaft collar to permit back-filling in the area stripped of over-burden, thus eliminating re-handling of excavated material.

The lower timber tunnel, of double and single widths, was poured for a length of 230 feet. It was thus possible to utilize this tunnel for storage of shaft sets and for loading of the cage with shaft steel under cover for winter weather. The tunnel area was also used as a place to store and drill shaft guides and as a workshop in the punching of corrugated sheathing.

A length of 76 feet of the service tunnel to the engine house was also completed. This tunnel served as a repair station for the work of the chain gang, a maintenance shop for the drilling machines used in the shaft, and also as a blasting station for the shaft.

A total of 574 yards of concrete was placed in the tunnel construction during the season.

Two lifts on the headframe backleg footings were poured, using 10 yards of concrete. The crusher foundation, which will also serve to carry other portions of the shaft house, was brought up to the elevation of the lower timber tunnel floor. This work necessitated pouring of 49 yards of mix.

Concrete work in general for the season, including the work just mentioned and the temporary engine house machinery foundations, required a total of 1600 yards of concrete.

In Section 1, a ditch 5,124 feet in length was excavated from the Lily Pond lying approximately on the section line between Sections 1 and 2, east to the Negaunee City storm sewers. Lateral ditching amounting to 803 feet completed the drainage of this pond. This

MATHER MINE "B" SHAFT
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6. SURFACE (Cont'd)

project was undertaken to remove the hazard of a surface accumulation of water overlying the mining areas between Shafts "A" and "B" of the Mather Mine, in which areas surface caving may reasonably be expected.

The work was done by a local contractor at a cost of $10,041.48. Test drilling and standpiping to obtain information on the saturation of the over-burden was accomplished during this period. Expenditures for the latter work was $2,927.27, making a total of $12,968.75 for drainage work.

7. UNDERGROUND:
a. Shaft Sinking

The shaft site was determined after many tentative layouts of the whole proposed operation were made. Because of the singular topographical aspect of the property, the plan finally reached through elimination was the only logical one that could encompass the physical problems of railroad entrance, stocking area, drainage and space for buildings.

Drill Hole No. 138, 200 feet east of the shaft site indicates a depth of 1650 feet, through jasper formation to the slate.

On removal of the shallow over-burden, several cuts were taken in the shaft outline to permit the laying of two heavy wood bearers on the ledge surface. Excavation continued in the shaft and five sets of steel on 7 foot centers were hung from the wooden bearers. The upper steel set was surveyed in accurately and alignment brought down to the bottom set which was then concreted solidly. Immediately above the 4th set, 4 - 12", 50-lb. H-section bearer beams were laid in with the ends jutting 4½ feet into the rock walls. The sets were concreted with solid pours, up to the interval between the 2nd and 1st sets below ledge surface. The rock walls were trimmed to provide a concrete thickness of 4½ feet between these two sets. With the upward advance of the concreting, a ventilation duct 5½ x 8 feet was also brought up on the north side of the shaft, starting from the 3rd set below ledge and concreted with the shaft pours.

It was then possible to remove the wood bearers and three sets with studdle intervals of 8' 4½", comprising the tunnel openings were poured and the shaft collar and headframe foundation pillars brought to

MATHER MINE "B" SHAFT
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7. UNDERGROUND (Cont'd)
a. Shaft Sinking (Cont'd)

elevation + 1459. The finished collar elevation will be + 1460. The collar concreting will be done at the time of erection of the permanent steel headframe.

Excavation of the 87 feet of shaft necessary for the foundation and collar concreting was accomplished by the use of a ½ yd. clam shell bucket on an Insley Excavator. Addition of a 200 lb. weight on each lip of the bucket provided adequate "bite" to dig the broken jasper and diorite. Several types of buckets operated by air and electric hoists have been experimented with to set up a method of mechanically mucking the broken rock in the shaft bottom. At present, an hydraulically controlled bucket is being tested by a crane builder in the mid-west that seems to offer greatest possibilities for "B" Shaft work. The crane company is doing all possible to get the bucket perfected so that we can make use of it in sinking.

Concreting of the shaft to ledge, 5 sets, required pouring of 245 yds. of mix. This yardage was placed with the use of a pumpcrete machine working from a two-yard mixer at a batching plant situated on the high ground immediately south of the shaft. Electric and pneumatic vibrators were used to insure proper distribution of concrete in the form work. To bring the shaft and tunnel stubs to elevation + 1459, an additional 243 yards of concrete were poured.

Shaft sinking from October 20th to December 31st, produced 235 feet of finished shaft beyond the initial 87 feet to a depth of 322 feet, requiring 78 yards of concrete for the bevel and bag set pours.

The rock penetrated to the year's end was quite hard, broke well and maintained a vertical wall outline excellently. Placement of the long axis of the shaft in a position normal to the strike of the formation has worked to a decided advantage in "B" Shaft sinking. The short north wall has not sloughed to any extent and the long east and west side walls have definitely shown overbreak much less than what would have been expected had they been parallel to the strike.

Testing of two leading makes of shaft sinking drill machines was conducted over a period of several months in the early excavation at the shaft site. Ingersoll-Rand J-50's were selected and their performance has been satisfactory. Tungsten carbide insert bits

MATHER MINE "B" SHAFT
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7. UNDERGROUND (Cont'd)
a. Shaft Sinking (Cont'd)

produced by that company were tried out in the shaft drilling on their first appearance to the trade. Excellent results were obtained despite early misgivings on the feature of center hole and small diameter. No over-drilling is obtained in the jasper and the center hole apparently provides proper placement for the introduction of water to flush the fine cuttings from the face of the bit. The small diameter hole with parallel sides, as compared to the slightly tapered sides of the standard jackbit hole, has limited the consumption of explosives to approximately 50% of the quantity formerly used with the jackbit hole, and has produced a fragmentation equal to, if not superior to, former results.

A reduction of drilling time from slightly over four hours with the standard jackbits to an average of two hours to make a 72 hole average round has been accomplished with the carbide insert bits. The over-all cost analysis of the insert bit on shaft sinking labor alone, shows a tremendous advantage over previous bits.

It may be mentioned in passing that considerable study was given to the possibilities of using the fusion-piercing method of obtaining drill holes of small size in "B" Shaft, that is, the use of oxygen and a liquid fuel in conjunction with a comparatively small rig. A representative of the company engaged in this type of work discussed the practical aspects of the project after a study of the shaft rock conditions with "B" Shaft representatives. The feasibility of the job was stressed by both sides,but actual proposal was not forthcoming from the people sponsoring the piercing method, presumably, because of the primary importance to them of furthering the surface market for their product rather than the more difficult underground application.

9. DIAMOND DRILL
EXPLORATIONS:

During the year 1947, a total of four holes were drilled, amounting to 1509 feet of hole.

The principal portion of this drilling was concerned with the completion of hole No. 142-B. This hole was wedged to the North from parent hole No. 142 at a depth of 1291 feet. The purpose of the hole was to determine the amount of ore contained in the structure formed by the fault cut in hole No. 142 and the footwall slate

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9. DIAMOND DRILL EXPLORATIONS: (Cont'd)

series. The hole was successfully completed after cutting the principal ore run from 2527' to 2645'. This concluded the deep exploration program in Section 1.

Further exploration is planned for the North half of the section. This exploration is to be conducted from the main level drift to be driven between Mather Mine "A" and "B" Shafts.

In addition, three short holes were drilled on the site of the shaft. They were holes Nos. 145, 146 and 147. The purpose of these holes was to determine the structural characteristics of the ground with relation to the support of the shaft collar and headframe foundation.

10. TAXES:

		1946	
	VALUATION	RATE	TAXES
Jackson Sec. 1, 47-27	$ 500,000	44.1433	$22,071.65
Coll. Fee 1%		.4414	220.72
Total Mather "B" (Sec. 1, City of Negaunee)	$ 500,000	44.5847	22,292.37

		1947	
	VALUATION	RATE	TAXES
Jackson Sec. 1, 47-27	$ 550,000	44.2664	$24,346.52
Coll. Fee 1%		.4427	243.46
Total Mather "B" (Sec. 1, City of Negaunee)	$ 550,000	44.7091	$24,589.98

11. ACCIDENTS AND PERSONAL INJURY:

Erection of the temporary surface plant and installation of the heavy machinery was accomplished without loss of time from accidents. Concern was felt over the construction work of the shaft collar, headframe foundations and tunnels, inasmuch as this type of work was new to the majority of workers employed and many hazards were undefined in advance.

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

One compensable accident occurred in December by a shaft boss bumping his knee when climbing around the bearer beams at the installation of the second bearer set. The man worked three shifts following the incident, paying slight attention to his knee until stiffening of the joint required medical attention.

It was a source of satisfaction for the "B" Shaft personnel to have the property presented with the Company's safety banner flag for achieving the lowest severity rating for the year 1947 of the underground mines.

18. NATIONALITY OF EMPLOYEES:

	Total	American Born	Foreign Born
Finnish	28	24	4
Italian	11	10	1
French	12	12	-
Swedish	13	13	-
Austrian	2	2	-
English	6	5	1
Irish	2	2	-
German	1	1	-
Swede-English	3	3	-
English-Finnish	2	2	-
Total	80	74	6
		92.5%	7.2%

NEGAUNEE MINE
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1. GENERAL:

The Negaunee Mine operated on a six-day, twelve-shift per week schedule during the entire year of 1947. In October, due to the gradual reduction of mining places, it was necessary to add a fourteen-man midnight shift. Mining was carried on by three contracts, while the remaining men were used in timber repairs on the level. The present schedule, while possibly more efficient from a cost and production standpoint, nevertheless requires considerable overtime work on Sundays with respect to repairs to the shaft, hoisting equipment and necessary timber repairs.

The production in 1947 was 518,387 tons. All ore in stock was not shipped this year and there was no overrun from stockpile shipments to add to the product. Shipments in 1947 were 569,512 tons, an increase of 44% over the 395,422 tons shipped in 1946. Late in the shipping season it was estimated that there were approximately 20,000 tons of stockpile overrun distributed between the Maas and Negaunee grades over and above the actual ore remaining in stock, which, according to book figures, amounted to 20,372 tons, as of November 30th. Some cancellations and deferments of shipments occurred late in the season, due to a change in weather conditions.

The product from the area under lease from the Maas Mine amounted to 41% of the total, as compared with the identical figure in 1946. This was also true in the percentage of Negaunee Ore, which was 52%, and the South Shore Right-of-Way, which was 7%. Despite the large reduction in the Negaunee ore reserves, the percentage of product remained relatively high due to stoping operations, all of which lie within the bounds of the Negaunee Lease. Due to heavy pressure in the Maas area, particularly the southwest portion, development has been retarded, with a correspondingly lower production.

Development of several small orebodies southwest of the main Negaunee deposit was underway during the entire year. In a number of instances after various stopes had been mined, additional ore was shown up, necessitating further exploration and development work. During the past five years, approximately seventeen sublevel stopes have been mined in the southwest troughlike ore deposit. This area extends approximately 1,000 feet laterally from a point 30 feet above the 13th Level to the 14th Level floor elevation, a vertical distance of 150 feet. The territory has been very irregular, particularly with respect to the jasper capping which has frequently cut off the ore, as have dikes and other jasper intrusions. This condition has been a decided advantage in giving support, through jasper pillars, to the entire area and preventing the possible caving to surface.

The estimated ore reserves at the end of 1947 indicated a probable life of about ten months for the Negaunee Mine. This is largely dependent on the success of mining operations on and slightly below the bottom level. Due to extreme ground pressure, it is questionable whether all remaining ore reserves in the Maas Lease can be mined at this elevation.

The safety record in 1947 continued to show considerable improvement over that of last year. While the average number of employees dropped 10%, accidents from all causes were reduced by 27%. There were no serious injuries and the loss of time resulting from accidents was relatively low.

The supply of stull timber early in the year was very critical due to adverse weather conditions preventing delivery. However, during the summer months a large amount was received and by the end of the year approximately ten months' supply was on hand, which is sufficient to cover the needs of the mining of all remaining ore in the Negaunee Mine.

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YEAR 1947

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1947	1946	Increase	Decrease
Negaunee Ore	268,972	216,510	52,462	
South Shore Right of Way Ore	34,083	28,414	5,669	
Negaunee-Maas Ore	215,332	171,097	44,235	
Total Ore	518,387	416,021	102,366	
Rock	12,550	14,250		1,700
Total Hoist	530,937	430,271	100,666	

Skip capacity reduced from 5.5 tons to 5.3 tons 11/10/43.

b. Shipments:

	Pocket Tons	Stockpile Tons	Total Tons	Total Tons Last Year
Negaunee Ore	157,114	114,774	271,888	223,957
South Shore Right of Way Ore	21,544	13,699	35,243	32,882
Negaunee-Maas Ore	127,213	135,168	262,381	138,583
Total 1947	305,871	263,641	569,512	395,422
Total 1946	278,472	116,950	395,422	
Increase	27,399	146,691	174,090	

Shipments increased 44% in 1947 and were 51,125 tons more than the product for the year.

c. Stockpile Inventories:

	Dec. 31st, 1947	Dec. 31st, 1946	Decrease
Negaunee Ore	24,451	27,367	2,916
South Shore Right of Way Ore	3,996	5,156	1,160
Negaunee-Maas Ore	22,991	70,040	47,049
Total	51,438	102,563	51,125

Including estimated overrun there were approximately 20,000 tons in stock at the end of shipping season.

d. Division of Product by Levels:

	1947	Percentage	1946	Percentage
9th Level	58,235	11.23	55,966	13.45
14th Level	460,152	88.77	360,055	86.55
Total	518,387	100.00	416,021	100.00

The product from the 9th Level as indicated above was 58,235 tons or 11.23% of the total product. Mining operations have now been carried on above the 9th Level during the past eleven years. The total production has amounted to 1,473,706 tons or approximately 500,000 tons in excess of the original estimate of reserves.

Note: It should be mantioned that all comparisons between 1947 and 1946, particularly with regard to production, are based on a 300 operating day year in 1947 and a 218 day year in 1946. The latter reduction being the result of the labor strike from February 8th to May 22nd, 1946.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (CONT.)

e. Production by Months:

Month	Negaunee	S.S.R/W.	Neg.-Maas	Total Ore	Rock
January	24,296	3,769	19,570	47,635	305
February	29,027	1,595	21,914	52,536	905
March	30,069	3,235	22,311	55,615	1,215
April	26,982	2,537	23,371	52,890	2,100
May	28,487	449	20,034	48,970	1,890
June	23,674	2,845	18,103	44,622	1,650
July	23,363	5,062	13,114	41,539	1,855
August	17,197	2,159	9,895	29,251	820
September	15,701	7,294	14,101	37,096	590
October	17,435	1,987	21,699	41,121	215
November	18,796	-----	16,978	35,774	270
Decemb er	13,945	3,151	14,242	31,338	735
Total 1947	268,972	34,083	215,332	518,387	12,550
Total 1946	216,510	28,414	171,097	416,021	14,250
Increase	52,462	5,669	44,235	102,366	
Decrease					1,700

The product by leases was distributed as follows:

	1947	1946	Increase
Negaunee Mine Company	268,972	216,510	52,462
South Shore Right of Way	34,083	28,414	5,669
Maas Lease	188,913	150,096	38,817
N 1/3 Right of Way	17,847	13,432	4,415
N 1/6 Right of Way	8,572	7,569	1,003
Total	518,387	416,021	102,366

f. Ore Statement:

	Negaunee	S.S.R/W.	Neg.-Maas	Total-1947	Total-1946
On Hand Jan. 1, 1947	27,367	5,156	70,040	102,563	79,188
Product for Year	268,972	34,083	215,332	518,387	403,982
Stockpile Overrun					14,815
Total	296,339	39,239	285,372	620,950	497,985
Shipments	271,888	35,243	262,381	569,512	395,422
Balance on Hand	24,451	3,996	22,991	51,438	102,563
Increase in Product	63,726	6,444	44,235	114,405	245,693
Decrease in Ore on Hand	2,916	1,160	47,049	51,125	
Increase in Ore on Hand					23,375

g. Delays:

January 13th, 1947 - 1-1/2 hours delay - Loss of Product - 132 tons.
Rod came off measuring pocket.

February 3rd, 1947 - 1 hour delay - Loss of Product - None.
Delay on account of cutting skip rope.

The loss of product for the year on account of delays was negligible as compared with the loss of 1,964 tons reported in the previous year. This is a very excellent record in view of the heavy operating schedule of the past several years.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (CONT.)

h. Delays from Lack of Current:

There were no delays from lack of current during the year.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	1947				1946			
Grade	Tons	Iron	Phos.	Sil	Tons	Iron	Phos.	Sil.
Negaunee	268,972	59.07	.089	8.73	205,246	59.59	.087	8.81
Neg-Maas	215,332	59.50	.089	8.59	171,097	59.71	.086	8.54
S.S.R/W.	34,083	59.67	.084	8.26	27,639	58.55	.093	9.96

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b. Average Mine Analysis on Straight Cargoes:

There were no straight cargo shipments during 1947.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12 cubic feet equals one ton.
10% deducted for rock and loss in mining.

			Leased from Maas Mine				
Area	Negaunee Lease	S½ R of W or¼ of Adams Strip	N 1/6 R of W or ¼ Adams Strip	N 1/3 R of W or C.C.I.Co. Strip	Maas Area	Special Grade	Total Tons
9th Level	7,692						7,692
12th to 13th Levels	2,625						2,625
13th to 14th Levels	61,265	36,587	4,125	22,642	259,162		382,781
Below 14th Level	2,083	4,167		375	35,275	59,000	100,900
Total Gross Tons 11/30/47	73,665	40,754	4,125	23,017	293,437	59,000	493,998
Less December 1947 Production	13,945	3,151	722	551	12,969		31,338
Total Gross Tons 12/31/47	59,720	37,603	3,403	22,466	280,468	59,000	462,660
Less 10% for Rock & Loss in Mining	7,367	4,075	412	2,302	29,344	5,900	49,400
Net Total 12/31/47	52,353	33,528	2,991	20,164	251,124	53,100	413,260

Maas Lease Ore	327,379 tons
Negaunee Lease Ore	52,353 "
S.S.R/W. Ore	33,528 "
Total	413,260 tons

b. Prospective Ore:

All ore in the mine is developed.

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4. ESTIMATE OF ORE RESERVES:

c. Estimated Analysis:

	Ore Reserves:	Approximate Expected Natural Analysis:									
Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Negaunee	85,881	52.45	.079	7.60	.13	3.24	.27	.14	.016	1.42	12.00
Neg.- Maas	274,279	52.64	.076	7.57	.13	3.27	.27	.15	.017	1.38	12.32
Maas Spec.	53,100	52.80	.070	7.50	.18	2.00	.52	.16	.200	1.10	12.50

The Negaunee Ore includes all ore from the Negaunee Lease and the South Shore Right-of-Way; the Negaunee-Maas Ore includes Parcels No. 1, 2 and 3, otherwise known as the Maas Strip, the north 1/3 and north 1/6 Rights-of-Way.

Ore in Stock - Average Natural Analysis:

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Negaunee	28,447	51.834	.085	8.493	.133	3.236	.328	.142	.018	1.290	11.350
Neg.-Maas	22,991	51.890	.080	8.341	.133	3.267	.301	.151	.015	1.312	11.450
Total	51,438										

5. LABOR AND WAGES:

a. Comments:

Throughout the year relations between the U.S.W.-C.I.O. and the supervisory force continued to be very satisfactory. There were no grievances between the union and management during 1947 and only one grievance has been turned in during the past five years since the original organization of the local union. It is quite apparent from the general attitude that a vast majority of the employees feel free to discuss their various problems directly with the management, resulting in a far more satisfactory and rapid settlement.

On May 29th, an overall wage increase of 12½ cents an hour was granted retroactive to May 9th. The last two wage increases, namely 12½ and 18½ cents per hour amount to $2.48 per day. This increase is brought out very clearly by the fact that one employee, during the year, received over $5,000.00 for his services, fifteen over $4,000.00, fifty-three over $3,500.00 and seventy-seven over $3,000.00, a total of 146 men. Included in the over-all earnings is vacation pay of one, two and three weeks depending on length of service. It might be added that one mining crew averaged slightly over $2.00 per hour during the first six months of the year. These men were employed as miners in a large, very productive stope.

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5. LABOR AND WAGES: (CON'T)

b. Comparative Statement of Product, Men, Hours and Wages:

	1947			1946			Increase Or Decrease		
	Surface	Underground	Total	Surface	Underground	Total	Surface	Underground	Total
Production			518,387			416,021			102,366
Number of Days Operated			300			218			82
Number of Shifts and Hours			1-8 3 2-8 594			1-8 4 2-8 428			1-8 1 2-8 166
Average Daily Product			1,728			1,908			180
Average Number of Men Working	49	186	235	45	183	228	4	3	7
Tons Per Man Per Day:									
Total			7.28			6.65			.63
In Ore			28.36			25.38			2.98
Total Number of Man Days	15,237	55,941	71,178	14,234	48,358	62,592	1,003	7,583	8,586
Total Hours Worked	117,809	445,330	563,139	96,554	384,577	481,131	21,255	60,753	82,008
Total Wages Paid Above Employes	$148,162.10	$654,998.31	$803,160.41	$108,552.35	$505,677.43	$614,229.78	$39,609.75	$149,320.88	$188,930.63
Average Earnings Per Man Per Month	$251.98	$293.46	$284.81	$201.02	$230.27	$225.00	$50.96	$63.19	$59.81
Average Wages Per Man Per Day	$ 10.06	$ 11.77	$ 11.41	$ 8.99	$ 10.52	$ 10.21	$ 1.07	$ 1.25	$ 1.20
Average Contract Wages Per Day			$ 12.69			$ 11.02			$ 1.67
Total Operating Labor Per Cost Sheet	$155,213.32	$660,362.31	$815,575.63	$128,893.04	$508,868.46	$637,761.50	$26,320.28	$151,493.85	$177,814.13
Labor Cost Per Ton	$.299	$1.274	$1.573	$.310	$1.223	$1.533	$.011	$.051	$.040

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6. SURFACE:

a. Buildings and Repairs:

There were no new buildings erected or major repairs carried on on the mine property. All buildings were kept in good repair during the year.

b. Fences:

The fences which surround the mine property or enclose the caved area to the north of the mine were inspected periodically and repairs made when necessary.

c. Tracks and Roads:

All Tracks and roads near the mine were maintained during the year. In October a pproximately 400 feet of railroad track adjacent to the mine buildings was elevated about 18 inches to prevent the formation of ice during the spring break-up from blocking the way.

d. Stockpiles:

Due to a late spring the steam shovel started loading from stockpile on the 15th of May, completing loading on the 25th of November. During the last month of shipping some difficulty was experienced on the north side of the east trestle where the ore would not readily cave and would stand at a vertical height of about 35 feet. This condition was a constant threat to the safety of the pit crew and it was necessary to blast the pile frequently. This condition resulted from the fact that a fairly high ridge of ore remained from the 1946 season. With additional ore being stocked on this pile it was prevented from caving as the second cut progressed.

d-1. Ore and Rock Trestles:

The usual repairs and maintenance were made to the permanent steel ore trestles and the rock trestle to the northeast. The return 5/8-inch cable which was formerly located between the box girders of the east trestle was moved into a position two feet south of the track at the same location. In this way the cable was supported by 12-inch sheaves at intervals of 50 feet and is more accessible for replacement and oiling. This change had been made the previous year on the west trestle and its operation was very satisfactory. This change resulted in the elimination of approximately 23 sheaves and a correspondingly lighter wear on the endless cable.

Despite the more modern methods of stocking ore by larry cars, locomotives, etc., the experience at the Negaunee Mine has been exceptionally good. The costs have been relatively low with no delay of a mechanical or electrical nature.

e. Shaft House:

There were no major changes or improvements to the shaft house and the usual maintenance and repairs were carried on throughout the year. In August several new steel members were installed at and just below the shaft collar and a number of casing planks were renewed between the cage and skip roads.

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6. SURFACE:

f. Water Supply:

The cost of water purchased from the City of Negaunee and used at the mine for the past four years is as follows:

	1947	1946	1945	1944
1st Quarter	200.40	99.04	212.44	318.00
2nd "	248.14	142.23	306.94	352.65
3rd. "	136.35	275.44	398.85	483.90
4th "	90.15	228.75	145.24	357.90
Total	675.04	745.46	1,063.47	1,512.45
Product - Tons	518,387	416,021	654,447	757,677
Cost Per Tons	.001302	.001792	.001409	.001996

As indicated above there was a reduction of approximately $70.00 in the cost of water used during 1947. This reduction was due to a revamping of the condensate return to the dry house heating plant as well as the installation of a new inner cooler in the engine house compressor. In both cases the improvement greatly reduced the need of city water.

g. Grounds:

The ground s around the mine were kept clean and in good condition throughout the year. The shrubbery surrounding the mine buildings was pruned and tied up in November to prevent injury from ice and snow during the winter months. The parking lot was kept in good shape by occasionally filling the low spots.

h. District Sawmill Plant:

The sawmill located at the west end of the timber yard was in intermittent operation throughout 1947. During the summer months approximatel y 500 large, hardwood logs were delivered and sawed for the Athens Mine, to be used in block cavin g. On the completion of this work a second lot of 15 railroad cars of hardwood timber were delivered, also to be used at the Athens Mine. In addition to this 8,636 ties, 275 sills, 79 uprights and 542 ladder sides were sawed. The mill was in operation approximately 150 days during the year with the labor amounting to $3,525.00 and supplies $300.00.

Due to the need of handling large size timber, two jammers were installed near the mill to facilitate the moving of the logs as well as the finished product. Some delay resulted from cleaning the logs before sawing, however, in general the operation was v ery satisfactory.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking during 1947.

b. Development:

There was no appreciable increase in the ore and rock development during 1947 as compared with 1946, particularly in view of the shorter working period during last year on account of the strike.

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7. UNDERGROUND: (CONT.)

b. Development: (Cont.)

The following table gives a comparison of the total drifting and raising in ore and rock for the years 1947 and 1946:

Year	Drifting		Raising		Grand Total
	Ore	Rock	Ore	Rock	
1947	2,560'	1,065'	1,553'	82'	5,260'
1946	2,048'	1,178'	992'	526'	4,744'

b-1. Rock Development:

The following table gives a summary of the rock drifting and raising in 1947 and 1946:

Location	Drifting	Raising	Total 1947
653' Sub-level	88'		88'
170' Sub-level	17	20'	37
160' Sub-level	50	10	60
150' Sub-level	97		97
140' Sub-level	125	29	154
125' Sub-level	320	23	343
100' Sub-level	150		150
90' Sub-level	128		128
14th Level	90		90
Total 1947	1,065	82	1,147
Total 1946	1,178	526	1,704

The rock development was carried on in three different phases of mining operations. The first and largest amount was the driving of transfers and developing small ore areas in the south stoping territory. In many cases these transfers were driven just below the ore in an effort to recover as much ore as possible. Second, several rock drifts were driven to extend the ventilation ways as mining operation s continued on the various sub-levels. In all cases this work was done in the rock footwall as far as possible away from ground pressure. Third, with the rapid depletion of the ore reserves it was necessary to drive various connecting drifts in the footwall between active mining raises. In some cases the raises were completely in the footwall, making it necessary to drift a short distance in rock to mine the remaining ore in local areas.

b-2. Ore Development:

The following is a summary of ore drifting and raising during 1947 and 1946:

Location	Drifting	Raising	Total 1947
9th Level	26'		26'
13th Level	47		47
150' Sub-level	247	175'	422
140' Sub-level	41	89	130
125' Sub-level	387	634	1,021
115' Sub-level	117	198	315
100' Sub-level	357	191	548
90' Sub-level	819	231	1,050
14th Level	519	35	554
Total 1947	2,560	1,553	4,113
Total 1946	2,048	992	3,040

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7. UNDERGROUND: (CONT.)

b. Development: (Cont.)

b-2. Ore Development: (Cont.)

Approxima tely 80% of the ore development was carried on in connection with stoping. This entailed the driving of small ore drifts and raises on the various sub-levels to develop as well as explore the small ore bodies.

The remaining ore development was carried on on the 14th Level where the 1480 an d 1440 Crosscuts were driven to the northwest Maas Mine Boundary. As previously stated this development was greatly hampered due to the ground pressure which required constant repairs in an effort to hold the various drifts open.

c. Stoping:

(1) General:

The product for the year was obtained from the three main leases, viz., the Negaunee Lease, The South Shore Right of Way and the Maas Area, the latter being divided into Parcels 1, 2 and 3. The percentage of production from the Maas lease was the same (41%) as reported in 1946.

The locations of the various mining territories are as follows: No. 1 Shaft Pillar, above the 9th Level, the main or central top slicing territory and the stoping area south of the main deposit, the latter two between the 13th and 14th Levels.

The sub-levels on which mining was carried on above the 9th Level include the 673', 663', 653' and 620'. Early in the year three mining contracts were in operation above the 9th Level. By the end of 1947 only one mining contract remained to mine the long, narrow ore body. In the central or main deposit mining operations (top slicing and sub-level caving) were carried on on the 170', 160', 150', 140', 125', 115', 100' and 90' Sub-levels. Approximately 70% of the product was mined from this territory. In the stoping area all sub-levels between the 220' elevation and the 14th Level (75' elevation) were used, including those mentioned above. Mining by the sub-level stoping method resulted in 24% or 122,000 tons of the product for the year. This proportion is greatly in excess of that reported last year and will also be in excess of that reported in 1948.

The locations of mining contracts in 1947 and 1946 are listed below:

	1947	1946
	1 above 9th Level	3 above 9th Level
	15 above 14th Level	24 above 14th Level
Total	16	27

The table above gives the number of contracts as of December 31st of each year. The average during 1947 amounted to 21 while the total drop in contracts amounted to 35%. Throughout the year 51% of the contracts were carrying on top slicing, 14% developing, 14% repairing, 11% cutting or timbering over raises on new sub-levels, 7% stoping and 3% sub-level caving.

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7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(1) General: (Cont.)

Near the end of December a new top slicing sub-level was being opened up at an elevation of 100, or 25 feet above the floor of the bottom haulage level. This will allow possibly one more sub-level which will be cut out just above the level timber with a second located on the 14th Level elevation and scraping directly into tram cars. Whether this method can be carried on with any degree of success is questionable due to the continuing ground pressure in the main ore body. In general top slicing has been very productive during the year and mining conditions have been very favorable. The average tons per miner per day throughout the year amounted to 31.1, despite the fact that approximately 26% of the time of all mining contracts was spent in timbering or repairing in their respective working places.

It is somewhat of a coincidence that during the past four years in December or January work has been underway in opening new sub-levels. The table below lists these dates:

1944 - December - Opened 210' Sub-level
1945 - January - Opened 170' Sub-level
1946 - January - Opened 140' Sub-level
1947 - December - Opened 100' Sub-level

During the year all mining contracts were operating on a two-shift basis with the exception of three contracts to which a third shift was added in October. At this time several gangs were also used for repair work in the level drifts on the third shift.

(2) Detail of Stoping:

Subs Above the 9th Level

Negaunee Lease - No. 1 Shaft Pillar

The last remaining ore area above the 9th Level is located south of the main dividing dike and approximately 200 feet northwest of the old No. 1 Shaft. This pillar was originally left to support this shaft many years ago at the time it was being used actively. The southeast footwall dips through the shaft toward the northwest and reduces the size of the sub-level ore body outline by approximately 30 feet on successive sub-levels.

Early in January mining operations were underway on the 673' Sub-level by three mining contracts. At that time several small pillars remained to be mined and late in February the 663' Sub-level was opened to mining. The actual size of the ore on this sub-level was approximately 300 feet by 80 feet adjacent to the dike on the north and old workings to the west. At this elevation the footwall was paralleled by the connecting drifts with the result that all mining was carried on to the northwest. In general the mining operations were very favorable and despite old wood which remained from the old stoping operations, practically 100% extraction resulted.

In May the 653' Sub-level was opened for mining and two of the three raises were approximately 20 feet in the footwall. The actual size of this sub-level was reduced to an area 200 feet by 80 feet. The comparative size of this area with that above showed a flattening of the footwall near the southwest end of

7. UNDERGROUND: (CONT.)

c. Stoping: (Continued)

(2) Detail of Stoping: (Cont.)

ore body, cutting the ore in such a way as to elongate the ore deposit adjacent to the dividing dike. As mining operations progressed it was quite evident that the remaining ore on subsequent sub-levels could only accommodate one mining contract, which would be located approximately 30 feet south of the dike which runs in an east-west direction.

In September, in an effort to partially offset the loss of production from three contracts it was decided to adopt the sub-level caving mining method by moving down 29 feet in No. 900 Raise. This would allow approximately 19 feet of pillar to be caved along the footwall to the south and the dike to the north. Near the end of the year about three-quarters of this area (150 x 40) had been mined and as evidenced from the driving of the original caving drift it appeared that it would be possible to cave a second sub-level from the 9th Level elevation and below.

10th, 11th, 12th, & 13th Levels

There was no mining or ore produced on any of the above-mentioned levels. The on ly activity was that of repairing and maintaining the various traveling and ventilation connections between the 9th Level and 13th Level, a vertical distance of 400 feet.

Subs Above the 14th Level

In January two mining contracts were completing operation s on the 170' Sub-level in the central portion of the main ore body north of the dividing dike and adjacent to the boundary of the South Shore Right of Way. This area is in the form of a triangle with the base lying on the boundary where the ore extends approximately 500 feet with a maximum thickness of about 150 feet. The footwall to the west dips approximately 18 degrees and is very irregular due to the intrusion of a large horse of jasper at the extreme northwest end. This sub-level was completed during the early part of February at which time the two contracts moved to the 150' Sub-level where mining was resumed. Two contracts were already mining at this elevation from Raises 1480 and 1433. The opening of the sub for the above-mentioned two contracts which were located at Raises 1430 and 1443 made a total of four contracts at this elevation. During the course of mining in the northwest portion of this area there was an overlapping into the South Shore Right of Way as well as Maas Parcels 2 and 3.

Due to the loss by caving of No. 1432 Raise it was necessary at the 150' elevation as well as below, to drive a 60-foot transfer drift from No. 1433 Raise. This transfer in all cases was on the sub-level below. At the southwest end of the drift a top timber raise was cut and timbered and slicing was then carried on in the usual manner. This transfer drift eliminated exceptionally long pulls as well as speeding up the mining of these sub-levels which have always lagged behind the main mining sub-level. This lag has been caused by the fact that this central area has remained approximately the same size for a number of sub-levels due to the fact that the main dividing dike is practically vertical as are the Maas Mine workings to the northwest adjacent to the boundary.

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7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

In August mining operations were started on the 140' Sub-level in the central Negaunee ore body where again four contracts were located. At this elevation the extreme northeast end had been cut off by the footwall as well as the large jasper intrusion and the area was approximately 300 feet by 200 feet, extending into the Maas Area and the South Shore Right of Way. The transfer of ore was again carried on by the above-mentioned contracts and operations were very successful. This area was well ventilated and very dry. Late in December the two contracts located on the south side were completing mining operations.

The 125' Sub-level was opened in August by two contracts located at Raises 1480 and 1433. The former commenced mining adjacent to the caved area in the Maas Lease and continued mining to the south and east in Parcels 2 and 3 and the South Shore Right of Way. The contract located at No. 1433 Raise completed a connecting drift to No. 1430 Raise to allow a third contract to commence mining operations. At the present time it is anticipated that the new raise will be extended into this area from the new 1440 Crosscut to take the place of No. 1430 Raise, which is now located in the footwall at the 125' elevation.

In the small triangular shaped ore body just south of the central mining area mentioned above, mining operations were underway on the 160' Sub-level in January. This ore body is troughlike in shape and is cut off by a small cross dike on the west side. Therefore the area is entirely bounded by dikes and is located in the mainddike split above the 1440 Crosscut. At the 160' elevation the area is approximately 180 feet long and 50 feet wide. Mining operations were completed in April and continued on the 140' Sub-level. At this point there was a slight reduction in size at the east end or apex of the triangular shape which was cut off by lean ore. During the course of mining it was evident that the ore was cut off by the flattening footwall at the lower elevations, thus the area was completed in September.

Southwest Ore Body Between Main Dikes

South Shore Right of Way

Mining operations were continued in the small ore body above the northwest end of the 1460 Crosscut. This area is located between a split in the main dike which divides the stoping and slicing territories. The ore lies almost within the bounds of the South Shore Right of Way adjacent to old workings along the Maas Mine Boundary and cut off on the north side by a small cross dike. It is approximately 160 feet in length by 50 feet in width. It might be added that this is the only ore which extends below the 14th Level in the Negaunee Lease. Slicing operations were continued in this southwest ore body on the 115' Sub-level. At that time the north portion of the ore body was being mined by the top slicing method. Operations were completed in March and further mining was temporarily abandoned. In May it was decided to use the sub-level caving method which would mine the area more rapidly as well as resulting in greater production. A cutout was made on the 85' elevation just above the top of the level crosscut. A drift was then driven 145 feet parallel to the dike to the jasper capping. The 18 foot pillar above the drift was then caved to within 20 feet of the raise location and thereafter slices were extended west and caving started toward the raise. In August mining operations were temporarily stopped to allow further development by this mining contract in the Maas Lease.

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7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Main Ore Body - Maas Lease

This territory comprises an area approximately 250 feet in width by 350 feet in length lying between the original Negaunee boundary and the Maas Mine. The southwest boundary lies along the old Maas workings approximately 300 feet northeast of the southwest end of the Maas Area. The ore to the northeast is bounded by the lean ore and slate footwall which dips irregularly to the southwest at approximately 13 degrees. For each 12-foot sub-level the ore body is reduced in size by about 60 feet, although locally the reduction may be considerably less. The Maas Area is served by the 1420 and 1430 Crosscuts.

In January eight contracts were engaged in mining operations as compared with an average of twelve during 1946. Early in the year mining was being carried on on the 140' Sub-level at which time several small pillars remained to be mined. Early in February several raises were timbered preparatory to continuing operations on the 125' Sub-level or about 50 feet above the floor of the main 14th Level Crosscuts. In July two mining contracts were moved from this area due to the completion of mining above the 1420 Crosscut raises. The abandonment of this drift also cut off the main ventilation connections with the Maas Mine and it was then necessary to install a booster fan in the 1420 Crosscut, rerouting the air to the Maas Mine through the 1410 Crosscut. It should be added that with the exception of a small portion of ore in the South Shore Right of Way this northwest ore body lies wholly within the bounds of the Maas Area.

In August mining operations were continued on the 115' Sub-level with the mining area reduced to a pproximately 250 feet by 250 feet. The total number of mining contracts was reduced to five although it was possible on one occasion to use two gangs at one raise during the mining of a portion of the ore body. This active sub-level was slightly below the original Maas Mine 4th Level development which was in use just prior to the time the Maas Area was leased to the Negaunee Mine. These drifts interfered in only a slight way as far as mining was concerned and had originally given the exact bounds of the north and east ore outlines.

In December mining operations were completed on the 115' Sub-level at No. 1439 Raise and contract 23 moved to the 100' elevation. A short time after contract 36, located at No. 1438 Raise, also moved to the new sub-level where a connecting drift was completed between raises 1439 and 1438. Contract 37 advanced two slices toward the northwest boundary and was in the process of caving several small pillars near the end of the month. Contract 30 continued slicing toward the east footwall from No. 1435 Raise with several slices being extended into the South Shore Right of Way. Contract 15 completed a long slice to a mining limit northwest of No. 1434 Raise near the middle of December and thereafter commenced slicing to the west toward old workings. The 100' Sub-level, which was opened to mining in December, is 23 feet above the floor of the original drift or main level. At this short distance timber repairs are extremely important and it is necessary to carry on considerable repair work during the third or midnite shift. The raise capacity amounts to three cars, with the result that the mining contracts require considerably more service from the trammers than heretofore. As a result of this it is practically impossible to repair during the day or afternoon shifts.

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Southwest Portion of the Maas Area

At the time the Maas Lease was turned over to the Negaunee Mine a southwest part of the strip had been mined to an elevation of 136, or 61 feet above the 14th Level. To the north and west in the Maas Mine mining operations were continued below this elevation with the result that considerable weight was found when development was started in this pillar which is 250 feet in width and 300 feet in length. Early in the year mining was carried on from No. 1481 Raise to the north and south and by continuous timbering and repairing the results were satisfactory. In May a drift was extended to the north approximately 120 feet and caved to the south in an effort to drain a small amount of water which was entering the slicing operations to the north. In June the main level drift could no longer be repaired and a portion of it was abandoned. A new crosscut was then turned off and directed to the northwest to mine a small area adjacent to the boundary. After the drift had been advanced approximately 170 feet a breakdown occurred near the property line and a portion of the drift was blocked off by a timber bulkhead. The back and sides were caved to recover as much ore as possible and a second timber pillar was installed. In November a small raise was extended to the 90' Sub-level or approximately five feet above the back of the level drift and operations were started toward caving an additional area in the central part of this southwest Maas ore body. Near the end of December this drift had been advanced 110 feet and indications were that a fair recovery could be made.

In May a new crosscut was started between raises 1441 and 1443 and directed toward the northwest Maas boundary. This drift was advanced approximately 350 feet and cutouts were made just above the timber in an effort to mine the ore adjacent to the boundary. In less than one month after continuous repairs (3 shifts per day) to the level timber, operations were temporarily given up and it was decided to drive a drift immediately over the level timber in an effort to reduce the pressure. This operation was only partly successful as the sides and bottom continued to push in and up. By the end of December two contracts were located above the drift. In general conditions were very poor and it is quite evident that further mining may have to be carried on by driving a level drift and caving the pillar above.

In the extreme southwest portion of the Maas Area adjacent to the old workings to the northwest and south, caving operations were carried on by three top timber drifts from a branch crosscut which was driven in the latter months of 1946. A considerable area was mined despite the extreme weight and excessive repairs. These operation s were completed in April and the area was abandoned for the remainder of the year.

Negaunee Mine Lease

Sub-level Stoping Area South of the Main Dike

The sub-level stoping area is located south of the main Negaunee ore body and adjacent to the dividing dike. The ore is in the shape of a trough extending from a point just above the 13th Level elevation southwest to the extreme end of the 1470 Crosscut at the 14th Leveleelevation. The total distance is approximately 1,000 feet with the ore occurring irregularly from 30 feet in height to 80 feet

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7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

in the central portion. It might be added that the footwall on the south side of the trough is extremely irregular, being cut up by dikes in the central portion where the ore has made into the footwall as much as 160 feet from its normal location. In January three stopes were being developed. The largest and most productive was being developed from the 125' Sub-level at No. 1472 Raise. This development was completed in February and stoping operations were immediately started on the various sub-levels between the transfer (125' Sub-level) and the 13th Level (195). During the next six months approximately 60,000 tons of ore were mined. The ore continued to make toward the east and the actual capping was finally encountered at an elevation of approximately 220. During the course of mining about 10 feet of ore was allowed to remain against the main dike to prevent its sloughing off and diluting the product. As mining operations were about completed this ore and the dike commenced caving and it was necessary to carry on further mining in several small remaining pillars to the southwest. In August a cutout was made in 1472 Raise at the 100' elevation to explore the possibility of the ore extending downward along the south side of the dividing dike. A test drift gave favorable results and development and stoping were continued at this elevation from a cross transfer which ran parallel to the dike from a right angle drift north of the raise. One small stope southwest of the transfer was completed in November and a second transfer was driven to the northeast to mine the triangular pillar adjacent to the dike under the old caved stope. By the end of December stoping operations were just being started and it is anticipated that the final product will amount to approximately 85,000 tons when stoping has been completed.

Earlier in the year several transfers were driven under small remaining pillars between stopes near raises 1473-74-75. The recovery from each operation or scram stope was very good and has been largely responsible for the continued high production at times when the slicing area was being reduced.

In July a transfer drift was drivennon the 150' Sub-level west of No. 1401 Raise which is located in the extreme east end of the stoping ore body. This area was originally intersected by the 1310 Crosscut on the 13th Level which was driven through approximately 45 feet of ore before encountering the main dividing dike. At the time the ore body appeared to be approximately 100 feet in length with its greatest vertical height to the west pinching out as the capping and footwall came together twoard the east. The stoping of this ore body was considerably less produc tive as compared with the large stope mentioned above due to the fact that all development was in rock in a relatively shallow ore body. Stoping operations were started near the end of September and continued through Decemb er. A portion of the mining was done west of the 13th Level Crosscut while the remaining was carried on to the east, thus allowing the level to remain intact as a traveling and ventilation drift.

In July development a nd exploration work was started at the extreme west end of the 1470 Crosscut just above the level elevation. A small drift was driven parallel with the level drift on the 90' Sub-level and in general the results were somewhat disappointing. Stoping operations were started by mining from the level and scraping the ore directly into cars. As this operation continued it appeared that the ore extended to the north at higher elevations. In October additional development indicated that the ore tied in with a small ore body adjacent to the Maas Mine in that property despite a cross dike which intersected the ore. In November it was decided to drive a new crosscut north of the 1470 drift and underneath the ore in an effort to facilitate the loading of the ore as well as to avoid an additional transfer. Near the end of the year this drift was being advanced.

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7. UNDERGROUND: (CONT.)

d. Timbering:

The tot al cost of timbering increased 33% in 1947 and the cost per ton .039, or 7.1%. The large increase was due to the gradual rise in the cost of stull timber, cribbing, lagging and poles as well as the raise of .12-1/2 per hour in wages. At least 60% of all repair work was carried on on the 14th Level in the various crosscuts and raises in the ore body. A portion of this expense was also incurred by the constant repair work necessary to the ventilation and traveling drifts and raises from the No. 2 Shaft to the 14th Level. In most cases where repairing was necessary in these drifts, 60 pound rail sets were installed due to their added strength as well as permanency.

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7. UNDERGROUND: (CONT.)

d. Timbering: (Cont.)

Statement of Timber Used:

	Lineal Feet	Avg. Price Per Foot	Amount 1947	Amount 1946
6" to 8" Cribbing	28,147	.0630	1,774.65	2,291.13
8" Stulls	52,690	.1121	5,906.20	4,751.12
10" "	69,722	.1699	11,846.94	10,604.09
12" " & Over	54,955	.2480	13,627.85	11,752.29
Total 1947	205,514	.1613	33,155.64	29,398.63
Lagging - 7 ft.	1,285,272	.0147	18,987.07	13,775.36
Poles - 9½ ft.	862,259	.0227	19,548.78	14,090.65
Total 1947	2,148,531	.0179	38,535.85	27,866.01
H Beams - 10' & 12'	1,984	.3781	750.32	735.34
Grand Total 1947			72,441.81	57,999.98

	1947	1946
Product - Tons	518,387	416,021
Feet Timber per Ton of Ore	.396	.520
Feet Lagging per Ton of Ore	2.481	2.332
Feet Poles per Ton of Ore	1.663	1.558
Feet Lagging per Foot of Timber	6.259	4.488
Feet H Beams per Ton of Ore	.0038	.0059
Cost per Ton for Timber	.0640	.0707
Cost per Ton for Lagging	.0366	.0331
Cost per Ton for Poles	.0377	.0338
Cost per Ton for H Beams	.0015	.0018
Total Cost per Ton	.1398	.1394

Total Cost for Timber, Lagging, Poles, Etc.

Year	Product	Amount	Cost Per Ton
1947	518,387	72,441.81	.1398
1946	416,021	57,999.98	.1394
1945	654,447	92,266.50	.1409
1944	757,677	108,489.21	.1431
1943	954,990	129,718.86	.1358
1942	1,106,694	123,588.82	.1117
1941	1,033,280	96,802.32	.0937

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7. UNDERGROUND: (CONT.)

e. Drifting and Raising:

This subject is discussed in detail under the development heading.

f. Explosives, Drilling and Blasting:

The total cost of all explosives increased about one cent per ton during 1947. This was due to the increased cost of powder, fuse and caps. In general, there was no particular change in mining conditions or the nature of the ore. The continued use of Hercomite XX has no doubt effected a slight reduction, although the present cost of this powder has increased seventy-eight cents per hundred pounds in the last year. During 1947 a considerable amount of Primacord was used in stoping operations where a number of long holes were blasted simultaneously. This would have a slightly increasing effect on the total cost per ton for all explosives. Near the middle of the year it was decided by the Central Safety Committee to increase the length of blasting fuse from seven feet to eight feet. This also had an effect in increasing the cost of explosives.

As shown in the following table there was a slight increase in the fractional pounds of powder used per ton of ore. This may well be the result of the greater use of Hercomite XX as compared with Gelamite #1, the latter being somewhat stronger. It should also be noted that the ratio in the consumption of Gelamite #1 as compared to Hercomite XX was approximately 1 to 4. In most cases where development in rock or ore was being carried on, Gelamite #1 was used.

In 1947 there were 177 blasting inspections made on an average of 21 contracts of four men each. These reports serve as a check on the use of powder and the practice of blasting as well as the handling of explosives. It might be added that these reports as well as their effect on the miners, have greatly reduced accidents resulting from misuse of explosives and general practice.

With reference to blasting, the Negaunee Mine has never had a definite blasting period and all contract miners have been allowed to blast at any time during the shift. The reason for this is that in general the ventilation has been exceptionally good and a minimum of delay has resulted from nearby contracts being effected by blasting smoke. This practice also tends to distribute the tramming of ore throughout the shift to a greater convenience for all concerned.

The general drilling practice has remained the same for a number of years. Considerable improvement has been made in the quality of auger steel to such an extent that breakage is well below previous years. This has been accomplished by the manufacturers lengthening the twist which not only increased the speed of drilling but adds greatly to the strength of the drill steel.

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7. UNDERGROUND: (CONT.)

f. Explosives, Drilling and Blasting: (Cont.)

The following statement gives a comparison of powder costs, etc. for the past six years:

Year	Cost per lb. for Powder	Lbs. Powder per Tons of Ore	Cost Per Ton For Powder	Cost per Ton Fuse & Caps	Total Cost
1947	.1359	.4415	.0600	.0133	.0733
1946	.1245	.4222	.0526	.0111	.0637
1945	.1150	.4346	.0500	.0100	.0600
1944	.1150	.4723	.0543	.0107	.0650
1943	.1150	.4918	.0566	.0115	.0681
1942	.1150	.4788	.0551	.0117	.0668

Statement of Explosives Used: (Ore Development & Stoping)

	Quantity	Average Price	Amount 1947	Amount 1946
Gelamite #1	50,050	14.18	7,095.06	5,470.75
Hercomit e XX	178,800	13.43	24,016.95	16,404.25
Total Powder 1947	228,850	13.59	31,112.01	21,875.00
Fuse - Feet	780,954	6.47	5,050.26	3,362.35
#6 Blasting Caps	98,492	13.70	1,349.33	1,050.68
Tamping Shells	13,300	6.32	84.12	98.40
Fuse Lighters	20,400	6.75	137.74	118.16
Primacord - Feet	8,000	32.00	256.00	------
Total Fuse, Etc. 1947			6,877.45	4,629.59
Total Cost All Explosives:			37,989.46	26,504.59
Product - Tons			518,387	416,021
Pounds Powder per Ton of Ore			.4415	.4222
Cost per Ton for Powder			.0600	.0526
Cost per Ton for Fuse, Caps, Etc.			.0133	.0111
Cost per Ton for All Explosives			.0733	.0637

Sinking, Rock Development, Etc.:

Gelamite #1	9,100	14.72	1,339.88	647.50
Hercomite XX	3,850	12.27	472.50	322.00
60% Gelatin				303.75
Total Powder 1947	12,950	14.00	1,812.38	1,273.25
Fuse Feet	35,780	6.49	232.31	166.32
#6 Blasting Caps	4,275	13.70	58.56	72.17
Total Fuse, Etc., 1947			290.87	238.49
Total Cost All Explosives 1947 Rock Development			2,103.25	1,511.74
Grand Total All Explosives Used 1947			40,092.71	28,016.33
Average Price per Pound for Powder 1947			.136	.125
Explosives Used for Stoping & Development			40,092.71	28,016.33
Explosives Used for Other Work			243.79	46.10
Total as per Cost Sheet			40,336.50	28,062.43

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7. UNDERGROUND: (CONT.)

g. Mining and Loading:

Throughout 1947 three mining methods were used, although the principal one continued to be top slicing. The production for the year resulted 70% from top slicing, 24% from sub-level stoping and 6% from sub-level caving. These methods lend themselves very well to the mining of different small ore bodies with variable conditions. During the coming year and throughout the mining of the remaining ore in the Negaunee Mine, it is likely that the greater portion of the product will come from top slicing and caving.

With the exception of a few cases all ore was loaded from raises or chutes directly into the cars with a minimum of transfers. During the past several years the tendency has been toward the elimination of individual chutes being replaced by transfers immediately above the level timber from which the mining raises a re extended. This method, while somewhat safer, complicates the hoisting of timber into the various working places. It also creates an unsatisfactory condition where several mining areas are wet and the ore becomes saturated with water in the transfer. Inasmuch as all known ore bodies have been developed by cribbed raises from level crosscuts, the transfer system of loading is rarely used.

h. Ventilation:

The aerodyne fan which was put into operation at No. 2 Shaft in 1942 was operated continuously during the past year. Minor mechanical and electrical repairs were made during 1947 to improve the heating plant and the automatic temperature controls. The general ventilation system has for the most part remain ed unchanged as far as the Negaunee and Maas Mines are concerned. The heating plant on the average has been used approximately four months, December through March, of each season and has operated satisfactorily. During extremely cold weather there has been some accumulation of ice in the shaft but at no time was this serious nor did it impede the passage of air through the shaft to any great extent. Semi-annual inspections by the safety and engineering departments continue to show good results in the ventilation of the two mines. The last report indicated an intake flow of slightly over 90,000 cubic feet per minute, which is relatively high considering the large number of drifts and raises of irregular size through which the air must pass. During 1946 two completely independent airways in rock were completed from the 13th Level to the 9th Level, a distance of 401 feet. These drifts and raises were kept in good repair throughout the year and were inspected once every two weeks. These inspections frequently brought to light minor necessary repairs and where possible steel rails or 4-inch I beams were used in supporting loose or slabby ground which had previously resulted in timber failures through deterioration.

As mining operations approached the 14th Level the problem of ventilation became considerably more favorable. It is on this level that there are two main connections with the adjoining Maas Mine. During the entire year two auxiliary fans were in continuous use on the 13th and 14th Levels to increase the flow of air into the various segregated mining areas. In many instances small, 5,000 cubic feet per minute auxiliary fans were used in either moving air on the sub-level or directing air from the level to the sub-level by means of canvas tubing. In general and despite the concentration of mining contracts in a comparatively small area above the 14th Level the ventilation has been exceptionally good.

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7. UNDERGROUND: (CONT.)

i. Pumping:

The number of gallons pumped per minute in each month of the year for the past four years are shown in the following statement:

Month	1947	1946	1945	1944
January	659	677	629	740
February	633	664	631	712
March	631	665	634	690
April	653	679	570	673
May	710	689	775	679
June	811	731	712	787
July	818	711	720	804
August	814	695	722	805
September	816	698	717	732
Octob er	807	680	696	654
November	792	664	685	642
December	792	632	684	634
Total Average	745	682	681	713

As indicated by the above table there was an increase of 63 gallons per minute average throughout 1947. This increase started in May at which time the surface water from the spring breakup was entering the mine. This condition is likely a returning of the high level cycle which was evident in 1943 during the same monthly period. The inflow of water on the 9th Level increased from 350 gallons per minute during last year to 410 gallons per minute in 1947. For the most part the other levels remained approximately the same, although a slight increase was noted on the 14th Level where a portion of the water formerly entering the Maas Mine was diverted due to continuing mining in the area under lease b y the Negaunee Mine.

In October the two large storage sumps on the 12th Level were cleaned of all accumulated mud with the result that the storage capacity increased well over 100%. The pumping equipment performed very satisfactorily with no breakdowns or delays during pumping operations throughout the year.

The following statement shows the average number of gallons pumped per minute for the past ten years:

Year	Gallons per Minute
1947	745
1946682	682
1945	681
1944	713
1943	770
1942	656
1941	645
1940	714
1939	1,015
1938	1,015

8. COST OF OPERATING: (CONT.)
b. Detailed Cost Comparison: (Cont.)
(7) Detail of Accounts:

		1947		1946		Increase Or
	UNDERGROUND COSTS:	Amount	Per Ton	Amount	Per Ton	Decrease
1	Exploring in Mine	570.55	.001	5,072.51	.013	.014
3	Development in Rock	12,044.23	.023	11,637.52	.028	.005
4	Development in Ore	37,417.66	.072	25,340.06	.061	.011
5	Stoping	282,290.76	.545	214,308.93	.515	.030
6	Timbering	317,976.24	.613	238,754.17	.574	.039
7	Tramming	84,591.18	.163	62,384.12	.150	.013
8	Ventilation	16,413.89	.032	12,175.91	.029	.003
9	Pumping	41,395.73	.080	26,851.31	.065	.015
10	Compressors & Air Pipes	35,044.38	.068	23,920.81	.057	.011
12	Underground Superintendence	38,784,90	.075	23,866.92	.057	.018
13	Cave-in	79.83		42.13		
14	Maint: Comp. & Power Drills	1,598.63	.003	705.22	.002	.001
15	Scraper Equipment	17,754.62	.034	12,041.32	.029	.005
16	Elec. Tram Equipt.	18,647.19	.036	15,472.29	.037	.001
17	Pumping Machinery	1,598.62	.003	2,047.47	.005	.002
	Total Underground Costs	905,067.31	1.746	674,620.69	1.622	.124
	SURFACE COSTS:					
18	Hoisting	39,809.09	.077	27,241.22	.065	.012
19	Stocking Ore	12,989.83	.025	6,544.74	.016	.009
21	Dry House	11,378.45	.022	10,974.80	.026	.004
22	General Surface Expense	15,282.62	.029	10,591.38	.026	.003
23	Maint: Hoisting Equipt.	6,843.99	.013	4,354.23	.011	.002
24	Shaft	5,659.91	.011	2,963.74	.007	.004
25	Top Tram Equipt.	3,208.98	.006	1,194.22	.003	.003
26	Docks,Trestles,Pockets	645.41	.001	953.00	.002	.001
27	Mine Buildings	1,329.15	.003	3,069.14	.007	.004
	Total Surface Costs	97,147.43	.187	67,886.47	.163	.024
	GENERAL MINE EXPENSES:					
	Employees' Vacation Pay	37,346.76	.072	26,201.90	.063	.009
28	Insurance	7,770.77	.015	3,440.50	.008	.007
	Geological	583.77	.001			.001
29	Mining Engineering	3,568.58	.007	2,642.30	.006	.001
30	Mech. & Elec. Engineering	3,256.98	.006	1,667.65	.004	.002
31	Analysis & Grading	18,154.85	.035	11,526.44	.028	.007
32	Personal Injury	20,960.42	.041	11,955.94	.029	.012
33	Safety Department	2,208.82	.004	1,677.62	.004	
34	Tel. & Safety Devices	5,732.26	.011	4,578.03	.011	
35	Local & General Welfare	3,550.14	.007	2,503.87	.005	.002
36	Spec. Exp., Pensions, All.	5,452.71	.011	5,272.40	.013	.002
37	Ishpeming Office	19,387.26	.037	15,575.21	.037	
38	Soc. Sec. & Group Annuity	17,662.56	.034	13,235.98	.032	.002
39	Mine Office	22,100.06	.043	15,625.51	.038	.005
	Total General Mine Expenses	167,735.94	.324	115,903.35	.278	.046
	COST OF PRODUCTION:	1,169,950.68	2.257	858,410.51	2.063	.194
	Taxes	58,438.52	.113	48,066.75	.116	.003

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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

UNDERGROUND COSTS:

1. Exploring in Mine:

There was no exploratory work by diamond drilling during 1947. The red figure shown in this account resulted from salvage of Bortz bits.

3. Development in Rock:

This account shows an increase of $406.71. In 1947 there were 1,164 feet of rock work compared with 985 feet in 1946.

4. Development in Ore:

Increase of $12,097.60 due to more development work in 1947 on account of min e being idle during the strike in 1946.

5. Stoping:

Expenditures increased $67,981.83. In 1947 there were 15,950 shifts as compared with 14,365 shifts in 1946. Tonnage produced in 1947 was 518,387 tons as compared with 416,021 tons in 1946.

6. Timbering:

Expenditures increased $79,222.07. Four pickhammers, $550.00, charged out in 1947. Mine idle during strike period in 1946.

7. Tramming:

Expenditures increased $22,207.06, due to larger tonnage trammed and more shifts worked in 1947.

8. Ventilation:

Expenditures increased $4,237.98. Electric current increased $1,744.64.

9. Pumping:

Expenditures increased $14,544.42. Electric Current increased $7,261.55.

Number of gallong pumped - 1947	390,741,304
Number of gallons pumped - 1946	279,835,161
Increase	110,906,143

Avg. No. gallons per minute - 1947	745
Avg. No. gallons per minute - 1946	682
Increase	63

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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

10. Compressors & Air Pipes:

Expenditures increased $11,123.57. Electric current increased $6,625.93.

Cubic feet air compressed - 1947	717,300,000
- 1946	518,406,000
Increase	198,894,000

12. Underground Superintendence:

Expenditures increased $14,917.98.

14 Compressors & Power Drills:

Expenditures increased 893.41 due to repairing inter-cooler and valve, seats an d springs for Ingersoll-Rand compressor.

15. Scraper Equipment:

Expenditures increased $5,713.30. Increase in wire rope used $5,367.05, also increase in repairs to hoists and drags.

16. Electric Tram Equipment:

Expenditures increased $3,174.90.

	1947	1946	Increase	Decrease
Generator	246.05	11.94	234.11	
Locomotives	5424.12	5690.54		266.42
Wiring	1229.40	1406.47		177.07
Tracks	9405.11	5840.36	3564.75	
Cars	2342.51	2522.98		180.47
Total	18647.19	15472.29	3174.90	

17. Pumping Machinery:

Expenditures decreased $448.85. Less Repairs to pumps.

SURFACE COSTS:

23. Hoisting Equipment:

Expenditures increased $2,489.76.

	1947	1946	Increase
Electric Hoists	1630.73	1113.06	517.67
Wire Rope	3208.59	1519.38	1689.21
Skips, Cages, Skip Roads	2004.67	1721.79	282.88
Total	6843.99	4354.23	2489.76

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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

25. Top Tram Equipment:

Expenditures increased $2,014.76.

	1947	1946	Increase	Decrease
Engine & Motors	7.63	16.26		8.63
Tracks & Cars	610.01	277.16	332.85	
Wire Rope	1988.07	576.16	1411.91	
Sheaves, Rollers, Etc.	603.27	324.64	278.63	
Total	3208.98	1194.22	2014.76	

26. Docks, Trestles & Pockets:

Expenditures decreased $307.59 due to the steel stocking trestle being painted in 1945.

27. Mine Buildings:

Expenditures decreased $1,739.99.

	1947	1946	Increase	Decrease
Office	25.10	1457.57		1432.47
Shops	117.51	333.12		215.61
Shaft House	57.91	147.92		90.01
Engine House	72.49	212.22		139.73
Dry House	529.62	467.01	62.61	
Coal Dock & Trestle	141.83		141.83	
Timber Tunnel	70.69	63.16	7.53	
Garage	72.53		72.53	
Miscellaneous	241.47	388.14		146.67
Total	1329.15	3069.14		1739.99

GENERAL MINE EXPENSES:

Employees' Vacation Pay:

Amount charged to operating mine was $37,346.76, an increase of $3,624.86 over 1946. Employees with a record of one year or more of continuous service were eligible for one week's vacation pay, employees with a record of five or more years of continuous service were eligible for two weeks' vacation pay, and employees with a record of twenty-five or more years of continuous service were eligible for three weeks' vacation pay. Employees were paid for forty-eight hours per week. Thirty-four employees received one week's pay, one hundred seventy-six two weeks' pay, and fifty-five three weeks' pay, a total of two hundred sixty-five employees receiving vacation pay.

28. Insurance:

	1947	1946	Increase	Decrease
Property	2165.71	1452.80	712.91	
Group - Health & Life	4643.19	1578.82	3064.37	
Group Annuity	738.35	469.00	269.35	
Catastrophe	223.52	408.88		185.36
Total	7770.77	3909.50	3861.27	

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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

31. Analysis & Grading:

	1947	1946	Increase
Ishpeming Laboratory Charges	12779.22	8076.55	4702.67
Shipping Department Expense	2563.00	2076.58	486.42
Mine Sampling	2812.63	1373.31	1439.32
Total	18154.85	11526.44	6628.41

32. Personal Injury:

	1947	1946	Increase
Compensation & Doctors	13511.89	7523.33	5988.56
Compensation Department	779.48	584.86	194.62
Hospital Loss	6669.05	3847.75	2821.30
Total	20960.42	11955.94	9004.48

35. Local & General Welfare:

	1947	1946	Increase	Decrease
General Welfare	2828.24	1984.46	843.78	
Local Welfare	721.90	519.41	202.49	
Total	3550.14	2503.87	1046.27	

36. Special Expense, Pensions & Allowances:

	1947	1946	Increase	Decrease
Pensions	426.92	474.90		47.98
Retirements	3227.64	2366.79	860.85	
Legal	375.97	1008.21		632.24
Examinations	350.00	368.50		18.50
Employment Office	748.81	573.13	175.68	
Other	323.37	480.87		157.50
Total	5452.71	5272.40	180.31	

37. Ishpeming Office:

Expenditures increased $3,812.05 as compared with 1946.

38. Social Security Taxes:

Unemployment Insurance Tax	10017.57	7215.84	2801.73
Old Age Benefit Tax	7644.99	5551.14	2093.85
Total	17662.56	12766.98	4895.58

39. Mine Office:

Mine Office	14021.39	9722.18	4299.21
Superintendence	5516.35	3553.70	1962.65
Central Warehouse	2562.32	2349.63	212.69
Total	22100.06	15625.51	6474.55

Amount charged to idle expense in 1946 was $5,055.86.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

There were no diamond drilling explorations carried on during 1947 and no future explorations are anticipated inasmuch as all known ore bodies have been explored and developed.

10. TAXES:

Following is a comparative statement of taxes for 1947 and 1946:

	1947		1946	
Description	Valuation	Taxes	Valuation	Taxes
Negaunee Mine - Real Estate	565,000	25,010.52	1,265,000	55,841.27
Personal Property	760,000	33,642.46	400,000	17,657.32
Collection Fees		586.53		734.99
Total Negaunee Mine	1,325,000	59,239.51	1,665,000	74,233.58
Other Negaunee Description, incl. fee				
Jackson - Section 1, 47-27	550,000	24,589.98	500,000	22,292.37
Oprtg. Negaunee Rented Bldgs.	8,975	401.26	5,260	234.52
Total	558,975	24,991.24	505,260	22,526.89
TOTAL CITY OF NEGAUNEE	1,883,975	84,230.75	2,170,260	96,760.47
CITY OF ISHPEMING				
Mather Mine - Real Estate	1,875,000	67,137.56	1,615,000	57,999.50
Personal Property	765,000	27,392.13	385,000	13,826.51
Pipe Line "Cloverdale Tract"	250	8.95	350	12.57
TOTAL CITY OF ISHPEMING	2,640,250	94,538.64	2,000,350	71,838.58
TOTAL NEGAUNEE MINE COMPANY	4,524,225	178,769.39	4,170,610	168,599.05
DISTRIBUTION BY ACCOUNTS				
Operating Negaunee Mine	1,325,000	59,239.51	1,665,000	74,233.58
Operating Mather Mine				
Mather Mine "A"	2,640,250	94,538.64	2,000,350	71,838.58
Jackson, Sec 1,47-27 "B"	550,000	24,589.98	500,000	22,292.37
Total Oprtg. Mather Mines	3,190,250	119,128.62	2,500,350	94,130.95
Oprtg. Negaunee Rented Bldgs.	8,975	401.26	5,260	234.52
TOTAL NEGAUNEE MINE COMPANY	4,524,225	178,769.39	4,170,610	168,599.05
DETAIL NEGAUNEE RENTED BUILDINGS				
No 1 Jackson Off. Lot 30 W.Iron St.	665	29.44	665	29.36
No 2 Penhale Hse. W½ Lot 30 Blk 4	855	37.85	855	37.74
No 3 Uren " " 3 " 7	950	42.05	950	41.94
No 4 Abbott " " 12 " 6	950	42.05	950	41.94
No 5 Toms " " 36 " 5	700	30.99	700	30.90
No 6 Portale " " 2 " 9	1,045	46.26		
No 7 Bowden " " 21 " 8	100	4.43		
No 8 Letcher " " 16 " 5	570	25.23		
No 9 Senobe " " 9 " 7	760	33.64		
No 10 Leaf " " 7 " 10	100	4.43		
No 11 Harris " " 4 " 8	1,140	50.46		
No 37 CCICo. 1st Add. " 7 " 2	1,140	50.46	1,140	50.32
Collection Fees		3.97		2.32
Total Rented Buildings	8,975	401.26	5,260	234.52

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11. ACCIDENTS AND PERSONAL INJURY:

The safety record for the Negaunee Mine in 1947 showed a slight improvement over that of the preceding year. The severity rate, which is the recognized basis for rating accidents, was comparable to that of 1946 despite the decided increase in the average a ge of employees. It might be mentioned that during the past year a vast majority of the transferees to the Mather Mine were younger men, with the result that as of December 31st, 1947, 32% of all employees were over 51 years of age. This amounts to a total of 73 men. This condition, despite the years of experience, has had a definite bearing on the safety record.

One of the greatest factors in improveing safety practices, as far as the writer is concerned, is the holding of monthly meetings for the supervisory force as well as periodic meetings for mine employees in various work classifications. At these meetings safety dealing with specific jobs can be brought out and frequently those in attendance contribute materially to improved safety practices.

During the past year with the gradual depletion of the ore reserves it has been neeessary to mine a number of small ore pockets by what is knows as the "scram" method. Oftentimes the miners are not accustomed to this type of mining and definite hazards are ever present. This condition together with the increased age of employees may well be the reason for the lack of greater improvement in 1947 as compared with 1946. The following statement lists the various compensable accidents for the past five years and indicates a substantial improvement since 1943:

	1947	1946	1945	1944	1943
Fatal	0	0	0	0	1
Time Lost - Over 4 Months	2	1	4	3	3
- 1 to 4 "	4	2	6	5	15
- Less than 1 Month	5	8	7	11	17
Total Compensable Accidents	11	11	17	19	36
No. of Cases paid compensation for accidents prior to Jan. 1, 1947	8	8	10	8	8
No. of cases being paid difference in wages (inc. in above total)	0	1	2	2	1

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

There was no new construction nor proposed new construction work in 1947.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. General:

As a result of several severe electrical storms in 1946 the large induction motor which drives the Ingersoll-Rand compressor was damaged to such an extent that seven coils have been cut out. Despite the standby Nordberg compressor, it was decided that the damaged motor should be re-wound. This motor has been in almost continuous use for over 20 years and its improvement will greatly relieve the possibility of a major delay. As mentioned in the 1946 annual report, a tie-in can be made with the Athens Mine in a comparatively short time by

13. EQUIPMENT AND PROPOSED EQUIPMENT: (CONT.)

a. General: (Cont.)

connecting a four-inch air line on the 11th Level to the Athens Mine air intake. In case of emergency a similar line can also be laid between the Maas and Negaunee Mines on the 13th or 14th Level.

Without major exception all large equipment operated very satisfactorily during the year and there were no delays resulting from failure of equipment.

There is no proposed new equipment during the coming year due to the gradual depletion of ore reserves. With reference to small, portable equipment connected with the mining of iron ore, a surplus has accumulated which in some cases has been scrapped and in others sold to other company mines.

b. Steam Shovels:

Throughout the shipping season two steam shovels were used intermittently in the stockpiles. These shovels, while very old, performed satisfactorily and will be used for the remaining life of the Negaunee Mine.

c. Scraper Hoists:

Following is a list of scraper hoists at the mine:

		1947			1946	
		Total Machines	Total Machines Repaired	Cost of Each Mach. Repaired	Total Machines Repaired	Cost of Each Mach. Repaired
I.R.	10 H.P. Elec.				1	44.14
	15 " "	7	4	238.96	4	252.20
	20 " "	12	--	----	--	----
	25 " "	2	--	----	--	----
Sul.	15 " "	10	1	42.44	1	408.43
	20 " "	1	--	----	--	----
	Total	32	5		6	
Total Cost repairs all scraper hoists:				998.28		1461.36

d. Underground Tram Cars:

All underground tram cars were serviced and repaired at the mine in 1947.

e. Drill Equipment:

There were 15 Ingersoll-Rand JB-4 Jackhammers purchased in 1947 for use late in 1948.

f. Haulage Tracks:

There were no ties or rail charged out in 1947.

g. Timber Hoists:

There were no timber hoists purchased during 1947.

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14. MAINTENANCE AND REPAIRS:

Expenditures for maintenance and repairs in the accounts listed under "Underground Costs" were $39,599.06 in 1947 as compared with $30,266.30 in 1946, an increase of $9,332.76. The cost per ton in 1947 was .076 as compared with .073 during 1946.

The following is a list of purchases and repair costs for 1947 & 1946:

	1947	1946	Increase	Decrease
91,174' Wire Rope - Scrapers	9924.19	4557.14	5367.05	
1 Worthington Pump	286.00	-----	286.00	
Total Purchases	10210.19	4557.14	5653.05	
Repairs to:				
Comp. & Power Drills	1598.63	705.22	893.41	
Scraper Hoists & Drags	7830.43	7484.18	346.25	
Generators	246.05	11.94	234.11	
Locomotives	5424.12	5690.54		266.54
Wiring	1229.40	1406.47		177.07
Tracks	9405.11	5840.36	3564.75	
Cars	2342.51	2522.98		180.47
Pumping Machinery	1312.62	2047.47		734.85
Total Repairs	29388.87	25709.16	3679.71	
Grand Total	39599.06	30266.30	9332.76	

Expenditures for maintenance and repairs in the accounts listed under "Surface Costs" amounted to $17,687.44 in 1947 as compared with $12,534.33 in 1946, an increase of $5,153.11. The cost per ton for 1947 was .034 as compared with .030 in 1946.

The following is a list of repair c osts for 1947 and 1946:

3 New Hoisting Ropes	3020.35	1371.46	1648.89	
Sheaves	188.24	157.54	30.70	
Repa irs to Hoists	1630.73	1113.06	517.67	
Repairs to Skips & Cages	2004.67	1712.17	292.50	
Repa irs to Shaft	5659.91	2963.74	2696.17	
Repairs to T.T. Motors	7.63	16.26		8.63
Repairs to Tracks & Cars	610.01	277.16	332.85	
Wire Rope, Sheaves & Rollers	2591.34	900.80	1690.54	
Repairs to Permanent Trestles	385.83	360.44	25.39	
Repairs to Pockets	259.58	592.56		332.98
Repairs to Mine Buildings	1329.15	3069.14		1739.99
Total Repairs	17687.44	12534.33	5153.11	

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15. POWER:

Following is a detail of electric current purchased in 1947 and 1946, the distribution of charges to various accounts and other data;

	1947 - 12 Months Optg.		1946 - 9 Months Optg.	
	Cost	Per Ton	Cost	Per Ton
Stoping	2880.00	.0056	2160.00	.0052
Timbering	120.00	.0002	90.00	.0002
Compressors	23241.19	.0448	16615.26	.0399
Ventilation	6131.70	.0118	4387.06	.0105
Pumping	24347.29	.0470	17085.74	.0412
Hoisting	20827.13	.0402	15401.37	.0370
Stocking Ore	125.98	.0002	128.42	.0003
Dry House Expense	1023.36	.0020	912.65	.0022
Tel. & Safety Devices	1380.00	.0027	1035.00	.0025
Mine Office	78.06	.0002	63.61	.0002
Electric Haulage	7380.75	.0142	6450.48	.0155
Shops	584.19	.0011	537.04	.0013
Dist. Carpenter Shop	.30	----	12.18	----
Surface Lighting	98.89	.0002	170.36	.0004
Total	88218.84	.1702	65049.17	.1564

Main Line Meter - K.W.	6,603,303	4,921,600
Separate Meter Readings	6,592,134	4,914,846
Line Loss - K. W.	11,169	6,754
Product - Tons	518,387	416,021
K.W. Per Ton -(Inc. Line Loss)	12.72	11.83
Cost Per K.W. (Avg. for Year)	.01428	.01419
15 Minute Demand (Avg. for Year)	1509	1519
Load Factor (Avg. for Year)	50%	50%

17 CONDITION OF PREMISES:

b. Negaunee Mine Houses:

During 1947 five additional were purchased by the Negaunee Mine Company in Section 1, south of the Mather Mine B Shaft location. Several of these required major repairs before they could be rented out. The present rent schedule has been increased and at the present time the rent is based on the number of rooms at from $4.00 to $5.00 per room depending on general conditions. As a result of this the houses have been kept in somewhat better condition.

The cost of repairs to all houses amounted to $4082.87 during the year and the revenue from rents $3,492.20.

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18. NATIONALITY OF EMPLOYEES:

The nationality record of employees is submitted in two forms, one as to parentage, the other as to country of birth:

As to Parentage:	1947	Percent	1946	Percent
Finnish	114	51.4	145	52.5
English	39	17.6	48	17.4
Italian	24	10.8	29	10.5
Swedish	20	9.0	22	8.1
French (Canadian)	11	5.0	18	6.5
Austrian	4	1.7	6	2.2
Norwegian	2	0.9	2	0.7
German	3	1.4	-	---
Danish	-	---	1	0.3
Belgian	3	1.4	2	0.7
Irish	1	0.4	1	0.3
Polish	1	0.4	2	0.7
Total	222	100.0	276	100.0

As to Birth:

	American Born		Foreign Born	
	1947	1946	1947	1946
Finnish	68	92	46	53
English	27	37	12	11
Italian	10	13	14	16
Swedish	15	17	5	5
French (Canadian)	10	17	1	1
Austrian	2	4	2	2
Norwegian	2	2	-	-
German	3	-	-	-
Danish	-	1	-	-
Belgian	3	2	-	-
Irish	1	1	-	-
Polish	1	2	-	-
Total	142	188	80	88

W. R. Atkins
supt

WRA/jl - 5
2/23/48

SPIES-VIRGIL MINE
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1. GENERAL

The production was 160,442 tons compared to 55,168 tons in 1946 when the underground program was confined mostly on development and operations were also affected by the strike. Shipments from the mine were larger and totaled 151,670 tons of Spies grade. The labor force was increased by 16% as operations expanded and a working schedule of 2-8 hour shifts, six days per week was in effect throughout the year.

A large development program has been continued in the East Deposit throughout the year. On the 4th Level and above development has been confined to bringing new stopes into production to replace those worked out. The persistent narrow width of the deposit is very disappointing from the standpoint of mining and also because of its effect on reserves. The small size of the deposit is causing development to be hard pressed to keep pace with the rate at which the stopes are being worked out. This has made it imperative that development of the 6th Level be rushed to bring it into production before the reserves above the 4th Level are depleted. Development of the 6th Level was started under E & A cc-181 early in the year and after completing the preliminary work at the shaft about 1400' of drift was advanced southeast toward the East Deposit.

The large amount of water encountered above the 4th Level has continued to hinder the mining and development. Some additional development was done on the drainage project to intercept more water above the mining areas in an attempt to make further improvement in mining conditions. Due to the short life of the stopes beneficial effects from this draining were not realized to the extent that expansion of the program was warranted so work was abandoned on this project early in the year. The small reserves above the 4th Level will be depleted in a relatively short time and the old stopes above this level will continue to serve as interceptors of water above the operations conducted from the 6th Level. The combined effect of intercepting water on the 4th Level and in the drainage project development can be expected to result in more favorable mining conditions above the 6th Level.

There has been no exploration drilling conducted from surface or underground. Development for stopes has followed a continuation of the orebody to the south where a sharp turn in the strike has been disclosed. Some drilling will be done to explore the south extension further and determine if main level development is warranted into this area.

A wage increase of 12½¢ per hour was granted hourly paid labor, effective May 9th in accordance with the new contract with the Union. In addition to the six regular holidays that were observed during the year a one week vacation was allowed eligible employees during the week of August 25th and there was no production during this period.

SPIES-VIRGIL MINE
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2. PRODUCTION, SHIPMENTS AND INVENTORIES

a. Production by Grades

	1947	1946
Spies	160,442	54,091
Spies Hi-Sulphur	-	1,077
Total	160,442	55,168

The production was all Spies grade in contrast to the previous year when a small tonnage of Hi-Sulphur ore was produced from the East Deposit. One grade of ore can continue to be produced but an increase in the sulphur content is indicated in the operations above the 6th Level.

b. Shipments

Grade	Pocket	Stockpile	Total	Total Last Year
Virgil	-	-	-	3,987
Virgil Hi-Sulphur	-	-	-	-
Total Virgil	-	-	-	3,987
Spies	94,655	57,015	151,670	45,120
Spies Hi-Sulphur	-	-	-	2,394
Total	94,655	57,015	151,670	51,501
Total Last Year	32,687	18,814	51,501	83,073
Difference	61,968	38,201	100,169	31,572

Shipments increased due to the larger production and it was all Spies grade. A small tonnage of this grade was left in stockpile at the close of the shipping season. Similarly as last year the bulk of the shipments was mixed with the Cliffs Group cargoes.

c. Stockpile Inventories

Grade	Tons
Spies	24,492
Spies Hi-Sulphur	-
Total	24,492

The stockpile inventory was slightly larger than at the end of the previous year.

d. Division of Product by Levels

All of the production was obtained from the mining and development above the 4th Level.

SPIES-VIRGIL MINE
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2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

e. Production by Months

Month	Days	Spies Grade Tons	Total Rock Tons	Tons Per Man Per Day
January	26	14,441	1,140	5.84
February	24	12,686	1,628	4.97
March	26	14,026	1,304	5.36
April	26	8,964	2,956	3.43
May	26	18,119	1,840	6.93
June	25	18,106	1,404	7.21
July	25	13,368	1,012	5.34
August	20	10,554	936	4.79
September	25	13,608	3,400	5.96
October	27	13,155	3,624	5.29
November	23½	10,706	3,064	4.88
December	24½	12,709	3,340	5.39
Total	298	160,442	25,648	5.45

f. Ore Statement

	Spies Grade	Total	Total Last Year
On Hand January 1, 1947	15,720	15,720	8,066
Output for Year	160,442	160,442	54,035
Overruns	-	-	5,120
Total	176,162	176,162	67,221
Shipments	151,670	151,670	51,501
Balance on Hand	24,492	24,492	15,720
Increase in Output	106,407	106,407	
Increase in Shipments	100,169	100,169	
Increase in Ore on Hand	8,772	8,772	

The operating schedule for the past five years follows:

1943 - 2-8 Hr. Shifts 5½ days per week Jan. 1 to Dec. 31.

1944 - 2-8 Hr. Shifts 5½ days per week Jan. 1 to July 1.
2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 5 days per week July 1 to December 31.

1945 - 2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 5 days per week January 1 to January 27.
2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 6 days per week January 27 to December 31.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

Operating Schedule (Cont.)

1946 - 2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 6 days per week January 1 to August 8.
2-8 Hr. Shifts mining and hoisting 6 days per week August 8 to December 31.

1947 - 2-8 Hr. Shifts mining and hoisting 6 days per week January 1 to December 31.

g. Delays

There were a number of delays to operations that resulted in a loss of production. Several serious interruptions to production from the stopes was caused by caving from the footwall side. After each cave it was necessary to clean the stopes of this material before mining could be resumed. The delays listed below are from other causes and their accumulative effect also resulted in a substantial loss in production.

On May 17 a four hour delay occurred on the afternoon shift due to poor ventilation in the stopes. The main ventilating fan at the air shaft had not been installed yet and the smoke and gases after a blast in the stopes did not clear out readily and caused a four hour delay to mining. Estimated loss in production was 200 tons.

On June 14 three loaded tram cars were derailed at the dump on the 4th Level and a five hour delay to tramming resulted. Estimated loss in production was 340 tons.

On the day shift on July 2 a scraper hoist in one of the stope transfer drifts went out of order and a five hour delay occurred before a spare hoist was installed. Estimated loss in production was 340 tons.

On the afternoon shift of August 8 a main bearing on the compressor overheated and burned out. No mining could be conducted on August 9th while repairs were being made, but it was possible to continue hoisting the accumulated broken ore in the stopes. Repairs were completed so that normal operations could be resumed on Monday, August 11. Estimated loss in production was 800 tons.

On September 26 a three hour delay occurred to hoisting when the trench scraper hoist on the 4th Level went out of order. Estimated loss in production was 200 tons.

On December 15 a three hour delay to tramming occurred when a car was derailed at the dump on the 4th Level. Estimated loss in production was 200 tons.

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2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

g. Delays (Cont.)

On December 19 a three hour delay occurred to hoisting when the trench scraper hoist went out of order and a spare hoist was installed. Estimated loss in production was 200 tons.

3. ANALYSIS

a. Average Mine Analysis on Output

Grade	Tons	Iron	Phos.	Silica	Sulphur
Spies	160,442	57.69	.251	6.68	.104

The average analysis shows a slightly lower iron and a higher sulphur content compared to the previous year. Contamination of the ore with slate that caved from the footwall side raised the sulphur content considerably above the guaranteed limits on several occasions.

b. Analysis of Ore in Stock

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Spies Dried	57.50	.257	6.75	.150	2.35	.20	.17	.114	6.74	
Spies Nat'l.	50.60	.226	5.94	.132	2.07	.18	.15	.100	5.92	12.00

c. Analysis of Shipments

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss
Spies	57.75	.246	6.30	.150	2.35	.20	.17	.098	7.59

d. High-Sulphur Ore

There was no Hi-Sulphur ore produced, but ore with a higher sulphur content than that produced has been encountered in the new development at the south end of the 4th Level. Two drill holes that crossed the orebody below the 4th Level also indicate higher sulphur in depth and when mining above the 6th Level gets underway it is very likely that the allowable limits on the sulphur will have to be revised upward.

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4. ESTIMATE OF ORE RESERVES

a. Developed Ore

The following is an estimate of the reserves made as of December 31, 1947 using a factor of 12 cubic feet per ton:

	Spies	Total
Above 4th Level	252,338	252,338
Between 4th and 6th Levels	482,767	482,767
Total Available as of November 30, 1947	735,105	735,105
Less December, 1947 Production	12,709	12,709
Net Total as of December 31, 1947	722,396	722,396

The large decrease in the estimated reserves is due chiefly to two factors that became apparent as mining and development expanded. The width of the orebody now proven is much less than assumed in previous estimates on the basis of drill holes. On the basis of the narrower width used in estimating, a substantial reduction in the mineable reserves above the 4th Level has resulted. The other factor that reduces the mineable reserves further is the additional ore that must be left in place as supporting pillars. Experience in the first stopes has disclosed the fact that the footwall slate caves very readily due to the character of the material and its nearly vertical dip. On this account the pillar size between the stopes has been increased slightly and a substantial floor pillar will be left in place between the 4th and 6th Level operations. The small reserves below the 6th Level are also excluded from the estimate. The combined effect of the above factors has decreased the mineable reserves by nearly 200,000 tons.

The most favorable area for exploration that might prove additional ore is along the south extension of the deposit. The north limits are determined by the Bates Mine boundary but the ore limits to the south are still unknown. A drill hole from surface in the previous year proved ore a considerable distance to the southwest from the present workings at the 6th Level elevation and below and the area in between offers the most favorable possibilities for a new find to supplement the small reserves. Two drill holes below the 4th Level have proved a continuation of the narrow width in depth and consequently the only hope for proving up more tonnage lies in exploration along the strike.

b. Estimated Analysis of Ore Reserves

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Spies Dried	57.70	.249	6.70	.20	2.18	.25	.38	.090	6.74	
Spies Nat'l.	51.35	.222	5.96	.18	1.94	.22	.34	.080	6.00	11.00

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5. LABOR AND WAGES

a. General

The general attitude of the employees has been quite satisfactory and relations have been on a very favorable basis. Employee membership in the union remains at 100% but despite the strong union position there have been no unreasonable demands. Complaints that have been submitted were minor in nature and were settled in Step 2 of the grievance procedure in each case. Employee representation on the grievance committee comprises a group of men who have shown fair mindedness in most grievance matters.

There were 114 employees on the payroll at the close of the year compared with 98 a year ago or an increase of 16%. The labor turnover has been large but the supply of labor has been adequate to maintain the force at the desired strength. There were 18 employees who quit, one died and one was retired. A total of 36 were hired resulting in a net increase of 16 men.

In addition to the wage increase that was granted under the new contract the benefits under the vacation plan were also enlarged. One year, five year and twenty-five year service became compensated at the rate of one week, two weeks and three weeks respectively. On September 1 a group hospitalization plan together with a new group insurance plan was put into effect and employee subscription to this was 100%.

b. Statement of Wages and Product

	1947	1946
Product	160,442	46,737
Number of Shifts and Hours	2-8	2-8
Average Number of Men Working		
Surface	32¼	32½
Underground	75-3/4	65
Total	108	97½
Average Wages Per Day		
Surface	10.03	8.98
Underground	11.72	10.31
Total	11.22	9.65
Average Per Month of 22 Days		
Surface	220.70	197.56
Underground	257.84	226.82
Total	246.75	212.30

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5. LABOR AND WAGES (Cont.)

b. Statement of Wages and Product (Cont.)

Average Per Month of 24 Days	1947	1946
Surface	240.77	215.52
Underground	281.28	247.44
Total	269.18	231.60
Product Per Man Per Day		
Surface	17.51	12.34
Underground	7.92	6.10
Total	5.45	4.08
Labor Cost Per Ton		
Surface	.5802	.8020
Underground	1.4695	1.7084
Total	2.0497	2.5104
Average Product Breaking and Tramming	36.71	31.39
Average Wage Contract Miners	13.57	12.75
Total Number of Days		
Surface	9,606½	7,028
Underground	22,610½	14,117
Total	32,217	21,145
Amount for Labor		
Surface	96,412.51	63,131.06
Underground	265,106.92	146,461.11
Total	361,519.43	209,592.17

Proportion Surface to Underground Men

1947	1 to 2.35
1946	1 to 2.01
1945	1 to 1.38
1944	1 to 1.60
1943	1 to 1.78

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6. SURFACE

a. Buildings

There were no new buildings constructed but some changes were made to the interior of the combined office and warehouse to provide larger captain's quarters. A portion of the warehouse space was taken and converted into a close?change room for the captain's quarters and the shelves in the warehouse were rearranged.

A small extension was constructed to the heating plant building at the south end of the dry house. A concrete reservoir was built in the extension for the return water from the steam heating system and the pump that delivers this water into the boiler was moved into the addition.

The small frame building that was constructed for use as a dry house while work was underway sinking the ventilation shaft was moved and installed on the east side of the office building. This building will serve as a storage shed for equipment and supplies.

When the Jeffrey Aerodyne Fan was installed at the collar of the air shaft a small metal building was erected to completely house the fan and motor at the top of the shaft. An air lock was also built into this structure.

b. Stockpiles

During the winter of 1947 and 1948 when the product was stocked in the area north of the shaft a large amount of the wet soupy ore spread from the stocking grounds onto the pocket loading tracks. This froze so quickly that the bulldozer could not keep up with the clean up work. Before the start of the shipping season in the spring the steam shovel was employed cleaning up this spillage.

A small tonnage of Spies grade was left in the stocking area to the north of the shaft at the close of the shipping season and no trestle was re-erected in this area. A total of 12 bents of wood trestle were erected in the area to the northwest of the shaft that had been cleaned of Virgil grade in the previous year and after the shipping season ended the product was stocked in this area.

Some additional wood trestle was erected to extend the rock trestle further to the southwest. A total of 8 bents of trestle were erected to provide additional dumping capacity for the rock that is hoisted from the 6th Level development. The bulldozer has been employed extensively spreading the rock in this area to provide more dumping capacity without erecting additional trestle.

7. UNDERGROUND

a. Shaft Sinking

There was no shaft sinking done in 1947.

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7. UNDERGROUND (Cont.)

b. Development

A large amount of the underground work was again confined to development. This work was done under three separate accounts namely: Stope Development in Ore and Rock; 6th Level Development - E & A cc-181; Water Drainage Project - E & A cc-165. Work was completed on the latter project early in the year but the other programs have been underway throughout the year.

Due to the extent of the development it will be described under the following sub level headings:

Stope Development
1270' Sub Level

This is the highest elevation to which development for the stopes has been conducted. Early in the year about 25' of small drift was advanced from the most southerly mill for No. 3 Stope to connect it to existing development at this elevation. After mining started about 40' of small drift was driven south from the traveling raise to provide a connection to the stope face. Two mill raises for No. 4 Stope were completed to this elevation and after each of the mills was cut out short test holes were drilled to the east. No ore was disclosed by the exploration from the most northerly mill but a width of 35' of ore was disclosed in the drilling from the most southerly mill. The block of ore being developed for No. 4 Stope narrows rapidly near the top and nearly pinches out at this elevation.

1240' Sub Level

After completing the most southerly mill for No. 3 Stope to this elevation a drift connection in ore was advanced 150' north to the traveling raise. From the two mills that were put up for No. 4 Stope a total of 220' of small drift was advanced in ore north and south along the strike. From the most northerly mill a connection to No. 3 Stope was driven for ventilation purposes. The development for No. 4 Stope at this elevation indicates a width of only 15' of ore between the jasper hanging and the footwall slate.

1210' Sub Level

The development for No. 3 Stope consisted of driving a connection from the most southerly mill north to the traveling raise a distance of 150'. From the two mills that were put up for No. 4 Stope a small amount of drifting was done to the north and south along the strike to provide a cutout on this sub as the raises were advanced to higher elevations.

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

1180' Sub Level

Development for No. 3 Stope on this sub also consisted of driving 150' of small drift in ore north from the most southerly mill to the traveling raise. No. 4 Stope Development consisted of driving 160' of small drift in ore to connect the two mills and extend the drift a short distance further north and south along the strike. Test holes to the east and west proved a width of 55' of ore at the most northerly mill and 38' of ore at the south mill.

1150' Sub Level

Development for No. 3 Stope again consisted of driving 150' of small drift north from the most southerly mill to the traveling raise. About 130' of small drift was advanced in the development for No. 4 Stope to connect two mills.

1125' Sub Level

Some additional development was driven for No. 1 Stope when caving from the footwall side interrupted mining. Another mill was put up from the transfer to this elevation and about 65' of small drift was advanced to connect the mill to existing development. Development for No. 3 Stope was completed at this elevation in the previous year. No. 4 Stope development was finished on this sub and it consisted of a drift connection in ore between two mills. Test holes to the east and west proved a width of 60' of ore at the most northerly mill and 40' of ore at the south mill. Some development was also driven south along the strike for the proposed No. 5 Stope and 150' of drift was advanced in this direction. The drift followed along the footwall slate and one test hole to the west disclosed a width of 35' of ore.

1100' Sub Level

Some additional development was driven on this sub for No. 1 Stope after caving interrupted the mining. A total of 50' of small drift was advanced in ore to connect a new mill raise to existing development. Some additional development was also driven for No. 2 Stope when caving from the footwall side interrupted the mining. About 25' of small drift was advanced in ore to connect a new mill to existing developments. Development for No. 3 Stope consisted of driving 105' of small drift in ore to connect a mill with the traveling raise. Development for No. 4 Stope consisted of driving 130' of drift in ore to complete a connection between two mill raises.

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

1075' Sub Level

A small amount of development was driven on this sub also for No. 1 and No. 2 Stopes after caving interrupted the mining. About 70' of small drift was driven to connect a new mill to existing development in one case and about 35' of small drift was driven for the same purpose in the No. 2 Stope. About 90' of small drift was advanced to connect the traveling raise for No. 3 Stope with an adjacent mill. Development for No. 4 Stope was completed on this sub and it consisted of driving 150' of small drift to connect the two mill raises and then 30' of small drift was advanced to the east and west from the most northerly mill. Test holes proved a width of 30' of ore at the most northerly mill and 40' of ore at the south mill.

1050' Sub Level

Three additional mills were put up from the west side of the transfer for No. 1 Stope for drawing ore as the stope was enlarged. As No. 2 and No. 3 Stopes were enlarged, additional mills were put up from the transfer to the stopes for the same purpose. A short drift was driven from the end of No. 3 Transfer to connect with a raise put up from the 4th Level. This connection provides a means of drawing water from the broken ore at the transfer elevation. Development for No. 4 Stope consisted of 170' of drift in ore to connect a series of four mills.

4th Level

In December of the previous year drifting was started to the south from the main haulage drift on the west side of the orebody. A total of 583' of drift was advanced and 45' of this was in ore to complete the main level extension. About midway in the drift a small size crosscut was advanced due east for a distance of 112' across the orebody and a short raise was put up to the transfer for No. 3 Stope for drainage purposes. Extension of the main level to the south enabled development for the No. 4 Stope to be started. A transfer drift was cut out at an elevation of 7' above the level and advanced 195' in ore to the north. Four mill raises were cut out on the west side and two of these were advanced to an elevation of 225' above the level to reach the top of the orebody. The transfer drift was driven on a -2% grade and it was connected at the end with the same drainage drift provided for No. 3 Stope. This arrangement permits draining water from the end of the transfer drifts and has resulted in much better loading conditions. Late in the year a transfer drift for No. 5 Stope was being advanced to the southwest and this was also cut out at an elevation of 7' above the level. The development in this area has disclosed a sharp turn in the strike to the west and a continuation of the orebody in the latter direction will be explored by drilling. It is very likely that the main level will have to be extended further southwest to explore the limits of the orebody.

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

4th Level (Cont.)

The difficult water problem in the East Deposit made it necessary to provide a second mud settling sump. A sufficient amount of solids carried in suspension by the water could not be settled out in the one sump that was provided for this purpose. A second sump was excavated on the east side of the new drift that was driven to the south and the water draining from each stope is diverted so it passes through both of the sumps. With two sumps in operation that are cleaned at regular intervals it has been possible to reduce the solids in the water reaching the main pumps to a small amount. The need to reduce the solids in the mine water to a minimum became advisable from a stream pollution standpoint besides the effect this has on pump maintenance. However, the cost of providing the sumps and the routine cleaning of them are added cost to mining that must be borne as long as the difficult water conditions exist. The following table shows the footage of stope development:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Small Size	2,819'	119'	1,165'	30'	4,133'
Large Size	407'	757'	-	-	1,164'
Total	3,226'	876'	1,165'	30'	5,297'

6th Level Development - E&A cc-181

Before the drifting program to the East Deposit could be started a large amount of preliminary work was required. New loading pockets were constructed and a storage trench 90' in length was excavated in the floor of the shaft plat. To provide the proper width for the track layout a large amount of rock stripping was necessary on the east and west sides of the plat. This preliminary construction was completed so that drifting could be started in August. By the end of the year the heading had been advanced 1421' to the southeast in slate and monthly progress was gradually improving. About 2400' of additional drifting will be required to reach the orebody and then two crosscuts will be driven, one branching to the north and the other to the south. This program is being rushed so the new level can be brought into production before the small reserves above the 4th are depleted. The following table shows a classification of the development footage:

Rock Stripping	Rock Drifting
354'	1,421'

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

Drainage Project - E&A cc-165
1330' Sub Level

A small amount of additional work was done on this project in the first quarter of the year. The connecting drifting between the airshaft and the orebody was completed and several additional holes were drilled to locate water courses. A dam was constructed at the shaft end of the drift and a pump was installed with a discharge line to surface through the air shaft. All the water draining from the development for the drainage project has been diverted to this pump and approximately 190 G.P.M. is being handled at this elevation. Three additional holes were drilled in an attempt to locate water courses, two to the southeast into the Johnson property and one to the north in the Spies property. Additional water was encountered in the holes to the southeast but the hole to the north was dry. The various drill holes together with the other development drains an area about 300' x 450' above the first two stope operations. Mining was completed in both stopes in such a short time that very little improvement was realized in the water conditions. The chief benefit derived from this draining and diversion of water is the reduction in the load on the main pumps at the Spies shaft. The project also makes possible the diversion of additional water from the main pumps should this be warranted by a further increase in mine water. As development disclosed a continuation of the narrow orebody along the strike it became evident that expansion of the drainage project was not justified on the basis of reserves and life of the mining operations above the 4th Level. It is reasonable to expect that operations above the 6th Level will not be seriously handicapped by water because approximately 650 G.P.M. will continue to be drained above these workings from the 4th Level and the development on the drainage project. The initial development and mining from this level will very likely encounter water in appreciable amounts until the formation above it has been drained. The following is a table of the development footage:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Small Size	25'	107'	-	-	132'

The following is a log of the drill holes:

D. D. H. No. 36

0' - 25'	Slate
25' - 123'	Ore
123' - 223'	Ore (Drilled in 1947)

D. D. H. No. 37

0' - 8'	Ore
8' - 90'	Hi Sulphur Ore

D. D. H. No. 38

0' - 180'	Ore

D. D. H. No. 39

0' - 40'	Ore
40' - 62'	Hi Sulphur Ore
62' - 83'	Ore
83' - 189'	Cherty Iron Form.

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7. UNDERGROUND (Cont.)

c. Stoping

Mining was completed in the first two stopes in the East Deposit shortly after the middle of the year. The No. 3 Stope was brought into production before the others were worked out and the block of ore developed for this stope was about 70% mined at the close of the year. Development was nearing completion for the No. 4 Stope, and No. 5 was in the initial stages of development at the end of the year. Several interruptions to mining was caused by caving from the footwall side into the stopes. This made it necessary to leave a supporting pillar in the center of each stope to permit recovery of the maximum tonnage from these areas. Early in 1948 the same trouble was developing in No. 3 Stope so in subsequent stopes it appears advisable to leave some ore in place on the footwall side for support. This will further reduce the percentage of extraction but a cleaner product can be mined and serious interruptions to mining eliminated.

Bench stoping has been employed almost exclusively but some experimenting was done with the radial deep hole method. The results with the latter method were very satisfactory from the standpoint of production but it was discontinued due to its effect on caving from the footwall. There was evidence that the heavy blasting done in this method promoted caving and aggravated the trouble from this source. It is likely that this method can be adapted to some other part of the orebody where the footwall condition will permit. The following is a detailed description of the mining conducted on the various sub levels:

1270' Sub Level

This is the top elevation of mining in each of the stopes. At the north end of the deposit in No. 1 Stope an area 50' x 30' was mined. The jasper hanging was encountered along the north and west side and the south face of the stope is defined by a pillar line. In No. 2 Stope an area 90' x 50' was mined at this elevation, bounded on the north and south sides by a pillar. An area 115' x 70' was mined in No. 3 Stope and in December mining was underway benching along the north face.

1240' Sub Level

An area 90' x 50' was mined at the north end of the orebody in No. 1 Stope and to the south in No. 2 Stope an area of nearly similar size was mined. Mining in No. 3 Stope started from a mill near the south pillar line and retreated north to comprise an area 95' x 40'. Mining was underway at this elevation in December benching along the north face.

1210' Sub Level

Some mining was done at this elevation in No. 1 Stope in the previous year and the stope was enlarged to extend the mining south to the pillar line. A small area was also mined in No. 2 Stope in the previous year and the stope was enlarged to the north and south extending both faces of the stope to a pillar line. An area 90' x 40' was mined in No. 3 Stope on this sub and in December the north face was being retreated to the pillar line.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

1180' Sub Level

An area 65' x 45' was mined in No. 1 Stope to retreat the south face of the stope to the pillar line. The mining in No. 2 Stope consisted of enlarging the original opening to 90' x 30' to complete the recovery of the ore at this elevation. An area 90' x 35' was mined in No. 3 Stope and at the close of the year the north face was being retreated toward the pillar line.

1150' Sub Level

No. 1 Stope was enlarged 90' x 50' by retreating the south face to the pillar line and No. 2 was also enlarged in the same manner 50' x 30'. An area 70' x 50' was mined in No. 3 Stope starting from the most southerly mill and retreating to the north.

1125' Sub Level

No. 1 Stope at the north end was enlarged about 100' x 55' to complete the mining at this elevation. No. 2 Stope was also enlarged by retreating the south face to the pillar line and an area 60' x 35' was mined. Mining in No. 3 Stope recovered an area 70' x 35'.

1100' Sub Level

Due to caving from the footwall side a narrow pillar was left near the middle of No. 1 Stope on this sub. The mining consisted of recovering an area 65' x 40' on the north side of the pillar and 50' x 40' to the south of the pillar. Caving made it necessary to leave a supporting pillar in No. 2 Stope also at this elevation. The mining consisted of enlarging the original stope to 60' x 40' and to the south of the pillar an area 25' x 35' was mined. The operations in No. 3 Stope at this elevation consisted of mining an area 60' x 35'.

1075' Sub Level

This is the lowest elevation of mining in the first three stopes. Two small areas were mined in No. 1 Stope, one on the north and the other on the south side of the supporting pillar. In the No. 2 Stope two small areas were again mined, one on the north and the other on the south side of the pillar. Only a small amount of mining was done in No. 3 Stope on this sub and it consisted of enlarging three mills and in December mining was underway along the north face.

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7. UNDERGROUND (Cont.)

d. Timbering

There was only a small amount of timber consumed but the cost was slightly higher than in the previous year. In spite of the large amount of development work very little of it required timber support. The only place where timbering has been required in the development is at the mouth of the mill raises in the transfer drifts. Quite frequent repairs to timber at these points has also been necessary. In all the raise development for the stopes no cribbing was required and only a small amount of this material was used in repairing the chute compartments of the short raises for the first three stopes. In the main level drifting on both the 4th and 6th Levels no timber support has been needed. There have been large increases in the price of timber supplies during the year. The inventory of this material on hand has been nearly sufficient to supply the needs of the mine for the year with the exception of a small amount of stull timber that was purchased. The total timber expense was slightly higher but the cost per ton was smaller due to the larger product. The following is a comparative timber statement:

Kind	Lineal Feet	Avg. Price Per Foot	Amount 1947	Amount 1946
6" to 8" Cribbing	1,000	.0616	61.56	92.32
8" to 10" Stull Timber	400	.1167	46.68	-
10" to 12" Stull Timber	1,529	.1729	261.25	-
Total Timber	2,929	.1262	369.49	92.32
Lagging	4,179	.0153	63.94	40.50
Poles	10,000	.0213	213.16	272.67
Total Lagging & Poles			277.10	313.17
Product			160,442	46,737
Feet of Timber per Ton of Ore			.0183	.0321
Feet of Lagging per Foot of Timber			1.4268	2.0000
Cost per Ton for Timber			.0023	.0019
Cost per Ton for Lagging			.0004	.0009
Cost per Ton for Poles			.0013	.0058
Cost per Ton for Timber, Lagging & Poles			.0040	.0086
Equivalent of Stull Timber to Board Measure			4,924	1,950
Feet of Board Measure per Ton of Ore			.0307	.0417
Cost of Timber, Lagging & Poles			646.59	405.49

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7. UNDERGROUND (Cont.)

f. Explosives, Drilling and Blasting

The amount of explosives consumed was considerably larger due to expansion of the underground program. There have been large increases in the price of these supplies also during the year. Electric blasting has been continued in the mining and development and blasting with the conventional fuse and caps is done only in block holing large chunks in the stope transfer drifts. Preference for electric blasting over the other method is based on its better application to the wet conditions in the mine. Gelamite #1 powder was used exclusively until late in the year when a change to Gelex #1 was made. The latter powder is comparable in characteristics to the Gelamite and it is manufactured by the E. I. DuPont DeNemours & Company. Early in the year when some stoping was done with the deep blast hole method some powder in large sized sticks was used and detonation was affected with primacord.

In the 6th Level development some carboloy insert bits were tried when extremely hard ground was encountered. A very favorable reduction in drilling time was realized with this bit proving it to be far superior to the conventional steel bit in hard ground. Only a small number of drill rods with the stud bit connection were obtained for the initial tests and these were used up in a short time. A complete change over to this bit in hard ground will be made when the necessary equipment has been received so the drill rods can be fabricated at the mine.

Statement of Explosives Used

Ore Development & Stoping	Quantity	Average Price		Amount 1947	Amount 1946
No. 1 Gelamite 60%	64,672	.1424	Lb.	9,212.52	2,953.39
No. 1 Gelex	8,935	.1425	Lb.	1,273.24	-
Electric Caps	25,094	16.190	C	4,062.87	1,059.45
Connecting Wire	1,248	.800	Lb.	998.40	400.00
Fuse (Feet)	14,391	6.915	M	99.52	1.71
No. 6 Blasting Caps	1,265	13.620	M	17.23	-
Hot Wire Fuse Lighters	1,600	7.037	M	11.26	-
Master Fuse Lighters	200	1.895	C	3.79	-
Powder Bags	16	1.850	Ea.	29.60	21.00
Tamping Bags	800	.215	M	1.72	-
Primacord	1,000	32.000	M	32.00	-
Charging Sticks	10	2.628	Ea.	26.28	-
Total Expense				15,768.43	4,435.55
Production Tons				160,442	46,737
Lbs. Powder Per Ton of Ore				.4587	.5059
Cost Per Ton for Powder				.0654	.0632
Cost Per Ton for All Explosives				.0983	.0949

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7. UNDERGROUND (Cont.)

f. Explosives, Drilling and Blasting

Statement of Explosives Used

Rock Development	Quantity	Average Price		Amount 1947	Amount 1946
No. 1 Gelamite 60%	10,166	.1405	Lb.	1,428.67	56.33
Electric Caps	4,399	15.282	C	672.27	17.62
Connecting Wire	126	.800	Lb.	100.80	9.80
Fuse (Feet)	178	5 .112	M	.91	1.28
No. 6 Blasting Caps	30	13.666	M	.41	.20
				2,203.06	85.23

E & A Development	Quantity	Average Price		Amount 1947	Amount 1946
No. 1 Gelamite 60%	21,208	.1425	Lb.	3,021.90	2,711.26
No. 1 Gelex	7,415	.1501	Lb.	1,113.31	-
Electric Caps	7,450	16.760	C	1,249.08	1,309.00
Connecting Wire	260	.800	Lb.	208.00	311.59
Fuse (Feet)	23,748	6.767	M	160.72	8.73
No. 6 Blasting Caps	3,597	13.670	M	49.19	3.05
Hot Wire Fuse Lighters	600	6.760	M	4.06	.67
Powder Bags	4	1.850	Ea.	7.40	9.80
Tamping Shells	3,865	8.685	M	33.57	21.24
Total Expense				5,847.23	4,375.34
Total Expense All Explosives				23,818.72	8,896.12

g. Ventilation

The Jeffrey Aerodyne Fan that was formerly used to ventilate the Virgil workings was installed and put into operation at the collar of the new air shaft early in the year. Good ventilation has been provided in all the areas in the East Deposit since the fan was installed. During the summer months the fan was delivering a volume of 30,000 C.F.M. into the mine but this was reduced to approximately 15,000 C.F.M. late in the year so that ice formation in the hoisting shaft during the freezing weather would not be so great. The practice of reversing the fan so that the hoisting shaft is upcast has also been followed during the winter months to reduce icing conditions. This latter practice however is not entirely satisfactory when the mine is operating because the smoke and gases after each blast are discharged through the main level haulage drift and causes some interference to operations on the level. Ventilation conditions are most satisfactory with the fan operating and discharging the air to surface through the ventilation shaft. On this account a small size heater was purchased to heat the intake air at the Spies shaft during the winter months and thereby prevent icing conditions in the hoisting shaft. The heater was received late in the year and installation was completed and it was put into operation early in 1948.

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7. UNDERGROUND (Cont.)

g. Ventilation (Cont.)

The main level heading on the 6th Level is being ventilated with a Sturtevant #45 fan that has a 14" metal pipe intake extending to the breast and a discharge line of the same size extending to the skip roads. The 4th Level heading was ventilated in the same manner when it was driven to the East Deposit and this method proved to be very satisfactory. A volume of approximately 3,000 C.F.M. is delivered by the fan and this has been sufficient to maintain the dust conditions within permissable limits. After the 6th Level heading has reached the orebody a raise connection to the 4th Level will be driven in ore and later it will also be necessary to drive a permanent connection in rock for ventilation purposes.

The old workings in the Virgil property have continued to be sealed off from the rest of the mine. There has been no trouble from leakage of foul air through the seals into the active levels. In January an inspection was made on the 3rd and 1st Levels in this part of the mine. The furthest point that could be reached on this inspection was approximately 400' northeast of the old Virgil shaft on the 1st Level. The inspection disclosed that a cave above old stopes has reached the 1st Level and a portion of the old level drift to the Virgil shaft is involved in the cave. Extremely high air and ground temperature was encountered near the cave indicating high latent heat in the formation surrounding the fire area despite the fact that these workings have been sealed off for more than two years.

8. COST OF OPERATING

a. Comparative Mining Costs

	1947	1946
Product	160,442	46,737
Underground Costs	2.202	2.540
Surface Costs	.436	.610
General Mine Expense	.431	.606
Cost of Production	3.069	3.756
Depreciation & Depletion	.995	1.148
Taxes	.092	.256
Loading & Shipping	.070	.068
Total Cost at Mine	4.226	5.228
Budget Estimated Cost at Mine	4.313	4.650
Number of Operating Days	298	152
Number of Shifts and Hours	298 2-8 Hr.	32 1-8 Hr. 120 2-8 Hr.
Average Daily Product	538	344

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison

		1947		1946	
	Underground Costs	Amount	Per Ton	Amount	Per Ton
1.	Exploring in Mine	30.71	.000	578.40	.012
3.	Development in Rock	15,998.29	.100	396.03	.008
4.	Development in Ore	37,195.66	.232	7,208.61	.155
5.	Stoping	95,333.68	.594	29,926.69	.640
6.	Timbering	6,887.51	.043	4,434.14	.095
7.	Tramming	61,584.74	.384	23,412.58	.502
8.	Ventilation	4,092.79	.026	99.11	.002
9.	Pumping	53,322.64	.332	19,642.89	.421
10.	Compressors & Air Pipes	17,306.32	.108	5,040.70	.108
12.	Underground Superintendence	13,753.24	.085	5,651.58	.121
14.	Compressors & Power Drills	2,811.36	.017	482.10	.010
15.	Scrapers & Mech. Loaders	23,776.69	.148	1,691.37	.036
16.	Electric Tram Equipment	10,711.27	.067	8,133.50	.174
17.	Pumping Machinery	10,537.60	.066	11,982.52	.256
	Total Underground Costs	353,342.50	2.202	118,680.22	2.540
	Surface Costs				
18.	Hoisting	18,445.16	.115	6,963.03	.149
19.	Stocking Ore	11,708.70	.073	3,793.58	.081
20.	Screening-Crushing at Mine	7,476.19	.047	2,702.48	.058
21.	Dry House	8,121.58	.051	3,628.43	.078
22.	General Surface Expense	9,963.14	.062	2,653.71	.057
23.	Hoisting Equipment	2,380.97	.015	3,712.68	.079
24.	Shaft	6,172.69	.038	2,470.06	.053
25.	Top Tram Equipment	2,313.42	.015	244.43	.005
26.	Docks, Trestles & Pockets	1,312.52	.008	1,663.80	.035
27.	Mine Buildings	1,984.34	.012	684.86	.015
	Total Surface Costs	69,878.71	.436	28,517.06	.610
	General Mine Expense				
	Geological	986.45	.006		
28.	Insurance	3,783.64	.024	670.33	.014
29.	Mining Engineering	5,962.34	.037	2,048.30	.044
30.	Mechanical & Electrical Engr.	687.18	.004	176.15	.004
31.	Analysis and Grading	5,369.96	.033	1,914.96	.041
32.	Personal Injury	2,824.59	.018	715.38	.015
33.	Safety Department	1,376.13	.009	553.86	.012
34.	Telephones & Safety Devices	1,422.24	.009	430.11	.009
35.	Local and General Welfare	1,816.71	.011	768.14	.016
36.	Special Exp., Pensions & Al.	3,170.56	.020	1,599.47	.034
37.	Ishpeming Office	7,940.16	.050	3,916.62	.084
38.	Social Security Tax	9,148.61	.057	4,741.88	..102
	Employees Vacation Pay	10,211.88	.063	4,788.41	.102
	Group Annuity Premiums			213.80	.005
39.	Mine Office	14,526.60	.090	5,795.81	.124
	Total General Mine Expenses	69,227.05	.431	28,333.22	.606
	COST OF PRODUCTION	492,448.26	3.069	175,530.50	3.756

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

		1947		1946	
		Amount	Per Ton	Amount	Per Ton
41.	General Supplies	13,280.77	.083	7,836.00	.167
42.	Iron & Steel	6,582.59	.041	1,317.19	.028
43.	Oil & Grease	3,206.83	.020	857.67	.018
44.	Machinery Supplies	21,500.10	.134	9,577.62	.205
45.	Explosives	18,198.60	.113	3,157.38	.068
46.	Lumber & Timber	4,231.50	.026	2,293.85	.049
47.	Fuel	5,440.15	.034	1,492.50	.032
48.	Electric Power	41,789.30	.260	15,630.96	.335
50.	Other Items of Expense	8,537.70	.054	56.45	.001
	Total Per Cost Sheet	122,767.54	.765	42,219.62	.903

The following are explanations of operating costs that show significant variations compared with the previous year:

3. Development in Rock

The large increase is due to extension of the 4th Level drift to explore and develop the south end of the East Deposit.

4. Development in Ore

The increase is due to a larger development program and this work was charged to operating during the year compared to the previous year when some ore development was done under E & A cc-138.

5. Stoping

The total expense was considerably larger due to larger mining operations and the increase in wages is also reflected in the higher expense. A large amount of new equipment was also purchased under this account.

7. Tramming

The total expense was considerably larger due to a larger underground program and the increase in wages. The cost per ton was smaller due to the larger product.

9. Pumping

The high cost of pumping is due to the large volume of mine water that is being handled. At the end of the year the total volume was 830 G.P.M. compared to 785 G.P.M. at the close of the previous year. It has been necessary to continue a pumping schedule of three, eight hour shifts per day for seven days a week throughout the year. Another large item of expense is the frequent sump cleaning that must be done. It was necessary to employ a crew almost constantly to maintain the sumps clean and provide adequate storage capacity for water. The increase in wages is also reflected in the higher costs.

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

10. Compressors & Air Pipes

The larger expense is due to more development and extension of the headings on the 4th Level. A large repair expense was incurred when a main bearing on the compressor overheated and burned out. The compressor rotor shaft was reconditioned at the Calumet & Hecla Company shops and it was also necessary to install new bearings to put this unit in good operating condition again.

12. Underground Superintendence

The total expense was larger but the cost per ton decreased due to the larger product. The supervisory force was reduced from three to two shift bosses late in the year. A substantial increase in salaries was granted the bosses effective May 1.

15. Scrapers & Mech. Loaders

The large increase is due to the purchase of new equipment and there was more maintenance required as operations expanded.

17. Pumping Machinery

This expense decreased compared to the previous year but it still represents a large part of the underground cost. To handle the large volume of mine water a number of small size pumps are needed in addition to the main pumps at shaft. There have been several small pumps purchased and repairs and replacement parts on the large pumps has been a large item of expense.

18. Hoisting
19. Stocking Ore
20. Screening-Crushing at Mine
21. Dry House

The total expense in the above accounts increased due to the larger operation compared to the previous year but the cost per ton was lower due to the larger production. The increase in wages is also reflected in the higher cost.

22. General Surface Expense

The increase is due to more labor employed as the underground operation expanded and also because of the increase in wages.

23. Hoisting Equipment

The decrease is due to less maintenance and there have been no major repairs required.

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

24. Shaft

The total expense was larger because of the major repairs that were made between the 4th and 8th Levels. A number of dividers between the cage and skip roads had become badly worn and these were replaced with new ones and new runners were also installed in the south compartment in this section of the shaft.

25. Top Tram Equipment

This expense was larger due to major repairs to a larry car that was damaged by derailment.

27. Mine Buildings

The increase in this account is due to remodeling the interior of the office and warehouse and erecting a small extension to the heating plant building.

28-41. Inclusive

The total expense in these accounts was higher due to the increase in wages and salaries but the cost per ton was lower in nearly every case due to the larger production. In the previous year operations were conducted under various E & A's in the first half and not until July 1st was the mine placed on an operating basis. This accounts for the large difference in the total expense in these accounts in 1947 and 1946.

9. EXPLORATION AND FUTURE EXPLORATION

a. Underground
b. Surface

There was no drilling done underground or from surface for exploration purposes. A small amount of drilling was done on the drainage project to test the upper part of the formation for water courses but the ore in this area is considered unmineable due to its close proximity to ledge. Development on the 4th Level has followed the strike of the ore-body to the south and ore has been proven in this direction to the assumed limits and a short distance further. A sharp turn in the strike has been disclosed and it is planned to explore this area further by drilling in the coming year. The persistent narrow width of the deposit which is further reduced in some areas by jasper inclusions is very disappointing. A favorable height has been developed above the 4th Level but unless more width can be disclosed in unexplored extensions the outlook from the standpoint of reserves is not very encouraging.

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9. EXPLORATION AND FUTURE EXPLORATION (Cont.)

a. Underground (Cont.)
b. Surface (Cont.)

Three drill holes have disclosed a continuation of the narrow width in depth below the 4th Level but there is a chance that more favorable extent of ore will be found outside the limits proven by this drilling. The heading on the 6th Level will reach the orebody in the coming year and very likely some drilling will be required to determine the ore limits at this elevation.

10. TAXES

The following shows a comparison of taxes paid in 1947 and 1946 in Iron County:

	1947		1946	
Description	Valuation	Taxes	Valuation	Taxes
Iron County				
Iron River Township				
Spies Mine				
NE¼ of NW¼ of Sec. 24, 43-35, 40A)				
SE¼ of NW¼ of Sec. 24, 43-35, 40A)				
Virgil Mine Lease No. 51				
SW¼ of NW¼ of Sec. 24, 43-35, 40A)	50,000	1,115.00	75,000	1,672.43
Stockpile, Supplies & Equipment	125,000	2,787.50	50,000	1,114.95
Total Spies Mine	175,000	3,902.50	125,000	2,787.38
Spies Dwellings	1,250	27.89	1,250	27.88
Total Iron River Township	176,250	3,930.39	126,250	2,815.26
Tax Rate		2.230		2.230
Village of Mineral Hills				
Spies Mine				
NE¼ of NW¼ of Sec. 24, 43-35, 40A)				
SE¼ of NW¼ of Sec. 24, 43-35, 40A)				
Virgil Mine Lease No. 51				
SW¼ of NW¼ of Sec. 24, 43-35, 40A)	50,000	282.49	75,000	376.00
Stockpile, Supplies & Equipment	125,000	706.22	50,000	250.67
Total Spies Mine	175,000	988.71	125,000	626.67
Spies Dwellings	1,250	7.06	1,250	6.27
Total Village of Mineral H.	176,250	995.77	126,250	632.94
Tax Rate		.564975		.501335

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10. TAXES (Cont.)

Description	1947 Valuation	1947 Taxes	1946 Valuation	1946 Taxes
City of Iron River				
Spies-Johnson (East Deposit)				
SE¼ of NE¼ of Sec. 24, 43-35, 40A	130,000	4,784.00	107,500	3,848.50
NE¼ of SE¼ of Sec. 24,43-35, 40A	130,000	4,784.00	107,500	3,848.50
Mineral Lands				
NE¼ of NE¼ of Sec. 24, 43-35 40A	2,000	73.60	2,000	71.60
NW¼ of NE¼ of Sec. 24, 43-35 40A	1,600	58.88	1,600	57.28
NW¼ of NW¼ of Sec. 24, 43-35 40A	2,000	73.60	2,000	71.60
NW¼ of SE¼ of Sec. 24, 43-35 40A	1,600	58.88	1,600	57.28
NE¼ of SW¼ of Sec. 24, 43-35 25A (Exc. Carlson's Maple Valley Add.)	1,400	51.52	1,400	50.12
Lots in Carlson's Maple Valley Add.	1,005	36.91	1,025	36.92
Total	269,605	9,921.39	224,625	8,041.80
Collection Fees		99.21		80.41
Total City of Iron River		10,020.60		8,122.20
Paid in August, 1947		5,446.02		4,537.43
Paid in January, 1948		4,574.58		3,584.77
Total		10,020.60		8,122.20
Tax Rate		3.680		3.580
Bates Township				
Spies East Deposit				
Mineral rights only in SW¼ of Sec. 19, 43-34, 125.5 Acres	20,000	600.00	25,000	750.00
Collection Fees		6.00		7.50
Total Bates Township		606.00		757.50
Tax Rate		3.00		3.00

Note: Iron River Township and Village of Mineral Hills taxes are assessed on the same valuation.

11. ACCIDENTS AND PERSONAL INJURY

The accident frequency and severity rate was not as good as in the previous year. There were three compensable accidents compared to two in the previous year but fortunately none of these were of a very serious nature. There was a total of 23,118 man days worked and the days lost on account of all injuries was 208 compared with 68 in the previous year. The lost time because of compensable accidents only was 197 days. The following table shows a comparison of the frequency and severity rate in the past two years:

	Frequency Rate	Severity Rate
1947	33.970	0.785
1946	28.328	0.385

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

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

The following is a detailed description of the compensable accidents:

Accident No. 167, March 19, 1947, Wilbert Puskala, Miner. While working in his contract a piece of dirt got in his right eye. Foreign body in right eye. Time Lost - 9 days.

Accident No. 168, March 24, 1947, Bolisus Martinkewiz, Carpenter. He was helping to load a pocket door onto the mine truck and a prop was placed under one end of the door to support it while loading. The prop slipped out of place causing the door to fall and strike him on the instep of the left foot. Bruised left instep. Time Lost - 14 days.

Accident No. 169, April 12, 1947, Richard Roberts, Shift Boss. He had just entered a working place where the miners were stripping and timbering a drift. As he approached the stage a piece of ore fell from the back striking the stage and a piece broke off and glanced and struck him in the left leg. Fracture of middle third Tibia and Fibula, left leg. Time Lost - 174 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was only a small amount of new construction on surface in addition to the usual erection of stocking trestle at the close of the shipping season. A small addition was constructed to the building that houses the heating plant at the south end of the dry house. A small frame building was erected and a concrete reservoir tank was built in the floor for the return water from the heating system. The small pump that is used to deliver the return water back into the boiler was moved into the new addition.

After the drift connection was completed from the new air shaft to the orebody the Jeffrey Aerodyne Fan was installed at the collar of the shaft. The fan was mounted on concrete footings and a sheet metal housing was constructed to completely enclose the fan over the collar of the shaft. A tripod was constructed of three rails directly over the shaft extending above the fan housing. A doorway was provided in the fan housing so that pumps and other equipment can be lowered and raised from the pump station at the bottom of the air shaft by means of the tripod. A woven wire fence that was salvaged from the Virgil shaft was erected around the new fan station. A short distance to the north from the air shaft transformers were installed on concrete foundations and a woven wire fence was also constructed around this station.

In the previous year about 1,600' of 6" pipe was laid on surface extending from the air shaft northwest following along the transmission line route. This line serves as a discharge for the water that is being pumped from the drainage project. To reduce the possibility of this line freezing in the winter months it was back-filled with several feet of earth with the bulldozer.

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

Before the second sump was provided underground to settle solids out of the mine water a large amount of silt was settling out of the water at a point in Iron River where the discharge ditch enters the stream. This material was accumulating rapidly along the bank of the river near a residential area and created an unsightly condition. To remedy this situation about 200' of 14" metal pipe was laid in the stream bed extending from the mouth of the ditch downstream to a point where a faster current prevented settling of any solids. Another means of settling out silt from the water before it reached the river was provided by excavating two large sumps on surface along the ditch in the Virgil property. The surface sumps could be used and maintained clean in the summer months but during the freezing weather their use had to be discontinued. No trouble is anticipated from this source in the coming year since two settling sumps have been provided underground because tests show that the solid content in the water has been reduced to a very small amount.

The major construction underground was part of the 6th Level development program. New loading pockets were constructed and a large trench storage pocket was excavated in the floor of the plat extending to the south of the shaft. The storage trench was constructed with a -3% grade in the floor so that water drains to the back end away from the loading pockets. This construction has proved very satisfactory in handling the wet ore. The trench was constructed of concrete and a lining of old steel rail was placed in the floor and also along part of the side walls. The capacity of the trench is approximately 300 tons and this storage has been very desirable for the high speed drifting program.

There is no large scale construction planned in the coming year, although some additional pumps will be installed to increase the pumping capacity through the air shaft. A second pump will be installed at the bottom of the shaft so additional water can be diverted to this station from the 4th Level. A dam will be constructed in the 4th Level drift leading to old No. 1 Stope and a portion of the drift will be utilized as a sump. A small pump will be installed so a portion of the 4th Level water can be diverted to the pump station at the air shaft. Approximately 1,100' of power cable will be extended from the bottom of the air shaft through the connecting drift to the orebody and down to the 4th Level through raises to provide power for the pump at the latter elevation. About 500' of discharge line will also be installed extending from the 4th Level through raises to the drift connecting with the shaft.

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13. EQUIPMENT AND PROPOSED EQUIPMENT

There was a large amount of new equipment purchased and most of the bigger items were charged to E & A's. All the necessary equipment for the drainage project was received and installation completed early in the year so that the diversion of water through the air shaft could be accomplished. There was a large amount of new equipment purchased for stoping operations, including scraper hoists, drill machines and scrapers. An underground locomotive that has been used for some time on a rental basis was purchased from the Lloyd Mine. Replacement of worn out parts on the main pumps has been a large expense and particularly so when it became necessary to order a spare crank shaft for the Aldrich pump on the 6th Level. New equipment received for the development program on the 6th Level consisted of four power feed drifters and a jackmill for reconditioning bits. An Eimco Model No. 21 loader has been ordered to replace the present one which is wearing out after long service. The following is a list of the important items of new equipment added to the inventory:

Item	Number of Items	Cost	
Drill Machine, Cleveland H10	2	$ 492.44	
Drill Machine, I. R. JB4	6	602.18	
Drill Machine, I. R. JA55	3	784.30	
Drill Machine, I. R. DA30 (Used)	2	600.00	
Scraper Hoist, I. R. 25 H.P.	1	2411.80	(2)
Scraper Hoist, Sullivan 25 H.P.	1	2427.00	
Air Hoist, Sullivan S-211	2	1397.36	
G. E. Locomotive (Used)	1	1800.00	
Brownell Stoker	1	948.19	
Sludge Pump, C.P. - 7	2	403.20	
Jackmill, I.R.	1	2055.07	(2)
Motor Pump, I.R. 2MRV-40	3	2362.29	(1)
Transformers, 50 K.V.A.	3	1104.48	(1)
Power Feed Drifter DA35	4	2928.45	(2)
Lee Oil Unit Heater	1	2334.00	(3)
Pump Pots	4	1020.00	
Forged Crankshaft	1	3234.32	(2)

(1) New Equipment charged to E & A cc-165
(2) New Equipment charged to E & A cc-181
(3) New Equipment charged to E & A cc-218

14. MAINTENANCE AND REPAIRS

a. Mine

Maintenance expense has continued to be abnormally high and this is due primarily to the difficult water conditions. The pumps have required a large amount of upkeep due to the abrasive action of the gritty water and the various sumps have required frequent cleaning to maintain storage capacity for water. It has been necessary to employ labor almost constantly on the sump cleaning program and the skip pit clean up work. The large volume of solids that deposits in the settling sumps has made it necessary to employ a crew regularly each weekend to keep these sumps clean and operating properly. Numerous leaks broke out in the discharge line in the shaft and a crew of welders was employed each time to repair the line. One of the standards on the 4th Level pump broke and to put this pump into condition again the break was welded and reinforced with steel plate.

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14. MAINTENANCE AND REPAIRS (Cont.)

a. Mine (Cont.)

Late in the year it became necessary to order new pots for both of the 8th Level pumps because the wall thickness of the old pots has been worn dangerously thin by the action of the gritty water.

A large repair expense was incurred when a main bearing on the compressor overheated and burned out. The rotor shaft was scored badly and to put it into good condition again it was turned down to a smaller diameter. There are no facilities at the General Shops to do this work so it was done at the Calumet and Hecla Company's Shops in Calumet during the vacation week. The repair work was completed and the compressor put into good condition and ready for operation when work was resumed after the vacation period.

Major repairs were made to the shaft loading pockets before the start of the shipping season. A number of new 8" channel irons were installed replacing badly rusted members in the frame work and several additional ones were put in to reinforce the structure. A new plank lining was installed and the interior was completely lined with 1/2" and 3/8" steel plate.

Repair work in the shaft has been confined mostly to the section between the 4th and 8th Levels. A number of 10" x 12" fir dividers between the cage and skip roads in this section had been weakened by wear and rotting and these were replaced with new members. While this work was underway a number of 6" x 8" dividers between the skip roads were also replaced wherever wear and rot indicated weakness. The fir runners in the south skip compartment between the 4th and 8th Levels had become worn after many years of service so it became advisable to install new runners in this section. Occasional repairs and replacement of worn out runners was also required in the north skip road. A weekend shaft inspection and repair program has been in effect for the entire year.

With the purchase of new drill machines and scraper hoists the repairs to this equipment has been less than in the previous years. Each of the four underground locomotives that are in regular use were completely overhauled in the previous two years and these have continued to give good service with a minimum of maintenance. The Granby type tram cars that were purchased in 1944 have also given good service and maintenance on them has consisted of replacing occasional broken springs and worn out wheels and bearings.

The TD-14 International tractor was sent to the General Shops for a complete overhauling. This unit has been in nearly continuous service since it was purchased in 1944 and due to normal wear a general overhauling of the machine became advisable. In addition to reconditioning the tracks and other parts the motor was sent to the International Company's Service Shops and put into condition. The old stoker for the main heating plant was giving very poor service due to frequent breakdowns and a new Brownell heavy duty type stoker was purchased to replace the old one.

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14. MAINTENANCE AND REPAIRS (Cont.)

b. Location

The maintenance on the two buildings in the location was higher than in the previous year. The major portion of the cost was expended in connecting each of the houses to the new sanitary sewer that was constructed in the location. The cost of the sewer system was borne by the village under a bond issue that had been voted on and approved in the previous year. The project was let on contract and construction completed during the summer months. Some minor repairs and interior decorating was also done in each of the houses.

	Labor	Supplies	Total	1946
Sanitary Sewer Connection	168.45	24.14	192.59	
Interior Decorating & Repairs	47.30	8.37	55.67	182.85
Total	215.75	32.51	248.26	182.85

15. ELECTRIC POWER

There were no delays to operations during the year due to the lack of electric power. Several interruptions in the power supply occurred but these were of such short duration that they were of no consequence. The maximum demand and total power consumption increased due to a larger underground operation.

Year	Average Maximum Demand	Rate Per K. W. H.	Total K. W. H.	Cost Per Ton
1947	617	.0127	3,386,900	.260
1946	480	.0127	2,492,444	.335

16. WATER SUPPLY

The water supply that is furnished by the Homer Mine for the village and mine has been satisfactory throughout the year. There were no extensions laid to existing water mains.

17. CONDITION OF PREMISES

There have been no improvements or landscaping done on the premises. Due to the office and shop building being located close to the shaft it is difficult to maintain the premises around these buildings in neat condition because spillage from hoisting the soupy ore spreads over a wide area.

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18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total	Percent
Finnish	18	6	24	21.82
English	17	6	23	20.91
Polish	11	4	15	13.64
French	12	0	12	10.91
Italian	7	4	11	10.00
Swedish	7	0	7	6.35
Danish	6	0	6	5.45
German	2	2	4	3.64
Lithuanian	3	0	3	2.73
Austrian	0	2	2	1.82
Irish	1	0	1	.91
Welsh	1	0	1	.91
Scotch	1	0	1	.91
Total	86	24	110	100.00

Nationality	Foreign Born	Total	Percent
Finnish	18	21	21.62
English	17	20	20.41
Polish	11	13	13.04
French	9	10	10.31
Italian	9	10	10.00
Swedish	7	8	8.33
Danish	5	5	5.15
German	4	5	5.04
Lithuanian	3	3	3.09
Austrian	2	2	1.82
Irish	1	1	.91
Welsh	1	1	.91
Scotch	1	1	.91
Total	86	110	100.00

AGNEW MINE
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1. GENERAL:

When the operation of the Agnew Mine was taken over from the International Harvester Company on Sunday, March 2nd, the general condition of underground workings was very good, due to constant repair by the bosses during thirteen months of strike shut-down.

With exceptional dispatch, a very fair offer was made to the Union which they accepted on March 5th. The Union responded with no labor troubles and very good production throughout the year. A necessary shaft repair job was started on the 7th, working two shifts, and temporary repairs completed on the 12th. More permanent repairs were made during a three-day week-end in September. After some drift repair and cleaning tracks, six contracts, two miners each shift, started mining on March 17th, working two, eight-hour shifts. A six-day per week schedule was maintained throughout the year. The number of contracts was gradually increased to ten in June and eleven contracts for the last three months of the year.

The remaining ore lies in the bottom of a steep north and south V-trough across one forty. The top of the orebody was mined by open pit, milling pit, and underground methods from 1902 to 1946. The east side of the trough is a fault and the west side is rock footwall. A layer of paintrock parallel the footwall divides the orebody. The property to the north has been stripped by the Oliver Iron Mining Company, and the one to the south, formerly an underground operation, is being stripped by Butler Brothers. Pillars of line ore are being left to be mined by open pit methods through these pits, limiting the available working places.

The main shaft has two hoisting compartments, one cage, one counterweight, one pipe and ladder compartment. Timber is lowered on trucks; the cage taking up to 12 foot lengths. Ore tramming is done on the main level at a depth of 338 feet.

A heavy rain and electric storm on September 9th caused considerable damage both on surface and underground. Shutting the water-tight doors on the main level saved the pumps, but drowned two electric locomotives which had been caught inside by power interruption.