15. EQUIPMENT AND PROPOSED NEW EQUIPMENT

1 - 29T electric blast hole drill
1 - Austin Western Mesabi Special Motor Grader
2 - International TD24 Crawler tractors No. 29 and 31
1 - Joy class W.K. - 80 Portable Air Compressor
7 - 30-ton Mack end dump trucks
1 - Ingersoll Rand - Type K - Service Garage Compressor
1 - P and H Model 1600 6 yd. electric shovel

Proposed new equipment for 1952 will consist of three replacements of some service and pickup trucks.

HILL-TRUMBULL MINE
ANNUAL REPORT
YEAR 1951

1. GENERAL

At the Hill-Trumbull Mine, the year 1951 opened with a heavy stripping program, a continuation of the project begun in 1950, which involved the removal of 1,500,000 yards of surface and waste material from the southeast Trumbull. This operation was conducted on a 7-day week basis, using 4 crews working 40 hours each and work continued on this basis until ore season began on April 30, when the schedule was reduced to 3 shifts, 6 days per week. Stripping continued until June 16 when the project was completed.

During the winter, in addition to the normal maintenance required for the stripping equipment, the mine shops conducted a general repair program during which all spare pit equipment was overhauled. Locomotives and cars were inspected and repaired.

The repair program in progress on the pit screening and conveying system was continued. Installation of a waste rock feeder was completed.

Repairs in the wash and retreat plants were of a general nature and were continued until ore season. No major changes were made in the flow sheet of either plant. A second secondary screen was installed in the wash plant to improve fine screening. A new 48 inch magnetic separator was installed in the retreat plant to improve media recovery.

Stockpile loading was begun early in April and continued through the month, with 104,568 tons shipped.

Mining operations were begun on April 30 on a 3-shift, 6-day basis and continued on this schedule through the season. Two shovels, serviced by 7 to 10 trucks, were used in the production of 2,259,480 tons of crude wash and retreat ores. Concentrates produced totalled 805,557 tons. No direct ore was produced.

Except for a minor tonnage from the West Trumbull, all wash ore came from the Trumbull-Delaware #2, Gross-Marble trespass area. Wash ore crude production totalled 159,014 tons, from which was obtained 93,274 tons of concentrates, at a shift average production of 2,892 tons and a recovery of 58.50 per cent.

Retreat crude production totalled 2,100,466 tons. Of this, 1,929,511 tons were Trumbull, mined from almost all areas of the Trumbull pit, with a major portion coming from the West Trumbull. In addition to the crude mined from the pit banks, 201,000 tons of lean ore stockpiled in the pit was mined and successfully concentrated. Hill retreat crude (170,955 tons) came mainly from the North bank. Retreat feed produced totalled 1,236,152 tons and final retreat concentrates totalled 712,283 tons. Shift production averaged 1,846 tons of concentrates, at an average recovery of 33.9 per cent.

Due to railroad car shortages, 152,161 tons of concentrates were stockpiled during the 1951 season.

The ore season closed on October 19, ahead of schedule, and crews were immediately transferred to stripping. The stripping project involved the removal of 560,000 cu. yds. of surface on the Hill lease in the extension northeastward toward the Barbara Mine. Upon completion of this yardage in December, it was decided to continue stripping in this area and the program was continued through December into 1952. Stripping removed on this project at year's end totalled 689,315 cu. yds.

Following the close of the ore season, the plants were washed out and shut down and the winter repair program begun. In addition to normal repairs, work was begun on re-design of the crushing circuit, which involved installation of a secondary crusher and screen for closed circuit crushing and installation of a conveyor arrangement for handling -2" material to be scalped from the primary screens.

1. GENERAL (Continued)

Ore loaded from stockpile at the close of the season totalled 3,446 tons, completing shipments for the year.

The extensive exploration program started in 1950 was continued until the fall of 1951, with drills working in the Hill-Trumbull, Hill-Walker and Potter leases.

2. PROCUCTION SHIPMENTS & INVENTORIES

a. Production by Grades

	Tons
Trumbull wash crude	157,124
Hill Retreat Crude	152,790
Trumbull Retreat Crude	1,748,986
Total Crude	2,058,900
Trumbull Bess.Wash Concts.	33,499
Trumbull N.B. Wash Concts.	59,775
Hill Bess. Retreat Concts.	31,674
Hill N.B. Retreat Concts.	33,317
Trumbull Bess. Ret. Concts.	280,102
Tru;mbull N.B. Retreat Concts.	367,190
Total Concts.	805,557

b. Shipments

Trumbull Bess. Wash Conct.	33,499
Trumbull N.B. Wash Conct.	25,192
Hill Bess. Retreat Conct.	31,674
Hill N.B. Retreat Conct.	16,632
Trumbull Bess. Retreat Conct.	331,449
Trumbull N.B. Retreat Conct.	368,889
Total Concts. Shipments	807,335

c. Stockpile Inventories

Hill Retreat Conct. (1950)	20,166
Hill Retreat Conct. (1951)	16,685
Trumbull Wash Conct.(1951)	34,583
Trumbull Retreat (1950)	2,187
Trumbull Retreat (1951)	100,893
Total	174,514

The following amount of lean material is now in stockpile:

	Tons	Iron	Phos	Silica
Hill	55,439	29.37	.037	52.71
Trumbull	314,471	29.50	.034	52.42
Total	369,910	29.49	.034	52.45
	Non-Concentrating Material above 40 per cent			
Hill	142,833	48.50	.081	21.90
	Coarse Non-Concentrating Material above 40 per cent			
Hill	7,527	33.23	.028	43.33

d. Production by Months

(1) Crude Ore

Month	Trumbull Wash	Hill Retreat	Trumbull Retreat	Total
April			7,126	7,126
May	1,369		336,892	338,261
June	4,357		272,000	276,357
July	27,427		344,499	371,926
August	43,268		396,355	439,623
Sept.	26,392	124,645	211,189	362,226
October	54,311	28,145	180,925	263,381
Total	157,124	152,790	1,748,986	2,058,900

(2) Concentrates

April			1,953	1,953
May	831		116,697	117,528
June	2,860		108,921	111,781
July	17,659		125,150	142,809
August	24,416		151,670	176,086
Sept.	15,624	53,051	73,128	142,803
October	31,884	11,940	68,773	112,597
Total	93,274	64,991	647,292	805,557

3. ANALYSIS

a. Analysis of Crude Ore

	Tons	Iron	Phos	Silica
Trumbull Wash	157,124	41.87	.034	34.86
Hill Retreat	152,790	34.12	.028	48.00
Trumbull Retreat	1,748,986	33.29	.032	47.96
Total	2,058,900	34.01	.032	46.96

b. Tonnage and Analysis of Concentrates Produced

	Tons	Iron	Phos	Sil.	Mang.	Alu.	Moist.	Fe. Nat.
Trumbull Bess.Wash	33,499	59.50	.040	6.90	.22	.46	11.22	52.82
" N.B.Wash	59,775	58.28	.046	8.33	.18	.41	10.23	52.32
Hill Bess.Ret.	31,674	55.81	.039	14.20	.13	.41	5.81	52.57
Hill N.B.Ret.	33,317	55.02	.042	15.47	.14	.42	5.54	51.97
Tr. Bess.Ret.	280,102	56.02	.042	13.03	.17	.42	6.95	52.13
Tr.N.B. Ret.	367,190	56.06	.049	12.68	.17	.42	6.84	52.23
Total	805,557	56.30	.045	12.42	.17	.42	7.22	52.24

c. Tonnage & Analysis of Concentrates Shipped

Trumbull Bess. Wash	33,499	59.50	.040	6.90	.22	.46	11.22	52.82
Tr. N.B. Wash	25,192	57.41	.049	9.51	.18	.40	9.54	51.93
HillBess.Ret.	31,674	55.81	.039	14.20	.13	.41	5.81	52.57
Hill N.B.Ret.	16,632	55.05	.042	15.34	.15	.42	5.83	51.84
Tr.Bess.Retreat	331,449	55.94	.042	13.13	.17	.42	6.77	52.19
Tr.N.B.Retreat	368,889	56.19	.049	12.69	.17	.42	6.71	52.42
Total	807,335	56.22	.046	12.65	.17	.42	6.96	52.31

2. ANALYSIS (Continued)

d. Mine Analysis of Ore in Stockpile

	Tons	Iron	Phos	Sil.	Mang.	Alu.	Moist.	Fe. Nat.
Hill Retreat (1950)	20,166	56.09	.040	13.49	.11	.40	5.94	52.76
Hill Retreat (1951)	16,685	55.00	.043	15.60	.13	.42	5.25	52.11
Trumbull Wash (1951)	34,583	58.92	.044	7.47	.19	.42	10.73	52.60
Trumbull Ret. (1950)	2,187	55.77	.046	13.31	.13	.46	5.77	52.55
Trumbull Ret. (1951)	100,893	55.12	.046	13.55	.16	.41	6.48	51.55
Total . .	174,514	55.98	.045	12.53	.16	.41	7.13	51.99

e. Complete Analysis of Shipments

	Iron	Phos	Sil.	Mang.	Alu.	Lime	Mag.	Sulph	Loss
Trumbull Bess.Wash	59.50	.040	6.90	.22	.46	.25	.17	.011	6.73
Trumbull N.B. Wash	57.41	.049	9.51	.18	.40	.26	.16	.010	7.20
Hill Bess.Retreat	55.81	.039	14.20	.13	.41	.27	.17	.011	4.87
Hill N.B. Retreat	55.05	.042	15.34	.15	.42	.27	.17	.010	4.77
Trumbull Bess. Retreat	55.94	.042	13.13	.17	.42	.25	.16	.010	4.84
Trumbull N.B. Retreat	56.19	.049	12.69	.17	.42	.24	.17	.011	5.77

4. ESTIMATE OF ORE RESERVES

a. Factors used

	C_u. Ft. Per Ton	Rock Deduction	% Recovery
Merch Ore	14	0	100
Wash Conct.	14	0	60
Lean Wash Conct.	14	0	48
Low Grade Wash Conct.	14	0	57
Lean Low Grade Wash Conct.	14	0	45
Retreat Conct.	14	0	36

b. Estimated Reserves

	Reserve 12-31-50	Mined 1951	Bal. After Mining	Changed by Re-Est.	Reserve 12-31-51
Trumbull					
NE-SE 18,56-23	-	271,731	-271,731	315,150	43,419
NW-SE 17,56-23	435,264	358,012	77,252	224,025	301,277
NE-SE 17,56-23	1,216,469	110,823	1,105,646	511,073	1,616,719
Total	1,651,733	740,566	911,167	1,050,248	1,961,415
Hill					
SE-NW 17,56-23	22,172	49,745	- 27,573	226,427	198,854
SW-NE 17,56-23	329,491	15,246	314,245	252,875	567,120
SE-NE 17,56-23	282,782	-	282,782	384,974	667,756
Total	634,445	64,991	569,454	864,276	1,433,730
Total Hill-Trumbull	2,286,178	805,557	1,480,621	1,914,524	3,395,145
Hill-Walker Reserve	-	-	-	136,017	136,017
Grand Total Hill-Trumbull . .	2,286,178	805,557	1,480,621	2,050,541	3,531,162

4. ESTIMATE OF ORE RESERVES

c. Estimated Analyses

Grade	Tons	Iron	Phos	Sil.	Mang.	Alu.
Hill						
Non. Bess. Direct	120,805	59.27	.064	10.50		
Bess.Wash Conct.	457,062	61.97	.028	9.50	.10	.48
Non Bess.Wash Conct.	166,552	60.66	.053	9.82	.12	.48
Bess. Retreat Conct.	427,984	59.81	.032	10.26	-	-
Non Bess. Ret. Conct.	261,327	59.32	.047	10.43	-	-
Total Hill	1,433,730	60.46	.039	10.02		
Trumbull						
Bess. Wash Conct.	61,556	58.71	.035	7.80	.14	.42
N. B. Wash Conct.	281,634	58.35	.056	9.32	.11	.51
Bess. Retreat Conct.	146,184	58.03	.036	10.22	-	-
Non Bess. Retreat Conct.	1,472,041	58.16	.057	9.82	-	-
Total Trumbull	1,961,415	58.19	.055	9.71		
Total Direct	120,805	59.27	.064	10.50		
Bess. Wash Conct.	518,618	61.58	.029	9.30	.10	.47
Non Bess. Wash Conct.	448,186	59.21	.055	9.51	.11	.50
Total Wash Conct.	966,804	60.48	.041	9.40	.10	.48
Bess. Ret. Conct.	574,168	59.36	.033	10.25	-	-
Non. Bess. Ret. Conct.	1,733,368	58.33	.055	9.91	-	-
Total Ret. Conct.	2,307,536	58.59	.050	9.99	-	-
Total Bessemer	1,092,786	60.41	.031	9.80	.10	.47
Total Non-Bessemer	2,302,359	58.55	.055	9.86	.11	.50
GRAND TOTAL	3,395,145	59.15	.047	9.84	.11	.49

5. LABOR & WAGES

a. Comments

The labor supply during 1951, although not over-abundant, was ample throughout the year due to a large influx of men from areas West and North of the Mesabi Range. However, this group was almost entirely inexperienced and generally of poor quality.

There were no new wage increases granted in 1951.

A strike over wage negotiations and retirement policy, which lasted from June 9th to June 14th, shut the mine down except for a small amount of stockpile loading. A threatened sympathy strike in July was called off. Relations between the company and the Union were otherwise normal.

b. Comparative Statement of Production & Wages

Product	805,557 tons
Number of shifts & hours	3 - 8 hr.
Average Number of Men Working	217
Average Wage per Day	$15.07*
Product Per Man Per Day	26.36 tons
Labor Cost per Ton	$.571 **
Total Number of Days worked	140
Amount paid for Labor	$477,460.15**

*Includes $.085 per hour wage adjustment
**Operating cost only - does not include D & I

6. GENERAL SURFACE

a. Buildings & Repairs

Only minor and necessary repairs were made to mine buildings. There was no new construction of buildings. Houses were paintedwhere necessary.

b. Roads, Transmission Lines, Tracks and Construction

Due to encroachment of the Gross-Marble stripping a new road was built into the mine office and shops in the spring of 1951. In the fall, as a part of the stripping project, a new road was completed to ledge on the north side of the pit. A transmission line on the north bank of the pit was extended to the dump to provide power for the stripping job and for dump lighting.

At the pit screening plant, a rock feeder was installed to handle reject rock from bin to trucks. Following the ore season, work was begun on installation of scalping and secondary crushing facilities at the plant. This work was in progress at the close of the year. Plans were also underway for extending the 22,000 volt power lines to a sub-station in the pit, reducing the length of 2,200 volt line and improving voltage throughout the pit power lines. This work will be done when the stripping operations cease in 1952.

The rock reject conveyor at the retreat plant was extended during the operating season.

7. OPEN PIT

a. Stripping

The year 1951 began with a heavy stripping project (E&A MC-196) in progress in the Southeast Trumbull area. This work originally involved removal of an estimated 1,500,000 yards of surface and waste to expose 400,000 tons of retreat ore and on January 1 there remained to be removed approximately 1,345,000 cu. yds. Stripping operations were conducted on a 20-shift per week schedule, working the crews 40 hours each, using 2 shovels and 12 to 14 trucks. Material was wasted on Oliver dump lands south of the mining area. Work on this project continued on a 20-shift schedule until ore season, when the schedule was reduced to 3 shifts, 6 days per week to conform to the ore operating schedule. Stripping was continued, using one shovel and 5 to 6 trucks until June 16, when the project was completed except for some cleanup on the pit bottom.

Material stripped totalled 1,124,133 cu. yds., with shift production averaging 2,543 yds. Cost per yard was $.384 (excluding depreciation), which was $.084 over the budget. This increase was due, in part, to a wage increase granted in December, 1950, not included in estimating cost on this job. Progress was affected by the long haul and by excessive truck delays and breakdowns, particularly in the case of the bottom-dump trucks, which comprised half of the truck fleet on this job. Shortage of trucks and drivers after ore season began also adversely affected costs.

Before this area could be stripped, a lean ore dump overlying it had to be moved. Extensive laboratory and mill tests indicated that this low grade material could be concentrated profitably, and it was, therefore, decided to dump the lean ore back into the pit. This work was begun in December, 1950, and completed after reaasting in February, 1951.

Following the close of the ore season on October 19, the crews were shifted to stripping. The project, a continuation of E&A MC-196 and E&A MC-235, involved the removal of an estimated 560,000 cu. yds. of surface on the North bank of the Hill extending the pit toward the Barbara Mine and moving the North bank road to the ultimate limit of the pit. An estimated 240,000 tons of retreat concentrate would be developed at a stripping ratio of 2.32. It was later decided to continue stripping beyond the 560,000 yards originally set up. Stripping operations were begun on a 3-shift, 6-days per week basis and continued thus until November 5, when the schedule was increased to 3 shifts, 7 days, using 4 crews at 40 hours each. Two shovels, serviced by 10 to 12 trucks, moved 689,315 cu. yds. by December 31, with a shift average production of 3,973 yds. and a cost excluding depreciation of $.239 per cu. yds.

7. OPEN PIT

a. Stripping (Continued)

Good progress, and therefore good costs, was made on this project. Equipment failures were moderate, the haul of medium length, and the digging excellent, all of which contributed to the low cost attained.

The following tabulation shows the stripping material moved in 1951:

Lease	Surface Cu. Yds.	Waste Cu. Yds.	Lean Ore Cu. Yds.	Total Cu. Yds.
Hill	689,315			689,315
Trumbull	565,590	557,889	654	1,124,133
Total . .	1,254,905	557,889	654	1,813,448

b. Open Pit Mining

The 1951 ore season opened on April 30 with crews working 3 shifts, 6 days per week. Using 2 shovels, services by 7 to 10 trucks, the mine produced 2,259,480 tons of crude ore in 139 days, for a shift av erage production of 5,405 tons. Of the above total tonnage, 200,580 tons of +4" rock was removed at the pit screening plant, leaving a net tonnage to the plant of 2,058,900 tons, for a shift average of 4,926 tons. Screening plant rock constituted 8.88 per cent of the total crude, 1.20 per cent of the wash crude, and 10.45 per cent of the retreat crude, and in the case of the retreat crude, added materially to the cost of pit operation. Mining cost per ton of crude was $.305.

Retreat ore constituted the major portion of the crude, with 2,100,466 tons produced as compared with 159,014 tons of wash. Trumbull retreat crude in the amount of 1,929,511 tons was produced from the West end of the pit and from the Trumbull pit bottom.

Approximately 200,000 tons were mined from the lean ore dump that was cast back into the pit. Hill retreat crude totalled 170,955 tons, the major portion coming from the North side of the Hill lease, with only minor tonnage produced from other areas.

Mining conditions were, in general, satisfactory from a loading and hauling standpoint. However, in the case of retreat ores, the crude was low grade and somewhat harder than in previous years, requiring more drilling and blasting, and the large percentage of rock in the ore slowed production and increased costs because of extra trucks needed to haul crude ore from the shovel and rock from the screening plant.

In addition to rock screened out of the ore, 25,350 tons of rock was sorted out at the loading faces and hauled to waste dumps. Cleanup of sand and other waste material totalled 33,896 tons. Rock and cleanup totalled 59,246 tons, giving a ratio of .026 tons waste per ton of crude ore. Cost of removing this material from the pit was approximately $0.20 per ton of $0.005 per ton of crude ore. Removal of rock and waste was carried on during periods when the plant was down or on Sundays when the plant was repairing.

c. Pumping & Drainage

A new pump line and pump were installed in the Trumbull area in the spring. After dewaterizing the pit bottom, pumping continued intermittently during the season, handling an inflow of approximately 300 gallons per minute. Cost of pumping was minor, amounting to $.001 per ton of crude ore.

Work was begun in November on relocation of a section of the drainage ditch on the north side of the pit. Relocation was forced by the northward extension of the pit.

7. OPEN PIT

c. Pumping & Drainage

With plans under consideration for mining in the Potter and Hill-Walker leases and the northeast extension in the Hill lease, a serious drainage problem is arising. Development of these areas will cut off the north side drainage ditch and since the large volume of water carried by this ditch cannot be allowed to flow into the pit, the pit, the drainage flow will have to be reversed or the water pumped to a new drainage course. At year's end this matter was under investigation.

d. General Pit Activities:

Mining of ore, with its attendant minor rock and waste cleanup, constituted the only important pit activity. There was no scramming during 1951.

8. BENEFICIATION

a. Washing Plant

The washing plant began operations on April 30th and followed the same schedule as the pit, working 3 shifts, 6 days per week. During the season, which closed October 20, the plant operated 418 shifts, handling 2,058,900 tons of crude ore, of which 157,124 tons was wash and 1,901,776 tons retreat. Plant production totalled 1,393,276 tons, of which 157,124 tons was washed concentrates and 1,236,152 tons retreat feed. On wash ore, with an average weight recovery of 59.4 per cent, the plant produced 2,892 tons per shift. At an estimated recovery rate of 65.00 per cent, the plant produced 3,202 tons of retreat feed per shift.

The washing plant operation was satisfactory during the season, although concentrating problems indicated that improvements in flowsheet were desirable. Use of two secondary screens showed a definite improvement in fine screening efficiency, resulting in a cleaner heavy media feed.

Difficulty encountered in concentrating some of the lean retreat ores forced a decision to revise the present crushing circuit, install a secondary crushing circuit and arrange for scalping ⁄2" material from the primary screens. These plant revisions, which should be in operation during the 1952 ore season, will provide opportunity to eliminate the ⁄2" fraction of the feed if desired. It has been proven by tests that much of this ⁄2" material cannot be effectively concentrated and its elimination from the heavy media feed should reduce costs and increase output from the heavy media plant. The new crushing circuit will provide facilities for crushing to -3/4" in closed circuit if desired. This reduction in top size of heavy media feed should also have a beneficial effect on heavy media plant operation and a definite improvement in grade of heavy media concentrate.

Washing plant delays totalled 14.37 per cent of the available working time. Of this, delays due to no crude ore were 11.6 per cent or 80.70 per cent of the total delays. Hours lost totalled 482.6, of which 389.7 were lost due to no crude ore and 93.0 to plant breakdowns. The large increase in crude ore delays was due somewhat to increased feed rate to the plant, but mainly to the large volume of rock encountered in the pit, which slowed up loading, reduced output of the screening plant and often resulted in delay due to an excessive number of trucks necessary to haul rock away from the screening plant.

Following is a brief statement showing lost time and percentage of total operating time:

Source of Delay	Hours Lost	% of 3360 working hours
Crude Ore	366.51	10.91
Crude Ore Conveyor	0.25	0.01
Plant Crude Pocket	10.00	0.30
8 ft. pan conveyor	2.00	0.06
Plant Crude Conveyor	10.75	0.32
Primary Screens	0.50	0.01
Crusher	3.85	0.11
Crusher Discharge Screen	3.08	0.09
Secondary Screen	5.24	0.16
66" Classifiers	1.50	0.04
Ball Mill	33.21	0.99

8. BENEFICIATION(Continued)

a. Washing Plant (Continued)

Source of Delay (Continued)	Hours Lost	% of 3360 Working Hours
1st stage spiral feed pump	0.50	0.01
Spiral Conc. Pump	1.67	0.05
Spiral Tail Pump	2.09	0.06
Changing Ore	0.51	0.02
Plant Tie-up for Weekend	2.98	0.09
Main Tailings Pump	1.33	0.04
Main Tailings Line	11.93	0.36
Surge Pile Feed Belt	7.34	0.22
Surge Pile Full	1.25	0.04
Electric Power	15.67	0.47
Clear Water Pump	0.50	0.01
Total	482.65 hours	14.37 per cent

Complete concentrating data for 1951 is as follows:

	Tonnage	% of Total Mined	% of Iron Dried	Tonnage Recovery	Iron Unit Recovery
Crude Ore & Rock Mined	159,014	100.00	41.60		
Less:Rock removed in mining	--	---	---		
Crude ore transported to Screen Plant	159,014	100.00	41.60		
Less: Rock rejects in Screen Plant	1,890	1.19	19.48		
Crude Ore Entering Mill	157,124	98.81	41.87		
Concentrates Produced	93,274	58.66	58.72	59.36	83.25
Tailings (By Deduction)	63,850	40.15	17.26		

b. Retreat Plant

Operation of the retreat plant began on April 30, following the same schedule as the pit and washing plant. During periods when the wash plant was treating wash ore, the heavy media plant was fed from the retreat surge pile. Retreat plant feed totalled 1,236,152 tons, from which was obtained 712,283 tons of concentrates, giving a shift average production of 1,846 tons and a net weight recovery from the crude ore of 37.45 per cent.

From ore of clean breaking structure, the heavy media plant produced a satisfactory concentrate despite some very low recoveries at times. However, trouble was encountered as in past years on ores containing much frozen silica. Also, when running at capacity, the rock load was so excessive at times that some tramp rock appeared in the concentrate. The scalping and finer crushing circuits should improve this situation materially.

Addition of more and better wash water sprays on screens and improvements in the media recovery circuit reduced media losses.

Treatment of fines in the Humphrey spirals continued to give unsatisfactory results. With feed to the spirals getting leaner yearly, it became apparent that a revision of the fine ore mill circuit was an immediate necessity. A sample of Trumbull classifier product was run through the M. A Hanna Company's Buckeye Mine heavy media cyclone plant, and based on the encouraging results of this and other laboratory tests, it was decided to construct a fine heavy media unit at the Hill-Trumbull plant. At year's end, this plant was in the design stage, and it is hoped that it will be running in 1952.

8. BENEFICIATION (Continued)

b. Retreat Plant (Continued)

As in the washing plant, plant delays were not excessive, amounting to 73 hours, or 2.21 per cent of the total available operating time. Delays due to lack of plant feed totalled 161 hours of 4.88 per cent of running time.

Following is a brief resume' of plant delays showing time lost and percentage of total time:

Source of Delay	Hours Lost	% of 3312 Working Hours
Our of Ore	139.83	4.22
Surge Pile Feeder	10.33	0.31
Feeder Sump Pump	4.50	0.14
H. M. Feed Conveyor	6.92	0.21
Feed Prep. Screen	9.25	0.28
Circulating Media Pump	4.00	0.12
Crockett Sands Pump	0.75	0.02
35 ft. Thickener	2.75	0.08
Coarse Conc. Wash Screen	1.33	0.04
Main Tailings Line (Wash Plant)	5.75	0.16
Rock Pocket	0.25	0.01
Rock Truck	11.24	0.34
Electric Power	6.92	0.21
R. R. Cars &Track	2.25	0.07
Stockpile Conc. Conveyor	0.50	0.02
Reject Conveyor	7.83	0.24
Charging and Tie Up	20.43	0.62
TOTAL	234.83	7.09

Complete concentrating data for 1951 is as follows:

	Tonnage	% Total Mined	%Iron Dried	Tonnage Recovery	Iron Unit Recovery
Crude Ore & Rock Mined	2,125,756	100.00	31.64		
Less: Rock Removed Ming.	25,290	1.19	17.29		
Crude Ore Transported to Screen Plant	2,100,466	98.81	31.81		
Less: Rock Rejects in Screen Plant	198,690	9.35	17.06		
Crude Ore Entering Mill	1,901,776	89.46	33.36		
Concentrates Produced	712,283	33.51	55.98	37.45	62.85
Heavy Density Rejects	413,171	19.43	18.75		
Tailings (ByDeduction)	776,322	36.52	20.38		

9. MAINTENANCE & REPAIRS

The usual winter repair program begun in the fall of 1950 was continued through the winter and spring of 1951. Shovels were overhauled in the pit. Drills were brought into the shop for a general inspection and overhaul. Because trucks and tractors were in use on the stripping project, only usual running repairs were made to this equipment.

The pit screening plant and conveying system were given the usual inspection and overhaul. Installation of a rock feeder was completed.

9. MAINTENANCE & REPAIRS (Continued)

The plant repair program was normal and is covered under "Beneficiation."

Following the 1951 ore season, the screening plant conveying system and beneficiation plants were cleaned out and general repair work begun. Repairs to screening and conveying system were normal. In addition to normal repair work at the washing plant, work was begun on a scalping and secondary crushing installation. Retreat plant repairs were normal.

10. COST OF OPERATION

a. Comparative Mining Costs

	1951 BUDGET	1951 COST PER TON	1950 COST PER TON
Product			
Direct Shipping Ore	-	-	-
Wash Concentrates	95,000	93,274	45,246
Retreat Concentrates	605,000	712,283	596,049
Total Production	700,000	805,557	641,295
Recovery	33.8 per cent	35.65 per cent	34.65 per cent
Average Daily Output	-	5,880	5,777
Tons Per Man Per Day	-	26.36	26.17
Days Operated	-	140	111
Cost			
Pit Operating	.278	.314	.202
Concentrating	.549	.500	.487
Loading Stockpile Ore	.017	.009	.010
General Mine Expense	.243	.214	.213
Idle & Winter Expense	.350	.404	.520
Cost of Production	1.981	2.007	1.813
Depreciation-Plant & Equipment		.102	.180
" -Motorized Equipment		.069	.063
" -Movable Equipment		.004	.007
Amortization - Stripping		.299	.325
Taxes - Ad Valorem	-	.098	.091
Taxes - Occupational	-	.130	.173
Taxes - Royalty		.092	.082
Total Depreciation, Amortization & Taxes		.794	.921
Administrative Expense		.100	.098
Misc. Expense & Income	-	- .017	.019
Total Cost at Mine		$2.884	$2.838

b. Detailed Cost Comparisons

Pit Operating cost in 1951 showed a rise of $.036 over the budget and $.112 over the 1950 cost. The major increase over the 1950 cost and budget was in truck operation, which showed a rise of $.065 over 1950 and $.046 over the budget. This increase was due to excessive truck breakdowns and use of 3 to 4 more trucks than had been planned due to the large amount of waste rock and a long haul. Structure drilling showed the second largest increase - $.018 over 1950 costs and $.017 over the budget, which was entirely due to the accelerated drilling program.

10. COST OF OPERATION

b. Detailed Cost Comparisons

Cost of operation of tractors in 1951 increased $.010 over the program, and $.009 over 1950 due to high maintenance charges. In other items, cost differences were minor and increases were due mainly to increased cost of labor and supplies.

The concentrating cost for 1951 was $.013 over the 1950 cost but $.049 under the budget. Cost increases over 1950 figures in most items were minor and due mainly as stated previously to increased labor and supply costs. The reduction in cost that showed up prominently was in retreat plant operation, which showed an improvement of $.061 over the budget and $.031 over the 1950 cost. This was due to a reduction in media loss and generally good plant operation. Major increase was in the item of maintenance, which showed a rise of $.026 over the 1950 cost and $.019 over the budget, due to installation of a rock conveyor and a tailings pipe line.

General Mine Expense showed a rise of $.001 over 1950 costs, but was $.029 under the budget. Cost differences in all items were minor.

Idle & Winter expense was $.116 under the 1950 cost and $.054 over the budget. The reduction from the 1950 figure was due to the large concentrate tonnage produced, since total money spent was comparative. This item looms up as one of the largest on the cost sheet and every effort is being made to hold it down, but with equipment and plants becoming larger and more complex, a future rise in this cost item is understandable.

In general, except for truck and tractor operation, cost increases over 1950 were reasonable in view of increases in the cost of labor and supplies.

11. EXPLORATION AND FUTURE EXPLORATION

At the start of the year, exploratory drilling had been stopped in areas outside the pit due to lack of water. One contract drill worked in the Trumbull lease drilling sample holes until March, when another drill was put to work in the same area. In April, drilling was begun on the Hill-Walker and Hill leases. During ore season, Trumbull pit drilling was discontinued because of its interference with mining operations. Work continued on Hill and Hill-Walker and Trumbull areas outside the pit until September when Hill-Walker exploration was stopped and the drills moved to the Potter lease. Hill drilling was completed for the year in October, and work on the Potter lease was completed in November. Exploratory drilling along the North bank of the Trumbull pit continued through December.

Drilling in the Hill lease continued to indicate considerable reserves of lean, low-grade retreat ore bearing a high silica ratio, difficult to concentrate but worth considering as possible ore if problems can be solved. Scalping and finer crushing planned for 1952 should be of great help in successfully concentrating these ores.

Trumbull drilling in the pit indicated considerable lean retreat ore below what had previously been determined as the pit bottom. Drilling along the North bank of the pit indicated ore in one area, but was disappointing generally.

Hill-Walker and Potter drilling indicated a low grade retreat ore that will be difficult to concentrate. Plant improvements as mentioned above plus use of heavy media on the -1/8" fraction of these ores may solve this concentrating problem.

In order to check structure drilling and to obtain large samples for test purposes, four test pits, totalling 168 feet, were dug on the Hill-Walker lease. One

11. EXPLORATION & FUTURE EXPLORATION (Continued)

One test pit, 39 ft. deep, was dug on the Potter. Samples from these test pits were of great value in determining the nature of the ore in these areas.

Drilling completed during 1951:

Hill	2645 ft. 6"
Trumbull	4891 ft. 6 in.
Hill-Walker	2168 ft. 6 in.
Potter	615 ft. 0 in.
Total Drilling	10,320 ft. 6 in.

12. TAXES

	1951	1950	Increase	Decrease
Hill Mine	$24,678.89	$13,528.34	$11,150.55	
Trumbull Mine	22,327.86	15,301.75	7,026.11	
Hill-Trumbull Shops	1,281.85	1,126.98	154.87	
Hill-Trumbull Wash Plant & Auxiliary Lands . .	13,558.80	12,246.00	1,312.80	
Potter Forty	45.56	40.06	5.50	
Hill-Walker	527.64	463.90	63.74	
Personal Property	14,232.56	18,347.96		$4,115.40
Total	$76,653.16	$61,054.99	$15,598.17	
Village Lots	530.08	466.05	64.03	
GRAND TOTAL . . .	$77,183.24	$61,521.04	$15,662.20	
Average Tax Rate (Mills)	146.04	140.37	5.67	

Mineral valuations were reviewed by the State, increasing the reserves by 2,971,707 tons at a tax value of $106,708.00. Personal property was decreased because stockpile on hand as of May 1, 1951 was smaller and took in ground value instaed of lower lake value.

Mill rate was increased because of additional levy allowed under new per capita tax law.

13. ACCIDENTS & PERSONAL INJURIES

There were 4 lost time accidents during 1951, which are described as follows:

(1) Name: Clifford Stone
Date of Injury: Jan. 15, 1951
Cause Stone got out of his truck and walked around in front to see how he was spotted at the shovel. He then returned to the left side of the truck, tightened the fuel cap, turned and started away from the truck. At that time a rock fell off the dipper teeth and struck him on the back.
Nature of Injury: Fracture transverse process left 3rd and 4th lumbar vertebrae, multiple contusion and abrasions.
Time Lost: 56 days
Compensation: $175.65

13. ACCIDENTS & PERSONAL INJURIES (Continued)

(2) Name: Mike Dubovich
Date of Injury: February, 1951
Cause While Dubovich was driving truck on dump the front wheels hit a chunk and steering wheel spun around, striking his little finger of left hand.
Nature of Injury Severe bruise of 2nd joint little finger left hand.
Time Lost: None
Compensation: Differential pay of $16.12

(3) Name: Morten Mortenson
Date of Injury: May 20, 1951
Cause: Mortensen was in the act of straightening out conveyor. He tried to drive one block in place with another block and in doing so he got his right thumb caught between the blocks.
Nature of Injury: Mutilation of terminal phalanx of right thumb. Nail torn off and tissue crushed.
Time Lost: 21 days
Compensation: $80.00

(4) Name: Joe Radmonovich
Date of Injury: August 5, 1951
Cause: Radmonovich was shoveling snow onto conveyor. He turned around with a shovel of dirt to place on conveyor and received a sharp pain in his lift hip.
Nature of Injury: Possible slipped disc
Compensation: $16.00
Time Lost: 9 days

14. PROPOSED NEW CONSTRUCTION

Plant operation and grade of concentrates produced indicate need for revision of plant flowsheets in order to successfully treat the lean retreat ores which now constitute the major portion of the Hill-Trumbull reserves. For this reason, it was decided to install equipment for scalping -2" rock at the wash plant, and crushing equipment to reduce the -2" material to -3/4" in closed circuit. This work was in progress and well along at year's end.

After much test work, it was proposed that a heavy media cyclone unit be installed to replace spirals for concentrating the -1/8" classifier product. At year's end, most of the machinery for this circuit had been ordered and design was proceeding.

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT

During the year, the following new equipment was received at the Mine:

1 - Model No. 70 Wayne pump
1 - Aro pump w/control & hose
1 - 1½ ton coffing hoist
5 - 60" steel desks, with chairs
1 - set HD 385 sockets w/case
1 - 1 ton C/M Hoist
1 - 1½ ton Coffing Hoist
1 - HA Rogers Tripod

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT (Continued)

Equipment rec'd in 1951 (Continued)

1 - N-528 Stadia rod
1 - Head Pulley W/shaft
1 - 2-ton C/M Hoist
1 - 6 ton Cyclone Hoist, Model M
3 - 40 TD Euclid End Dump Trucks, 20-ton
1 - 4161 Marion Power Shovel, 4 cu. yd.
1 - 1½ ton International Service Truck.
1 - Motor Generator set for pit feeder
1 - 150 H.P. Electric Motor
1 - 5 GT Centrifugal Pit Pump
2 - 29T Bucyrus-Erie Blasthole Drills, 9 inch
1 - 20-ton Mobile crane w/attachments
2 - CTS Monroe Calculators
2 - Magnetic switches
1 - 48" HM Crockett Separator
1 - Bucyrus-Erie 150-B electric shovel, 5 yd.
2 - 86x976 transformers
1 - DS Watt-Hour meter
2 - 9SW6AAW transformers
1 - 300 HP Cummins truck engine
1 - 24" Merrick Weightometer
1 - D8 tractor w/bulldozer
1 - Cable control Bulldozer blade
1 - Model F-1 1/2 ton Ford pickup
1 - Model F-2 3/4 ton Ford pickup
1 - V-60 6" Thor grinder
1 - electric hot water heater
1 - OTC socket tool set w/case
1 - Analytical Balance
934 - ft. 30" conveyor belting
960 - ft. 24" conveyor belting
5100 - ft. 2/0 bare copper wire

Proposed New Equipment:

2 - 6" Triplex Denver adjustable stroke diaphram pump
2 - 30 ft. SAR Hardinge Heavy-Duty thickener mechanism
2 - motor driven rising mechanism for above
2 - 30 ft. Dia. x 8' high Hydro-classifier tanks.
2 - 8" Wemco sand pumps
4 - 4" Wemco sand pumps
1 - set manganese pads for D-8 tractor
1 - 16" x 8" x 11 5/8" bucket elevator 50 ft. center
2 - 7½ HP class Falk motor reducer
1 - 60 HP Westinghouse Gear Motor
1 - No. 60 Falk Backstop
4 - 36" Dia. x 36" wide Magnetic separator
1 - 24" x 36"
5 - Type Co-1 Jeffrey Magnetic Separators
2 - 72" Akins classifiers
2 - Wemco Roll feeders
4 - 5' x 10' Symons single-deck horizontal screens
4 - 5 HP motors and drives for " "
2 - 5' x 8' Symons single deck " "
2 - 5 HP motors and drives for " "
6 - Model 1FFD rear dump Euclid trucks, 30 ton

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT

110 - ft. 18" Goodrich elevator belt
650 - ft. 24" Goodyear conveyor belt
60 - ft. 36" Goodyear conveyor belt
218 - ft. 24" Goodyear conveyor belt
1035 - ft. 36" Goodyear conveyor belt

HOLMAN-CLIFFS MINE
ANNUAL REPORT

YEAR 1951

1. GENERAL

Operating conditions in general throughout the year were satisfactory. Stripping operations were continued from 1950 on a 20-shift per week basis until March 11th, when they were suspended for repair program. Resuming on April 16th on a 3-shift, 6-day basis in connurrence with ore, production was suspended for the balance of the year on November 3rd.

1951 ore shipment was started on April 27th and carried forward on a 2-shift, 6-day basis until completion on October 21st. No serious delays were encountered except for "wild cat" strike from June 9th to June 14th. The concentrating plant operated on the same schedule as the pit. Concentrates were loaded from stockpile intermittently as demand arose. There were no serious breakdowns during the season.

Exploratory drilling was carried forward throughout the year, with company and contract rigs outlining possible ore extensions, testing pit bottoms, and proving barrenness for dump room.

Repairs to equipment were carried on throughout the year with a heavy program during idle seasons.

Construction program was in progress throughout the entire year. New shop building was completed and put into use, pilot sink-float unit completed and addition to central warehouse practically completed. Good progress was made on lean ore stockpile plant, addition to truck shop and addition to test laboratory.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades - Crude

	Tons
Holman Wash Crude	19,411
Holman Retreat Crude	331,165
Brown Wash Crude	66,066
Brown Retreat Crude	348,860
North Star Wash Crude	535,309
North Star Retreat Crude	258,183
Total	1,558,994

Production by Grades - Concentrates

Holman Bess. Wash Conct.	341
Holman N.B. Wash Conct.	12,175
Holman Bess. Retreat Conct.	40,499
Holman N.B. Retreat Conct.	126,424
Brown Bess. Wash Conct.	22,205
Brown N.B. Wash Conct.	20,880
Brown Bess. Retreat Conct.	73,613
Brown N.B. Retreat Conct.	122,363
North Star Bess.Wash Conct.	80,978
North Star N.B. Wash Conct.	283,326
North Star Bess. Retreat Conct.	34,647
North Star N.B. Retreat Conct.n	112,557
North Star N.B. Direct	1,505
Total . .	931,513

2. PRODUCTION, SHIPMENTS & INVENTORIES (Continued)

b. Shipments

	Tons
Holman Bess. Wash Conct.	341
Holman N.B. Wash Conct.	12,175
Holman Bess. Retreat Conct.	40,499
Holman N.B. Retreat Conct.	126,424
Brown Bess. Wash Conct.	22,205
Brown N.N. Wash Conct.	33,481
Brown Bess. Retreat Conct.	84,134
Brown N.B Retreat Conct.	127,769
North Star Bess. Wash Conct.	80,978
North Star N. B. Wash Conct.	283,326
North Star Bess. Retreat Wonct.	34,647
North Star N.B. Retreat Concts.	110,908
North Star N.B. Direct	1,505
Total	958,392

c. Inventories

Brown Concts.	1,347
Brown Retreat Concentrates	15,637
North Star Retreat Concts.	1,649
Total . . .	18,633

d. Production by Months

(1) Crude Ore

Month	Holman Wash	Holman Retreat	Brown Wash	Brown Retreat	North Star Wash	North Star Retreat	Total
April		8,544					8,544
May	7,755	180,049	17,359	75,663			280,826
June	933	85,251	6,089	145,538			237,811
July	6,135	43,698	30,151	121,916	70,246	21,087	293,233
August	4,588	9,906	8,798	569	211,239	55,342	290,442
Sept.		3,717	3,669	5,174	135,718	99,255	247,533
October					118,106	82,499	200,605
	19,411	331,165	66,066	348,860	535,309	258,183	1,558,994

(2) Concentrates

April		3,660	2,522	23,898			30080
May	4,400	93,588	11,421	38,420			147,839
June	641	43,659	3,704	72,095			120,099
July	4,142	18,107	17,774	58,161	46,155	12,266	156,605
August	3,333	5,618	5,281	335	139,381	30,737	184,685
September		2,291	2,383	3,057	94,905	59,390	162,026
October					77,948	44,811	122,759
November					5,915		5,915
	12,516	166,923	43,085	195,976	364,304	147,204	930,008
November - North Star Direct							1,505
							931,513

3. ANALYSIS

(Continued on next page)

3. ANALYSIS

a. Tonnage & Analysis of Crude Ore Produced

	Tons	Iron	Phos	Silica
Holman Wash Crude	19,411	46.35	.052	27.60
Holman Retreat Crude	331,165	43.17	.046	32.38
Brown Wash Crude	66,066	43.88	..037	31.72
Brown Retreat Crude	348,860	39.73	.040	38.70
North Star Wash Crude	535,309	48.00	.050	25.29
North Star Retreat Crude	258,183	46.69	.053	27.43
	1,558,994	44.71	.047	30.45

b. Tonnage & Analysis of Ore Produced

	Tons	Iron	Phos	Sil.	Mn.	Alu.	Moist.	Fe. Nat.
Holman Bess. Wash	341	50.70	.045	20.30	.38	.46	8.60	46.34
Holman N.B. Wash	12,175	54.70	.065	13.47	.25	.56	8.18	50.23
Holman Bess.Retreat	40,499	56.66	.039	11.88	.23	.42	7.40	52.47
Holman N.B. Retreat	126,424	56.45	.062	11.80	.28	.50	7.56	52.18
Brown Bess. Wash	22,205	57.00	.029	13.58	.15	.40	7.08	52.96
Brown Bess. Retreat	73,613	57.48	.032	12.66	.14	.39	6.70	53.63
Brown N.B. Retreat	122,363	56.26	.065	12.49	.18	.47	6.79	52.44
North Star Bess.Wash	80,978	57.10	.035	11.93	.28	.44	7.69	52.71
North Star N.B. Wash	283,326	56.32	.062	11.75	.31	.43	8.09	51.76
North Star Bess.Retreat	34,647	57.64	.041	11.04	.31	.43	7.75	53.17
North Star N.B. Retreat	112,557	56.97	.062	11.06	.33	.44	7.71	52.58
North Star N.B. Direct	1,505	57.33	.030	13.53	.15	.71	10.42	51.36
Total	931,513	56.62	.055	11.92	.26	.44	7.57	52.33

c. Tonnage & Analysis of Ore Shipped

Holman Bess. Wash	341	50.70	.045	20.30	.38	.46	8.60	46.34
Holman N.B. Wash	12,175	54.70	.065	13.47	.25	.56	8.18	50.23
Holman Bess. Retreat	40,499	56.66	.039	11.88	.23	.42	7.40	52.37
Holman N.B. Retreat	126,424	56.45	.062	11.80	.28	.50	7.56	52.18
Brown Bess. Wash	22,205	57.00	.029	13.58	.15	.40	7.08	52.96
Brown N.B. Wash	33,481	56.43	.061	12.25	.22	.39	6.85	52.56
Brown Bess. Retreat	84,134	57.21	.033	12.99	.14	.39	6.70	53.38
Brown N.B. Retreat	127,769	56.20	.063	12.64	.17	.45	6.71	52.43
North Star Bess. Wash	80,978	57.10	.035	11.93	.28	.44	7.69	52.71
North Star N.B. Wash	283,326	56.32	.062	11.75	.31	.43	8.09	51.76
North Star Bess.Retreat	34,647	57.64	.041	11.04	.31	.43	7.75	53.17
North Star N.B. Retreat	110,908	56.97	.062	11.05	.33	.44	7.71	52.58
North Star N.B. Direct	1,505	57.32	.030	13.53	.15	.71	10.42	51.35
Total . .	958,392	56.60	.055	11.99	.26	.44	7.53	52.34

d. Mine Analysis of Ore in Stockpile

Brown Concts.	1,347	57.60	.058	11.44	.28	.40	7.20	53.45
Brown Retreat Concts.	15,637	56.34	.069	12.29	.18	.55	7.30	52.23
North Star Ret. Concts.	? 1,649	56.64	.061	11.70	.35	.41	7.55	52.36
Total	18,633	56.46	.067	12.18	.20	.53	7.31	52.33

(Continued on next page)

3. ANALYSIS (Continued)

e. Complete Analysis of Season's Shipments

	Iron	Phos	Sil.	Mn.	Alu.	Lime	Mag.	Sulph.	Loss
Holman Bess.Wash	50.70	.045	20.30	.38	.46	.27	.17	.011	5.65
HolmanN.B.Wash	54.69	.065	13.47	.25	.56	.26	.16	.010	6.84
HolmanBess.Retr.	56.66	.039	11.88	.23	.42	.26	.16	.011	5.84
HolmanN.B.Ret.	56.45	.062	11.80	.28	.50	.27	.17	.010	5.99
Brown Bess.Wash	57.00	.029	13.58	.15	.40	.26	.17	.011	3.80
Brown N.B. Wash	56.43	.061	12.25	.22	.39	.26	.16	.011	5.79
BrownBess.Ret.	57.21	.033	12.99	.14	.39	.25	.16	.010	4.12
Brown N.B.Ret.	56.20	.063	12.64	.17	.45	.25	.17	.011	5.74
No.StarBess.Wash	57.10	.035	11.93	.28	.44	.27	.17	.011	5.06
No.Star N.B.Wash	56.32	.062	11.75	.31	.43	.26	.16	.010	6.28
" " Bess.Ret.	57.64	.041	11.04	.31	.43	.25	.16	.010	5.16
" " N.B. "	56.97	.062	11.05	.33	.44	.26	.16	.011	6.01
" " N.B.Direct	57.32	.030	13.53	.15	.71	.16	.26	.016	3.08

4. ESTIMATE OF ORE RESERVES

a. Factors

	Cu. Ft. Per Ton	Rock Deduction	Recovery
Merch	14	0	100.00
Wash Conct.	14	0	58.63
Lean Wash Conct.	14	0	47.80
Low Grade Wash Conct.	14	0	58.58
Lean Low Grade Wash Conct.	14	0	45.06
Retreat Concts.	14	0	40.00

b. Ore Reserves 12-31-51

	Reserve 12-31-50	Mined 1951	Balance After Mining	Changed by Re-Estimate	Reserve 12-31-51
North Star					
N½-NW¼ 21,56-24	958,427	513,013	445,414	-	445,414
Bingham					
NW SE 21,56-24	1,686,464	--	1,686,464	-	1,686,464
Holman					
SE-NE 21,56-24	2,357,096	179,439	2,177,657	-	2,177,657
Brown No. 1R	782,765	-	782,765	-	782,765
SW-NE 21,56-24					
Brown No. 2					
SW-NW 21,56-24	3,760,713	239,060	3,521,653	-	3,521,653
Total Holman-Cliffs	9,545,465	931,512	8,613,953	-	8,613,953

c. Estimated Analyses of Ore Reserves

	Tons	Iron	Phos	Sil.	Mang.k	Alu.
North Star & Bingham						
Non-Bess. Direct	67,728	58.00	.051	11.82		
Bess.Wash Concts.	687,800	59.57	.032	10.47	.16	.51
Non.Bess. Wash Concts.	437,342	58.98	.050	10.03	.16	.69
Bess. Retreat Concts.	379,275	57.80	-	11.32	-	-
Non-Bess.Ret. Concts.	559,733	57.80	-	11.28	-	-
Total No.Star-Bingham	2,131,878	58.62	.040	10.79	.16	.58

(Continued on next page)

4. ESTIMATE OF ORE RESERVES (Continued)

c. Estimated Analyses of Ore Reserves

	Tons	Iron	Phos	Sil.	Mang.	Alu.
Holman-Brown						
Bess.Wash Concts.	2,356,671	58.98	.029	10.28	.17	.43
Non.Bess.Wash Concts.	1,464,896	57.82	.062	10.05	.19	.57
Bess. Ret. Concts.	1,611,892	57.22	-	11.83	-	-
Non.Bess.Ret. Concts.	1,048,616	56.94	-	11.73	-	-
Total Holman-Brown	6,482,075	57.95	.042	10.85	.18	.48
Total Direct	67,728	58.00	.051	11.82		
Bess.Wash Concts.	3,044,471	59.11	.030	10.32	.17	.45
Non-Bess.Wash Concts.	1,092,238	58.09	.059	10.05	.18	.60
Total Wash Concts.	4,946,709	58.72	.041	10.22	.17	.51
Bess. Ret. Conct.	1,991,167	57.33	-	11.73	-	-
Non-Bess.Ret.Concts.	1,608,349	57.24	-	11.57	-	-
Total Ret. Concts.	3,599,516	57.29	-	11.66	-	-
Total Bessemer	5,035,638	58.41	.030	10.88	.17	.45
Total Non-Bess.	3,578,315	57.71	.058	10.77	.18	.60
Total Holman-Cliffs	8,613,953	58.12	.041	10.83	.17	.51

5. LABOR & WAGES

a. Comments

The supply of labor was ample and of average quality throughout the year. Although a "wildcat" strike of about a week's duration occurred in June, relations with the local Union were satisfactory.

b. Comparative Statement of Production & Wages

Product	
Wash and Retreat Concentrates	931,513 tons
Number of days Mine Operated	141 days
Average Number of Men Working	137 men
Average Wages per Daya	$15.50
Production per Man Per Day	48.15 tons
Labor Cost per Ton	$.322
Total Number of lMan Days	19,344 days
Amount Paid for Labor	$299,766.36

6. GENERAL SURFACE

a. Building & Repairs

Normal maintenance work was carried on throughout the year on all mine buildings and location houses.

b. Roads, Transmission Lines, etc.

There were no major road changes during the year. In the pit, power line changes were made due to mining operations on the North Star lease. A new transmission line of approximately 9,000 feet was built to service Hill Lake pumps. A road was built and grounds graded for construction of lean ore plant.

6. GENERAL SURFACE (Continued)

c. Miscellaneous General Construction

E&A MC-176 - the old roundhouse was torn down and a new machine shop was erected in its place.

E&A CC-435 - an addition to the central warehouse was practically completed.

Under E&A MC-213 an addition to the present truck shop was started in 1951 and was about 50 per cent complete the first of the year.

An addition to the test laboratory under E&A MC-214 was also started in 1951 and was approximately 20 per cent complete the first of the year.

At the end of the year, the construction of lean ore plant to treat ore from the lean ore stockpiles under E&A MC-215 was 75 per cent completed.

The following installations were completed and put into use during the year:

E&A MC-193 - Stockpile Conveyor System
E&A MC-201 - Pilot sink-float unit
E&A MC-202 - Return water line to Hill Lake.

7. OPEN PIT

a. Stripping

Stripping operations at this property were carried on during the year under E&A's numbers MC-198 and MC-217.

E&A MC-198 was started on January 1st on a 20-shift per week schedule, with one shovel a majority of the time serviced by eight or nine trucks. The material moved was taconite and lean ore from the North side of the Brown No. 2, paint rock, lean ore and wash from the South side of the Holman and surface from the East North Star. Operations were suspended on March 11 for repair of equipment and were resumed on April 16th on a 3-shift, 5-day basis until the start of ore season on April 27th, when the schedule was changed to 3 shifts, 6 days per week with one shovel on day and afternoon shifts and two shovels on night shift serviced by as many trucks as necessary. Work continued on this basis until July 11th, when E&A MC-198 was completed. An average production of 2,311 cu. yds. per shift was maintained with no serious delays. A cost of $.0359 per cu. yd. was realized in comparison to a budget estimate of $.380.

Stripping under E&A MC-217 was carried forward upon completion of E&A MC-198 on the same basis until October 20th (the end of the ore season) and then put on a 3-shift, 6-day schedule, with two shovels and an average of twelve trucks until November 3rd, when all operations were suspended for the balance of the year. During July and August, paint rock, lean ore, and waste were moved from the South side of the Holman and the North side of the Brown No. 2, with all movement from the North Star being surface material. During the balance of the year only surface from the North Star was removed. An average of 2,670 cu. yds. per shift was maintained and with fair weather and good haulage conditions operations were satisfactory with a cost of $.316 per yard being realized compared to a budget estimate of $.360.

The following tabulations show the yardages of material moved by leases, and by E&A programs for the year of 1951:

(Continued on next page)

7. OPEN PIT

a. Stripping (Continued)

Brown #1 and #2	Surface	Taconite	Lean Ore	P.R. & Waste	Total
E&A MC-198	4,255	237,959	41,985	200,356	484,555
E&A MC-217	12,493	1,447	9,253	37,308	60,501
Total	16,748	239,406	51,238	237,664	545,056
Holman					
E&A MC-198		6,193		97,238	103,431
E&A MC-217	1,132	587		25,816	27,535
Total	1,132	6,780		123,054	130,966
North Star					
E&A MC-198	375,183	893		1,969	378,045
E&A MC-217	667,035	2,281		3,741	673,057
Total	1,042,218	3,174		5,710	1,051,102
Totals					
E&A MC-198	379,438	245,045	41,985	299,562	966,031
E&A MC-217	680,660	4,315	9,253	66,865	761,093
Total for Year	1,060,098	249,360	51,238	366,428	1,727,124

b. Open Pit Mining

Open pit ore operations were started on April 27th and completed October 21st on a 2-shift, 6-day a week basis. A one shovel operation was set up, but due to grading requirements, a second machine was used a great deal of the time. From five to seven trucks serviced shovels and a total of 1,767,014 tons of gross crude were moved on 280 shifts for an average of 6,311 tons per shift. From the above crude, 208,020 tons of screen rock were removed for a net crude to mill of 1,558,994 tons and a shift average of 5,568 tons. In the course of mining, some 75,379 tons of pit rock, lean and waste material were moved and placed on respective dumps, for a ratio of .08 tons per ton of shipping ore. The cost of this movement was $.004 per ton of shipping ore.

The following tabulations show the material mined from the various leases:

Lease	Gross Crude	Scr.Plt.Rock	Net Crude	Pit Rock Lean & Waste Material	Direct Ore
Holman	391,301	40,725	350,576	18,636	-
Brown #2	449,246	34,320	414,926	37,825	-
North Star	926,467	132,975	793,492	19,918	1,505
Total	1,767,014	208,020	1,558,994	75,379	1,505

Operations from the Holman lease were all conducted on the Northeast corner of the property benching down as the North Star was mined North. Approximately 94 per cent of the material mined was retreat ore and 6 per cent wash ore.

On the Brown #2, ore was mined from upper benches on the North side. The ratio of ore from the property was 84 per cent retreat and 16 per cent wash ore.

All mining on North Star lease was from the East forty, and as stripping progressed northward, ore was mined as required for grading. As mined, the ore was 32 per cent retreat and 68 per cent wash ore. In addition to the above movement, 1,505 tons of direct ore were mined and shipped.

Of the ore mined from all leases, forty per cent was wash and sixty per cent retreat. The ore was all of good quality and by shifting shovels and operating retreat plant as required, no trouble was encountered in producing grade ore. Mining conditions throughout the year were average and good production was maintained. The total cost of producing crude ore was $.239 per ton.

7. OPEN PIT (Continued)

c. Pumping & Drainage

There were no major changes in pumping and drainage during the year and flow of water remained constant. After the ore season, both upper and lower sumps were cleaned with the dragline and both pump houses and discharge lines were moved North to escape danger from rocks rolling down from high banks in the area. The pumping cost per ton of shipping grade ore produced was $.022.

d. General Pit Activities

The cost per ton on shipping grade ore was $.010. This was in major part changes made in power lines to release the area for stripping and mining on the East North Star property.

8. BENEFICIATION

a. Washing Plant

The plant was operated on the same basis as the pit, with the third, or night shift, utilized for repair and maintenance work. On 280 shifts of operation, a total of 1,558 tons of crude ore were treated to obtain 897,673* tons of concentrates for a combined weight recovery of 57.60 per cent and an average rate of production of 3,206 tons per shift. Of the wash ore portion of the feed, 620,786 tons produced 411,568 tons of concentrates for a recovery of 66.30 per cent. The retreat feed of 938,208 tons produced 486,205 tons of concentrates for a recovery of 51.80 per cent. Of the 486,205 tons of retreat concentrates, only 190,342 tons were beneficiated by the heavy density process. The balance of 295,863 tons was the -1/8" material concentrated through the plant classifiers only.

During the winter season of 1950-51, several changes in plant flowsheet were made. The log circuit was removed and two 6' x 20' screens were substituted and the two outside classifiers were raised to eliminate pumping in double classification circuit. During the past season, the spiral set up was operated continuously on tailings. These changes all added up to a very satisfactory season of operation. The increase in recovery over the previous year was due in part to the above changes and also to a higher recovery ore being treated from the North Star lease.

A pilot plant to treat the fine sizes by heavy media process utilizing cyclone and Hardinge separator units was constructed during the year. However, due to the late arrival of equipment, time did not permit a full exploration of the possibilities. No work was done with the Hardinge separator, but runs made from October 4th to October 19th on cyclone indicated that with several major changes to be made this winter, the plant has very good possibilities.

The new stacker installation was put into operation on the 27th of June and operated very satisfactorily the balance of the season. Ore was stockpiled during shortages of cars and loaded out intermittently as required. The balance in stock as of January 1, 1951, was 45,513 tons. During the 1951 season, 141,608 tons were placed in stock and 168,486 tons loaded out, leaving a balance of 18,633 tons in stock as of January 1, 1952.

* The apparent discrepancy between this figure and the 930,008 tons of concentrates produced as per the cost sheet is 32,335 tons of stockpile overrun.

8. BENEFICIATION (Continued)
a. Washing Plant (Continued)
The following tabulations show time lost to production due to delays:

Source of Delay	Hours Loss	Per Cent of Total Work Hours
Pit		
Shovel Repairs	8.25	
No Power - Storm	3.00	
Total	11.25	0.51
Pit Screen Plant & Conveyors		
Screen Repairs	1.50	
Rock stuck in Pocket	4.00	
Vulcanizing Belts	15.00	
Total	20.50	0.95
Plant Equipment		
6' x 20' Screen Repairs	4.50	
H.D Screens Plugged	2.50	
Broken Classifier Shaft	3.25	
Total	10.25	0.47
Electrical		
No Power - Storm	1.00	
Concentrate Conveyor - Motor Burned Out	11.00	
Motor Generator Set - Repairs	2.50	
Screen Motors - Repairs	1.75	
Total	16.25	0.74
Pumps & Pipelines		
Clear Water Pump - Repairs	3.00	
Tailings Pump - Repairs	10.00	
Total	13.00	0.60
GRAND TOTAL	71.25	3.27 per cent

The following tabulation shows tonnage and analysis of various mill rejects and products:

	Tonnage	% Total Mined	%Iron Dried	Tonnage Recovery	Iron Unit Recovery
Crude Ore & Rock Mined	723,527	100.00	46.57		
Pit & Screen Plant Rock	102,741	14.20	30.49		
Crude Ore Entering Mill	620,786	85.80	47.51		
Concentrates Produced	419,905	58.04	56.46	67.64	80.38
Tailings (ByDeduction)	200,881	27.76	28.80		
Retreat Plant:					
Crude Ore & Rock Mined	1,109,538	100.00	40.75		
Rock Removed in Mining	48,555	4.38	26.22		
Crude Ore Transported to Screen Plant	1,060,938	95.62	41.42		
Rock Rejects in Screen Pl.	122,775	11.07	30.42		
Crude Ore Entering Mill	938,208	84.55	42.85		
Concentrates Produced	510,103	45.97	56.77	54.37	72.03
Heavy Density Rejects	103,051	9.29	41.14		
Tailings(By Deduction)	325,054	29.29	21.56		

9. MAINTENANCE & REPAIRS

The usual maintenance work on all mine equipment was carried on throughout the year. The concentrating plant equipment, pit conveyor equipment and pit screening plant was completely overhauled during the idle period.

Trucks, tractors, graders, drills, shovels and otherpit equipment were given a thorough check and repair where necessary during spring and fall shutdown period.

10. COST OF OPERATION

	1951 Budget	1951 Cost Per Ton	1950 Cost Per Ton
Product			
Direct Ore		1,505	
Wash Concentrates	230,0 00	419,905	83,587
Retreat Concentrates	670,000	510,103	796,166
Total Production	900,000	931,513	879,753
Recovery	-	52.63%	49.62%
Average Daily Output		6,596	6,767
Tons Per Man Per Day	-	48.08	42.29
Days Operated		141	130
Cost			
Total Pit Operating	.270	.239	.191
Concentrating	.364	.292	.281
Loading Stockpile Ore	.005	.008	.008
Gen'l Mine Expense	.208	.176	.162
Winter & Idle Expense	.369	.427	.390
Cost of Production	1.507	1.358	1.225
Depreciation-Pl. & Equipment		.155	.141
" -Motorized & Other		.043	.067
" -Movable Equipment		.004	.007
Amortization - Leasehold		.125	.218
" - Stripping		.403	.355
Taxes - Ad Valorem		.211	.193
" - Occupational		.288	.208
" - Royalty		.102	.125
Total Depreciation, Amortization & Taxes		1.331	1.314
Administrative Expense		.100	.100
Misc. Expense & Income		- .015	.007
TOTAL COST AT MINE		$2.774	$2.630

Detailed Cost Comparison

Due to decision to increase shipments from the North Star lease, considerably more wash concentrates and a corresponding decrease in retreat concentrates were produced in 1951 than was anticipated. The 1951 analysis of natural iron, silica and weight recovery were 52.63 percent, 11.86 per cent and 57.60 per cent as compared to 1950 results of 52.61 per cent, 12.25 per cent and 49.62 per cent. The natural iron was practically the same, but due to treatment of a preponderance of high grade North Star wash ore, the silica content dropped and a much higher recovery was obtained.

The cost of production in 1951 was $.149 lower than the budget and $.133 higher than the 1950 cost.

10. COST OF OPERATION

Detailed Cost Comparison

In comparison to the budget, the decreases were spread throughout the various items except for Winter & Idle, which was higher. Due to changes in plans after the budget was submitted, more wash and less retreat ore was mined with a corresponding lower cost. The increase in Winter & Idle over the budget of $.058 was due entirely to unexpected charges to this item, such as installation of 6' x 20' screens in the plant, power line and substation for Hill Lake pumps, spare dipper sticks and spare trailer for bottom dumps.

The 1951 cost of production was $.133 higher than 1950 cost. This increase was spread proportionately in all items and was due to increase in costs for labor and supplies.

11. EXPLORATION & FUTURE EXPLORATION

During the year a total of 4,288 feet of drilling was completed of which 1881 feet and 8 inches were in the North Star lease, 530 feet and 10 inches in the Brown No. 2, 1801 feet and 6 inches in the Holman lease and 74 feet and 0 inches in the Downing forty. The Schultze Drilling Co. drilled 2,490 feet and 2 inches, Atkins-Walker Co. 650 feet and 6 inches and the company rig 1,147 feet and 4 inches.

The hole in the Downing property was put down to quartzite to prove barrenness and the area was approved for dump ground by the State of Minnesota.

Drilling in the North Star property outlined limits of ore to the North and proved up additional ore in this area.

In the Brown No. 2 and Holman properties all drilling was done to prove up the bottom of the ore on the North side of the pit and some additional tonnage was found.

During 1952 very little drilling will be required at this property. A few holes along the South side of the Holman and Brown No. 2 properties will be put down early in the year for sample purposes.

12. TAXES

	1951	1950	Increase	Decrease
Holman-Brown Mine	$129,504.96	$123,868.75	$5,636.21	
Bingham Mine	27,335.76	23,681.79	3,653.97	
North Star Mine	12,769.67	11,399.23	1,370.44	
Test Lab. & Truck Shop	578.54	1,147.05		$568.51
Washing Plant Site	5,893.09	5,260.65	632.44	
Auxiliary & Dump Lands	924.99	692.44	232.55	
Holman-Cliffs Shops, Office, Fuel Oil Plant & Central Warehouse	2,531.38	441.25	2,090.13	
Holman-Cliffs Person Property	12,095.63	10,631.92	1,463.71	
Total	$191,634.02	$177,123.08	$14,510.94	
Rented Buildings	321.00	1,205.08		$884.08
GRAND TOTAL	$191,955.02	$178,328.16	$13,626.86	
Average Tax Rate (Mills)	131.05	116.99	14.06	

12. TAXES (Continued)

There were no changes in mineral reserve tonnage except for reduction in tons by production, reclassification of ores from undeveloped to developed, leaving a net reduction in the value of $6,500.00. Test laboratory, truck shop, fuel oil plant, central warehouse and new shop were all revalued by the County Assessor, with a tax value increase for the group.

Rented buildings tax was reduced because of the sale of buildings by the Oliver Iron Mining Co. that had been leased to Holman-Cliffs and the purchase of 8 of these units by the Holman.

Personal property tax increased because of stockpile on hand May 1st.

Mill rate increased by additional allowances given by new state per capita tax law.

13. ACCIDENTS & PERSONAL INJURIES

There were two compensable accidents at the Holman-Cliffs Mine during 1951:

(1) Name: Gordon Yorks
Date of Injury: July 10, 1951
Cause: While lifting a piece of iron onto a towmotor, Yorks felt his back snap.
Nature of Injury: Slipping of last thoracic vertebrae, left lumbar spasm, possible disc.
Time Lost: 26 days
Compensation: $133.33

(2) Name: Alvin Schroeder
Date of Injury: October 26, 1951
Cause: Schroeder had spotted a truck on the edge of the dump. The driver dumped his truck and started. He had gone approximately 30 feet when he noticed the cat operator waving his arms. He stopped the truck and was told he had gone over Schroeder with the front wheel.
Nature of Injury: Severe crushing of left leg and pelvis, laceration of pelvis. Hospitalized.
Time Lost: 57 days
Compensation: $320.00

14. PROPOSED NEW CONSTRUCTION

a. To be completed in 1952:
Truck shop addition
Central Warehouse Addition
Test Laboratory Addition
Lean Ore Stockpile Plant

b. To be Constructed in 1952
300 H.P. drives and Exchange belts on pit conveyor system
Addition to Stockpiling System at Plant
Changes in fine ore cyclone pilot plant

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT

A. Major Equipment Received in 1951

2 - 6' x 20' Allis-Chalmers Screens
Link Belt stacker equipment at plant
Pilot Plant - Heavy Density Fine Ore Treatment Equipment
Machine Shop & Equipment
3 - 39 TD Euclid Trucks
1 - 2-ton Ford dump truck.
1 - 3/4 ton Ford Pickup
1 - 125 H.P. Electric Motor
1 - TD-24 I.H. Company Tractor (at Hawkins Mine)
1 - 5 cu. yd. Amsco Dipper
1 - Ford Tank truck - Fuel Delivery
2 - 29T Bucyrus churn drills
1 - Trailer for Euclid Bottom Dump Truck.

b. To be Received in 1952

2 - 300 H.P. Fairbanks-Morse motors for pit conveyor
2 - 300 H.P. Link Belt drives for above
1622 ft. USTEX 30" Conveyor Belting
6 - 34-ton Euclid trucks
1 - 2 ton Electrician truck
5 - 30 ft. conveyor sections - stacking equipment
1 - 75 H.P. Drive for concentrate conveyor
1 - 300 H.P. Motor - Tailings Pump
1 - Dynamometer - District Motor Shop

SALLY MINE
ANNUAL REPORT

YEAR 1951

1. GENERAL

This property has merely been explored and no mining operations have been conducted to date.

2. PRODUCTION SHIPMENTS & INVENTORIES

None

3. ANALYSIS

None

4. ESTIMATE OF ORE RESERVES

a. Factors

	Cu. Ft. Per Ton	Rock Deduction	Recovery
Merch	14	-	100.00
Wash	14		56.76
Log Wash	14		45.85
Low Grade Wash	14		58.38
Lean, Low Grade Wash	14		50.50
Retreat	14		40.00

b. Reserves as of 12-31-51

	Reserve 12-31-50	Mined 1951	Bal.After Mining	Changed By Re-Est.	Reserve 12-31-51
Bovey #1 NW-SE 21,56-24	1,751,579	---	1,751,579	---	1,751,579

c. Estimated Analyses of Ore Reserve

	Tons	Iron	Phos	Silica
Bovey #1 NW-SW,21,56-24				
Bess.Merch	88,457	64.01	.020	5.50
N.B. Merch	63,657	62.22	.078	5.59
Bess.Wash Conc.	755,429	60.92	.026	7.85
N.B. Wash Conc.	450,438	58.89	.067	8.65
Bess.Retr. Conc.	229,073	58.33	.031	11.73
N.B. Retr.Conc.	164,525	57.73	.061	10.03
Total . . .	1,751,579	59.96	.042	8.57
Total Bessemer	1,072,959	60.62	.027	8.48
Total Non-Bessemer	678,620	58.91	.067	8.70
Total Bovey #1	1,751,579	59.96	.042	8.57

5. LABOR & WAGES NONE

6. GENERAL SURFACE: NONE

7. OPEN PIT: NONE

8. BENEFICIATION: NONE

9. MAINTENANCE & REPAIRS: NONE

10. COST OF OPERATION: NO PRODUCTION

11. EXPLORATION & FUTURE EXPLORATION: NONE

12. TAXES:

The following is a statement of 1950 and 1951 taxes:

	1951	1950	Increase	Decrease
Sally Mine	$26,823.19	$24,109.27	$2,713.92	
Auxiliary Lands	28.30	25.91	2.39	
Total	$26,851.49	$24,135.18	$2,716.31	
Average Tax Rate(Mills)	133.24	119.75	13.49	

There was no change in basic tax value. Increased mill rate was caused by additional allowances under new per capita tax law.

13. ACCIDENTS & PERSONAL INJURIES: NONE

14. PROPOSED NEW CONSTRUCTION: NONE

15. EQUIPMENT RECEIVED AND PROPOSED NEW EQUIPMENT: NONE

SARGENT MINE
ANNUAL REPORT
YEAR 1951

1. GENERAL

Mining operations at the Sargent Mine were carried forward from the first of the year to the end of the year on a two shift, six day a week basis. In addition to time lost on holidays, five regular working days were lost due to walkout of men from June 9th to June 15th. In April all mining was suspended in the northeast corner of the mine for the summer months due to danger of mud runs from old caves. Flash floods did not hamper production in 1951, but may be troublesome in 1952, as mining will be done directly below the old pit in the southeast corner of the mine. Production was suspended during the week of November 19, 1951, to allow for repairs to timber underground, cleaning of sumps, and equipment repairs on surface. Ore was placed in stockpile from January 2nd to April 10th. Loading of direct ore into cars from the pocket started on April 10th and continued until November 17th, at which time stockpiling was resumed. The direct ore stockpile was loaded out as cars were available from April 28th to June 5th. The washing plant was put into operation on May 2nd and operated until October 26th.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production by Grades

	Tons
Crude Ore	162,015
Direct Ore	137,992
Concentrates	112,658

b. Shipments

Sargent Bess. Shaft Direct	297
Sargent N.B. Shaft Direct	142,171
Sargent N.B. Concts.	112,658
Total	255,126

c. Stockpile Inventory

Sargent Shaft Direct	3,108

d. Production by Months

	Sargent Crude	Sargent Concts.	Sargent Direct	Total Merchantable
January	21,222	[illegible]	7,041	7,041
February	18,642		5,616	5,616
March	21,576		8,253	8,253
April	8,823		15,917	15,917
May	16,482	24,779	8,622	33,401
June	4,863	21,570	16,386	37,956
July	6,210	25,085	18,325	43,410
August	10,190	20,255	21,252	41,507
Sept.	11,491	6,475	18,092	24,567
October	21,384	14,494	6,515	21,009
November	6,111		9,735	9,735
December	15,021		2,238	2,238
Total	162,015	112,658	137,992	250,650

e. Ore Statement

Crude ore production, after depletion by the amount of feed to concentrating plant, left a crude balance in the pile of 22,170 tons as of December 31, 1951.

3. ANALYSIS

a. Tonnage & Analysis - Crude Ore

Tons	Iron	Phos	Silica
162,015	52.20	.059	17.37

b. Tonnage & Analysis of Concentrates & Direct Produced

	Tons	Iron	Phos	Sil.	Mn.	Alu.	Moist.	Iron Nat.
Concentrates	112,658	56.68	.061	11.32	.76	1.65	11.99	49.88
U.G.Bess.Direct	297	54.80	.032	10.30	1.39	3.74	14.50	46.85
U.G.N.B. Direct	137,695	55.25	.057	12.56	.86	2.05	13.28	47.92

c. Tonnage & Analysis of Ore Shipped

Concentrates	112,658	56.68	.061	11.32	.76	1.65	11.99	49.88
U.G.Bess.Direct	297	54.80	.032	10.30	1.39	3.74	14.50	46.85
U.G.N.B. Direct	142,171	55.13	.057	12.76	.85	2.04	13.26	47.82
Total	255,126	55.82	.059	12.12	.81	1.87	12.70	48.73

d. Mine Analysis of Ore in Stockpile

Sargent N.B.U.G. Direct	3,108	54.13	.057	13.53	1.03	1.97	13.78	46.67

e. Complete Analysis of Ore Shipped

	Iron	Phos	Sil.	Mn.	Alu.	Lime	Mag.	Sulph	Loss
Sgt.Bess.Shaft	54.80	.032	10.30	1.39	3.74	.33	.21	.011	4.99
Sgt.N.B.Shaft	55.13	.057	12.76	.85	2.04	.34	.20	.012	4.47
Sgt.N.B. Concts.	56.68	.061	11.32	.76	1.65	.34	.21	.011	4.20

4. ESTIMATE OF ORE RESERVES

a. Factors

	Cu. Ft. Per Ton	% Recovery
Merch	14	100
Wash Conct.	14	60

b. Ore Reserves as of 12-31-51

	Reserve 12-31-50	Mined 1951	Bal.After Mining	Changed by Re-Estimate	Reserve 12-31-51
NW-SE 23,57-22 Merch	99,715	—	99,715	—	99,715
NE-SE 23, 57-22Merch	317,772	—	317,772	—	317,772
SW-SE 23,57-22 Merch	341,384	81,262	260,122	—	260,122
" " -Wash Conct.	291,696	64,324	227,372	—	227,372
Total	633,080	145,586	487,494	—	487,494
SE-SE 23,57-22 Merch	107,769	50,534	57,235	—	57,235
" -WashConct.	287,784	37,401	250,383	—	250,383
Totals	395,553	87,935	307,618	—	307,618
NW-NE 26,57-22-Merch	44,528	6,196	38,332	—	38,332
" -WashConct.	73,785r	3,951	69,834	—	69,834
Total	118,313	10,147	108,166	—	108,166
Total Sargent Merch	911,168	137,992	773,176	—	773,176
Total Wash Concts.	653,265	105,676	547,589	—	547,589
GRAND TOTAL	1,564,433	243,668	1,320,765	—	1,320,765

4. ESTIMATE OF ORE RESERVES (Continued)

c. Analysis of Ore Reserves

	Tons	Iron	Phos	Sil.	Mn.	Alu.
NW-SE 23,57-22 - Merch	99,715	57.94	.060	9.80	.88	1.42
NE-SE 23,57-22 - Merch	317,772	57.94	.060	9.80	. 88	1.42
SW-SE 23,57-22 - Merch	260,122	56.00	.059	11.87	.78	2.56
" -WashConcts.	227,372	57.50	.054	10.00	.93	1.27
Total	487,494	56.70	.057	11.00	.85	1.96
SE-SE 23,57-22 - Merch	57,235	56.10	.073	11.30	1.27	2.56
" -Wash Concts.	250,383	57.50	.054	10.00	.93	1.27
Total	307,618	57.24	.056	10.24	.99	1.51
NW-NE 26,57-22- Merch	38,332	55.80	.075	11.50	.90	3.16
" -Wash Concts.	69,834	57.50	.054	10.00	.93	1.27
Total	108,166	56.90	.061	10.53	.92	1.94
Total Sargent						
Merch	773,176	57.05	.061	10.69 a	.88	1.97
Wash Concts.	547,589	57.50	.054	10.00	.93	1.27
GRAND TOTAL . .	1,320,765	57.24	.058	10.40	.90	1.68

5. LABOR & WAGES

a. Comments

The labor supply was ample throughout the year, but there continued to be a shortage of experienced miners. A program of training available men was continued and no serious shortage developed for present operations. Local labor relations continued satisfactory. No general increase was granted during the year, but an estimated wage increase of $.085 per man hour worked was carriedon the cost sheet throughout the year.

b. Comparative Statement of Production and Wages

Production	
Direct Ore	137,992 tons
Crude Ore	162,015 tons
Total Direct & Crude	300,007 tons
JConcentrates	112,658 tons
Total Concentrates & Direct	250,650 tons
Number of days operated	294 days
Average Daily Production	1,032 tons
Average Number of men working	111½ men
Tons Per Man Per Miner	22.57 tons
Tons Per Man Total Underground	12.77 tons
Tons Per Man total Mine	9.28 tons
Average Rate per Day	
Surface	$12.74
Underground	$16.56
Contract Miners	$17.58
Total Mine	$16.03
Amount Paid for Labor	$494,940.95
Labor Cost Per Ton	$1.649

6. SURFACE

a. Buildings & Repairs

Minor maintenance repairs to buildings were carried on throughout the year.

b. Timber Shafts

No. 2 timber shaft was repaired by blocking voids caused by runs of sand due to rains, until a fan was placed on top of the shaft and the sides were frozen. The ore pillars supplied by this shaft will be completed this winter, making it possible to discontinue the use of this shaft next spring.

6. SURFACE (Continued)

c. Washing Plant Repairs

A Dorr bowl classifier was installed to replace the Akins.

7. UNDERGROUND MINING

a. Main Shaft

New studdles were installed for the first sixty feet on the ladder-road side. Skip guides were replaced for the first hundred feet. New cables were installed on both skips.

b. Development

No extensive development. Drifts and raises were driven as needed to mine back pillars in an orderly manner.

c. Mining

Mining was carried forward during the year with an average of 11 gangs employed. Of these 11 gangs, 5 mined by slicing, 4 by sub-level caving, and 2 developing and making timber repairs. The average height of slices was 12 feet and varied in width from 10 to 12 feet. In the sub level caving places, blocks approximately 28 feet high and 25 feet wide were caved. Pillars were mined back in an orderly manner on the various sub-levels.

In April two gangs were moved out of the northeast corner of the mine due to the mud runs during the spring breakup. These gangs could not be put back until late in November. Throughout November and December working places became wet and made the ore sticky, thus hampering production from the working places to the stockpile.

d. Timber, Explosives, etc.

The supply of timber was ample and of good quality. Due to shortage of tamarack timber, elm was substituted for about one-half of the tamarack. Maple has been substituted in a limited supply and has proven satisfactory. During the next season, approximately three-fourths elm will be used instead of tamarack.

Lineal Feet of timber used per ton of ore	.502 ft.
Cost per ton for timber	$.093
Cost per ton for lagging, poles and boards	$.077
Cost per ton for wire	$.002
Pounds of explosives per ton of ore	.464 lbs.
Cost of explosives per ton of ore	$.088

e. Pumping and Drainage

There were no changes in pumping arrangements. All pumps were completely overhauled during the year.

The greatest pumping problem was encountered during severe rainstorms at which time production from the west side of the mine has to be stopped, the dams closed, and the water released slowly as the pumps are able to handle it.

8. BENEFICIATION

The washing plant started operating on May 2nd on a two shift, six day basis. This operation continued on a two shift per day basis until the end of August, when exhaustion of crude ore in stockpile made it necessary to operate the plant only when hoisting crude ore from the shaft.

During the season the plant operated 243 shifts, treating 172,164 tons of crude ore, producing 112,658 tons of concentrates, for an average weight recovery of 65.44 per cent. An average of 89.94 TPH was maintained , with a resulting product of 58.70 TPH of concentrates.

In general, the plant worked satisfactorily except for the need of continuous blowing to work the wet sticky ore through the chutes.

8. BENEFICIATION (Continued)

The following represents the plant product distribution for the Sargent Mine:

	Tonnage	% Tonnage Mined	% Iron Mined	Tonnage Recovery	Iron Unit Recovery
Crude	172,164	100.00	51.91		
Concts. Produced	112,658	65.44	56.68	54.36	71.45
Tailings (Deduction)	59,506	34.56	42.88		

9. COST OF OPERATIONS

a. Comparative Mining Costs

	1951 BUDGET	1951 COST PER TON	1950 COST PER TON
PRODUCT			
Direct Ore	125,000	137,992	120,240
Milling Pit	-	-	20,404
Crude Ore	178,555	162,015	152,134
Total Direct & Crude Ore	303,355	300,007	292,778
Concentrates	125,000	112,658	78,665
Total Concts. & Direct Ore	250,000	250,650	219,309
Recovery	-	64.82%	65.90%
Average Daily Product	-	1,000	1,061
Tons Per Man Per Day	-	9.28	8.87
Days Operated	-	300 Days	276 days
COSTS			
Total Underground Costs	2.508	1.922	1.950
Total Surface Costs	.208	.181	.167
General Mine Expense	.429	.327	.338
Cost of Production	3.145	2.430	2.455
Concentrating Cost	.230	.358	.256
Total Cost-Production Merch Ore	3.375	3.284	2.827
Depreciation-Plant & Equipment	-	.123	.088
" -Motorized Equipment	-	.002	.015
" -Movable Equipment	-	.003	.004
Taxes-Ad Valorem	-	.135	.168
" -Occupational	-	.000	.019
" -Royalty	-	.061	.068
Total Depreciation & Taxes	-	.324	.362
Loading & Shipping	-	.037	.026
Total Cost at Mine	-	3.645	3.215
Administrative Expense	-	.050	.069
Misc. Income & Expense	-	.044	.014
GRAND TOTAL	-	3.739	3.298

b. Comments

The cost of production of crude ore in 1951 was $.715 lower than the budget and $.025 lower than the 1950 costs.

The concentrating cost was $.128 higher than the budget and $.102 higher than the 1950 costs. These increases are due to the absorption of cost of a new concentrate belt, installation of the Dorr Bowl Classifier and repairs to tailing pond dike.

The cost of production of merchantable ore for 1951 was $.091 lower than the budget and $.457 higher than the 1950 costs.

10. MAINTENANCE & REPAIRS

A continuous program of maintenance and repair was carried on throughout the year as the need arose. During the week of November 19, production was suspended to allow for repairs to timber underground, cleaning of sumps, and equipment repqirs. These repairs were done in places and to equipment that would hinder production if done when the mine was hoisting ore.

11. EXPLORATION & FUTURE EXPLORATION

On January 8th E. J. Longyear Co. resumed the structure drilling program on NE-SE 23, 57-22. A total of 814 feet in 4 holes was drilled and the program was completed in May.

Enough direct ore and wash ore has been outlined to warrant laying out a proposedopen pit.

Three holes have been proposed to be drilled in the first months of 1952 by contract with H. Schultz & Company. Two of these holes are needed to outline a portion of the merchantable material to be mined by open pit this coming season, and the third to check some of the old drilling under the present surface dump. Additional drilling may be required to completely drill out the property.

12. TAXES

a. Statement of Taxes

	1951	1950	Increase	Decrease
Sargent Mine	$31,461.89	$33,427.76	-	$1,965.87
Auxiliary Lands	54.94	56.74		1.80
Personal Property	2,233.03	3,363.78		1,130.75
GRAND TOTAL	$33,749.86	$36,848.28		$3,098.42
Average Tax Rate (Mills)	235.40	213.39	22.01	

13. ACCIDENTS & PERSONAL INJURIES

There were five compensable accidents at the Sargent Mine During 1951:

1. Name: Joe Verzich
   Date of Injury: July 13, 1951
   Cause: Verzich and partner had put up an 8' cap timber onto post. As he turned to pick up a opo bar the cap slipped off the post, striking him on his left side.
   Nature of Injury: Injury to side - requiring taping.
   Time Lost: 11 days
   Compensation: $58.67

2. Name: Lee Jackson
   Date of Injury: April 5, 1951
   Cause: Jackson was putting in a tie with the dumpman. He was pushing and the dumpman was pulling the tie into place when Jackson bumped his right thumb on the rail.
   Nature of Injury: Fracture of Proximal phalanx of right thumb.
   Time Lost: Not time lost - partial permanent disability
   Compensation: $630.00

3. Name: Tony Vukovich
   Date of Injury: March 29, 1951
   Cause: Vukovich was in the act of pulling timber with a pick. The pick slipped and struck him.
   Nature of Injury: Bruised right foot.
   Time Lost: 26½ days
   Compensation $254.32

13. ACCIDENTS & PERSONAL INJURIES (Continued)

4. Name: Lee Jackson
Date of Injury: Sept. 15, 1951
Cause: Jackson had dropped three empty Great Northern cars from tail track. He was climbing down from the car when he slipped and fell, striking his left hip on another car.
Nature of Injury: Tenderness over left ischial tuberosity and some radiation of pain down leg.
Time Lost: 83 days
Compensation: $357.33

5. Name: Saro Bjellos
Date of Injury: Jan. 24, 1951
Cause: Bjellos was lifting a cap timber when he felt a pain in his left hip.
Nature of Injury: Sacroiliac strain & old arthritis of the spine.
Time Lost: 24 days
Compensation: $120.00

14. PROPOSED NEW CONSTRUCTION

Complete layout to mine both direct and wash ore from open pits and underground on the NE-SE 23, 57-22.

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT

a. Equipment Received

1 - Air saw - Wright pneumatic
1 - Gasoline saw - Disston
2 - 15 H.P. Sullivan tuggers
1 - Aerodyne Midget Blower
1 - 5 H.P. - #4 Universal Type Blower
2 - RB-12 Ingersoll-Rand Jackhammers

b. Proposed New Equipment

2 - Aerodyne Midget blowers
1 - 15 H.P. Double Drum Scraper Hoist
2 - RB 12 Ingersoll-Rand Jackhammers

WANLESS MINE
ANNUAL REPORT
YEAR 1951

1. GENERAL

Stripping at the Wanless Mine was carried on from January 1, 1951 until March 12, when operations were suspended in order to repair open pit equipment. After this repair period, operations were again resumed on April 25, 1951, and with the opening of the shipping season activities consisted largely of mining with some concurrent stripping. The first shipments were made from stockpile May 19, 1951.

Due to the spring breakup in April, about 16,600 yards of quicksand and caved material sloughed into the open pit from the Kosmerl property, causing a substantial delay in ore production.

The year of 1951 was the first year that the Wanless Mine was able to enter the role of full scale production.

A great many delays in production were encountered during the season due to shovel breakdowns caused by defective parts, as well as one accident due to caving of the bank. The trucks at the Wanless property are old and are scheduled for replacement by better units from some of the other mines, to which the large 34-ton trucks are to be delivered in the months of June and July, 1952.

During the season it became evident that the crusher, which is of the jaw type, would be unable to handle the sticky, painty material from the Wanless pit, and it was decided that a new crusher must be installed for the 1952 season, with the result that this crusher was ordered late in 1951.

On June 9th the Union went out on strike, which was ended on June 15th.

Operating conditions in the pit were good during the spring until late July and early August, when heavy rainfall was far from being spasmodic, causing a great deal of difficulty in the pit and to approach roads, hindering production very substantially, and resulting in high truck costs and tire wear. The Wanless pit is one which is seriously affected by wet weather, and like the Atkins will probably be faced with this for the life of the pit until all approach roads can be fully established and heavily graveled.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production

	Tons
Wanless	276,257
Woodbridge	10,419
Total	286,676

b. Shipments

Wanless N.B. Direct	273,164
Woodbridge N.B. Direct	8,449
Total	281,613

c. Stockpile Inventories

Wanless N.B. Direct	25,734
Woodbridge N.B. Direct	4,884
Total	30.618

d. Production by Months

Month	Wanless	Woodbridge	Total
January	1,206		1,206
February	666		666
April	342		342
May	3,835	1,224	5,059
June	34,710	6,867	41,577
July	40.236	1,272	41,508

(Continued on next page)

2. PRODUCTION, SHIPMENTS & INVENTORIES (Continued)

d. Production by Months (Continued)

Month	Wanless	Woodbridge	Total
August	44,711	1,056	45,767
September	55,762		55,762
October	67,746		67,746
November	27,043		27,043
Totals	265,257	10,419	286,676

3. ANALYSIS

a. Tonnage & Analysis - Production

	Tons	Iron	Phos	Sil.	Mn.	Alu.	Moist.	Iron Nat.
Wanless N.B. Direct	276,257	51.12	.095	10.12	1.01	6.22	21.00	40.39
WoodbridgeN.B.Dir.	10,419	45.63	.121	13.27	1.86	8.40	20.12	36.46
Total	286,676	50.92	.096	10.24	1.04	6.30	20.97	40.24

b. Tonnage & Analysis - Shipments

Wanless N.B.Direct	273,164	51.00	.095	10.33	.99	6.34	20.94	40.32
Woodbr.N.B.Direct	8449	46.09	.110	13.44	1.58	8.44	20.20	36.78
Total	281,613	50.85	.095	10.42	1.01	6.40	20.92	40.21

c. Tonnage & Analysis of Ore in Stockpile

Wanless	25,734	49.66	-	11.49	-	6.83
Woodbridge	4,884	45.76	-	13.48	-	8.37
Total	30,618	49.04	-	11.81	-	6.83

d. Complete Analysis of Shipments

	Iron	Phos	Sil.	Mang.	Alu.	Lime	Mag.	Sulph.	Loss
Wanless	51.00	.095	10.33	.99	6.34	.05	.07	.010	8.64
Woodbridge	46.09	.110	13.44	1.58	8.44	.08	.11	.012	9.50

4. ESTIMATE OF ORE RESERVES

A. -Factors

	Cu.Ft. Per Ton	Rock Deduction	% Recovery
No. 1 Ore	14	0	100
No. 2 Ore	14	0	100

b. Reserves as of 12-31-51

	Reserve 12-31-50	Mined 1951	Balance After Mining	Changed by Re-Est.	Reserve 12-31-51
Woodbridge	380,114	10.419	369,695	41,143	410,838
Wanless O.P.	1,475,200	276,257	1,198,943	62,142	1,261,085
" U. G.	91,772	-	91,772	-	91,772
Total	1,566,972	276,257	1,290,715	62,142	1,352,857
Total Wanless	1,947,086	286,676	1,660,410	103,285	1,763,695

4. ESTIMATE OF
ORE RESERVES (Continued)

c. Estimated Analysis of Ore Reserves

Grade	Tons	Iron	Phos	Sil.	Mang.	Alum.
Woodbridge						
No. 1 Ore	290,400	55.40	.096	7.02	1.24	2.28
No. 2 Ore	120,438	48.78	.106	10.88	2.34	6.10
Total	410,838	53.40	.099	8.15	1.56	3.40
Wanless						
O.P.No. 1 Ore	955,864	54.92	.119	7.33	1.61	3.41
O.P.No. 2 Ore	305,221	48.46	.100	12.85	1.31	7.65
U.G. No.1 Ore	38,743	54.50	.151	8.22	.90	2.65
U.G. No. 2 Ore	53,029	50.05	.092	13.03	1.78	3.81
Total	1,352,857	53.26	.115	8.82	1.53	4.36
Total No. 1 Ore	1,285,007	55.02	.115	7.29	1.50	3.13
Total No. 2 Ore	478,688	48.72	.101	12.39	1.62	6.83
Total	1.763,695	53.30	.111	8.67	1.53	4.13

5. LABOR & WAGES

a. Comments

The labor supply, while adequate during most of the year, was not of the best quality in some classes, and a considerable amount of absenteeism hampered operations to quite an extent. The sic-day work week schedule resulted in less labor turnover then had been previously encountered during the 5-day work week.

b. Comparative statement of production & Wages

Production	
Direct Ore	286,676 tons
Number of Days Operated	135½ days
Average Number of Men Working	62½ men
Average Wages per Man	$14.86
Production per Man per Day	62.40 tons
Labor Cost per Man per Ton	$.248
Total Number of Man Days	4,399 days
Amount Paid for Labor	$72,407.11

6. GENERAL
SURFACE

a. Building & Repairs

An overhead crane was erected in the shop and other than a change house and dump shcak no major building program took place during the year.

b. Roads

The grades on the main haul road coming out of the pitwere reduced, effecting a better and more uniform grade. This resulted in ability to operate more efficiently in the wet and freezing weather.

c. Dumps

Two lean ore dumps were removed from the surface dump to make room for extension of the stripping dump on which they were located. Negotiations were started with the State of Minnesota for extension of surface dumps, which are becoming overloaded, and a sufficient amount of drilling was done to obtain an extension of these dumps from the State during the past year.

7. OPEN PIT

a. Stripping

The stripping program carried over from 1950 continued until March 12, 1951, when the pit operations were suspended in order to provide an equipment repair period as mentioned above. Stripping was again resumed on a 2-shift basis on April 25, 1951, and on May 14 was stepped up to a 3-shift operation, which continued until ore shipments began subsequent to the removal of the slough on the Kosmerl property. Equipment available for stripping and mining during the year consisted of 6 20-ton trucks leased from other properties, which were not in too good condition, and one truck which could be considered in fair condition, resulting in a high truck cost during the year due to the necessity of frequent repairs. One 85-B electric 3¼ yd. shovel transferred from the Canisteo Mine and a 1201 Lima 3½ yd. shovel which was purchased for the Wanless Mine were used in both stripping and mining. Both of these machines suffered frequent breakdowns during the year, hampering production. After the start of ore season, a 54-B electric dragline was transferred from the Atkins for the purpose of maintaining a sump in the open pit area by the removal of gob or caved material.

During the year stripping operations were carried on under several E&A's - namely, E&A CC-412, covering 200,000 yd;s (which E&A was completed in February, 1951); E&A CC-434 in the amount of 688,000 yds., completed in December; and E&A CC-489, for 167,000 yds., which was started in December but not completed at the end of the year.

During the year of 1951, a total of 743,864 cu. yds. of various classes of material were moved in 482 shifts. The average yardage moved per shift amounted to 1,544 cu. yds., and the estimated cost for this stripping amounted to $.452, as compared to the actual cost of $.509 per cu. yd. for the season, resulting in an overrun of $.057. The reason for this increase over the budget was the result of major shovel breakdowns, high tire costs due to the wet conditions, and also the long haul, which amounted to 4,250 feet with a lift of approximately 180 feet.

During the year a contract was let to the Al Johnson Construction Company to remove stripping from the Kosmerl and Whiteside properties adjacent to the East line of the Wanless open pit. This stripping is a joint venture between Snyder Mining Company, the Oliver Iron Mining Company, and The Cleveland-Cliffs Iron Co. This stripping will enable the C.C.I. Co. to obtain ore from the ultimate approach road on the Whiteside-Kosmerl line. The contract also provides that the Oliver Iron Mining and the Snyder Mining Co. will pay for the removal of their lean ore, taconite and ore mined in lining up this approach on a cost plus 10 per cent basis. The entire stripping contract let to the Al Johnson Co. anticipates the removal of approximately 208,652 yds., which will be participated in by the three companies mentioned at a cost of $.400 per cu. yd. The total stripping removed on this contract to January 1, 1952 was 17,146 cu. yds. for the C.C.I. Co. account.

b. Open Pit Mining

During the year of 1951, a total of 286,676 tons of ore were produced and 281,613 tons shipped, the major portion of which came from the Wanless lease, the minor portion from the Woodbridge, and a very minor portion from lean ore stockpile. Considerable tonnage, amounting to almost 170,000 tons, is available for future shipment in the form of lean ore running somewhat in excess of 17 to 18 per cent silica.

A small tonnage was shipped in May; however, in June the schedule was stepped up with steady shipments the balance of the season except for lack of cars.

The crushing plant proved inadequate for the type of ore encountered in this property due to its painty-sticky structure, which continually plugged the jaw type crusher.

It was found necessary in some cases to dump ore into stockpile prior to any attempt at crushing in order to relieve this condition somewhat, and during the season a great number of chunks had to be broken to size by hand or at the shovel; however, this handicap is being corrected and a new Hammermill crusher has been ordered for the 1952 season.

7. OPEN PIT (Continued)

b. Open Pit Mining (Continued)

A schedule of 300,000 tons had been set up for 1952, and by the end of the season, with shipments totalling 281,613 tons, the shortage in shipment amounting to only 18,387 tons.

Some lean ore was stockpiled during the year, which was encountered in the course of mining. Actual cost of production was $.947 versus a budget of $.885, indicating an overrun of $.062. This increase in cost was largely due to increase of pumping costs because of the wet weather, increased tire costs resulting from the same handicap, inadequate crusher facilities, as well as truck and shovel repairs.

c. Pumping & Drainage

A deep well pump was operated in the Wanless shaft and a second pump operated in the Woodbridge caved area throughout the year; however, it was found that as the pit was deepened below the drifts leading to the Wanless shaft, these two pumps were insufficient to take care of the inflow of approximately 1,250 gallons per minutes. A fresh water pump - the only one available - was installed; however, maintenance proved to be excessive and other provisions must be made for the 1952 season.

As the Wanless pit becomes deeper, this pumping problem will become more difficult. During the year of 1951 sumps were dug in three different locations and new pipelines out of the pit were installed, totalling a length of 350 feet.

The Woodbridge Creek was diverted in conjunction with the Snyder Mining Co., who bore part of the expense, with the hope that this diversion would keep the water from seeping into the muskeg at the North end of the Woodbridge property and eventually reaching the Wanless Mine. The efficiency of this operation will not be definitely proven of disproven until the year of 1952.

The State Division of Waters and Health Dept., in their regular program of investigating all Mesaba Range pumping problems, made it necessary to establish a settling basin just West of the Wanless Mine between the Great Northern and the DM&IR tracks in order to clarify the water pumped from the mining area. It is possible that this basin may have to be enlarged during the year of 1952, and in order to obtain the enlargement it will have to be moved to some site farther South.

9. MAINTENANCE & REPAIRS

A shutdown period from March 12 to April 23 made possible the general overhauling of trucks, tractors and shovels; however, this period was somewhat short for the smount of repair work necessary.

Changes were made in the railroad loading bin - the pocket and the sides being lined and a false bottom put in to obtain a greater slope in order to make the ore flow out of the pocket and into the cars underneath.

10. COST OF OPERATIONS

a. Comparative Mining Costs

(Continued on next page)

10. COST OF OPERATION

a. Comparative Mining Costs

	1951 Budget	1951 Cost Per Ton	1950 Cost Per Ton
Direct Ore	300,000	286,676	65,334
Average Daily Output		21.80	17.19
Tons Per Man Per Day		62.40	33.67
Days Operated		131½	38
Costs			
Total Pit Operating	$ .408	$ .484	$ .937
Loading Stockpile Ore	.034	.005	.001
Total Gen'l Mine Expense	.207	.162	.256
Winter & Idle Expense	.236	.296	.936
Cost of Production	$ .885	$ .947	$ 2.130
Depreciation-Plant & Equipment		.068	.069
Depreciation - Motorized & Other Equip.		.012	.057
Depreciation - Movable Equipment		.012	.024
Depreciation - Equipment Loaned		.005	-
Amortization - Stripping		.708	.671
Taxes - Ad Valorem		.079	.297
" - Occupational		.003	-
" - Royalty		.003	.001
Misc. Expense & Income		.004	.002
Total Cost at Mine		$1.841	$3.251

b. Comments

No fair comparison between 1950 and 1951 costs can be made due to the extremely low tonnage produced in 1950, which was largely a stripping year. Open pit operating costs showed an increase of $.076 over the budget, with the major increases resulting from truck operation, largely because of the wear on tires caused by the wet weather and slippery roads. Truck maintenance increased due to the fact that the trucks were old and were continually requiring more maintenance. Pumping exceeded the budget due to wet weather making the installation of new pipeline necessary and causing need for increased maintenance on the fresh water pump, which was used in emergencies. Exploration drilling exceeded the budget due to the fact that more drilling was done than anticipated. Other items showed only minor increases, except winter & idle, which exceeded the budget estimate by $.060, caused by the increased repairs necessary.

11. EXPLORATION & FUTURE EXPLORATION

Three holes were put down to a total depth of 898 feet in combined depth. Three holes were drilled on two parcels of land as requested by the State to prove this area for dumping purposes, these holes reaching a combined depth of 244 feet.

12. TAXES

(Continued on next page)

12. TAXES

	1951	1950	Increase	Decrease
Wanless Mine	$20,592.11	$16,919.72	$3,672.39	
Personal Property	2,065.88	2,514.24		$448.36
Total	$22,657.99	$19,544.96	$3,224.03	
Average Tax Rate (mills)	85.91	79.62	6.29	

Mineral reserve was reviewed by the State and increased by 347,591 tons. Tax value increased $27,188.00 on ad valorem taxes.

Personal property value was decreased by depreciation of equipment and sale of new shovel from the property.

Mill rate increased because of additional levy allowed under new per capita law.

13. ACCIDENTS & PERSONAL INJURY

There were 25 minor accidents at the Wanless Mine during 1951 and only one serious accident, which, however, involved no lost time:

Name: Richard Whitney
Date of Injury: January 14, 1951
Cause: Whitney was walking on a slippery road and fell, striking his right knee on the ground.
Nature of Injury: Infected laceration of right knee, involving gland.
Time Lost: None
Compensation: Salary Payroll

14. PROPOSED NEW CONSTRUCTION

An estension to the shop to be used for combined welding and electric shop is proposed for 1952 as well as the installation of a new crusher.

15. EQUIPMENT RECEIVED & PROPOSED NEW EQUIPMENT

Equipment received in 1951:

1 - second hand International KB6 truck for providing service between the pit and the central warehouse.

Proposed new Equipment:

1 - Model HC4 Hammermill is being replaced during the year to do the work which was unsatisfactorily done in 1951 by the present jaw crusher.

11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents

There were two fatal accidents during the year of 1951; one of which occurred at the Lloyd Mine and one at Mather Mine, "B" Shaft.

The total average employment for the year was 4,975, which gives us a fatality rate of .25 for the year. Only three previous years since records have been kept (1898) has the fatality rate been lower. Those years were 1932 (no fatalities), 1946 (no fatalities) and 1949 when the rate was .24.

The fatality rate for 1911 to 1951, inclusive, is 1.98.

One of the fatal accidents occurred from a fall of ground when the miners failed to support broken ground, which could easily be seen. The other occurred when a new employee attempted to walk across the sand in a hopper and a cave-in occurred, caused by a void.

The fall of ground accident was classified as II-5, III-A-4, III-B-4 and the other as II-6.

A brief summary of the two accidents follows:

LLOYD MINE - PAUL L. GRUND

Grund received injuries from a fall of ground on June 10, 1951 at about 1:15 P.M. and died from these injuries within the next half-hour.

Grund, Francis Nault and Wilhart Alanko were engaged in cutting a new sub in Number 832 Raise. An opening had been made in the dividing cribbing and room had been made for two sets of raise timber. After lunch these men were to hoist timber from the level below and then stand the timber in place. When hoisting the timber, the dividing cribbing shifted down somewhat from the weight, causing some sloughed ore in the hanging side of the raise to loosen. At least one of these chunks, together with a few cribbing which had been used as blocking in the hanging of the raise, fell and struck Grund, causing fatal injuries.

MATHER MINE, "B" SHAFT - ROBERT LERLIE

This accident occurred at 12:30 P.M. on November 28, 1951 in the Sand Bin of the Concrete Aggregate Batching Hopper.

Although there were no actual eye witnesses, from investigation and testimony it is apparent that Lerlie attempted to walk across the top of the previously filled sand bin and while in the act, the sand caved, drawing Lerlie into the bin, causing fatal injuries. It is believed that the removal of two or three 650-pound buckets full of sand had left a large void in the bin. The sand no doubt had bridged over the void because it was damp and partly frozen. Lerlie's work was to bar sand in the hopper so it would flow through the chute into the measuring buckets. This work was to be done while standing outside the hopper. Not realizing the danger of standing on the sand in the hopper, he was caught in the cave-in, which fractured his neck. He had been instructed by the foreman as to his duties before starting work that morning.

11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents (Continued)

TABLE I

FATAL ACCIDENT RECORD
THE CLEVELAND-CLIFFS IRON CO. AND CLIFFS POWER & LIGHT CO.
1898-1951, INCLUSIVE

YEAR	NO. MEN EMPLOYED	NO. OF FATALITIES	FATALITY RATE
1898	1065	6	5.63
1899	1174	4	3.41
1900	1427	4	2.80
	3,666	14	3.79
1901	1317	9	6.83
1902	1485	8	5.38
1903	1551	8	5.15
1904	1338	4	2.97
1905	2038	12	6.54
	7,729	41	5.30
1906	2418	10	4.13
1907	2843	17	6.00
1908	2340	6	2.52
1909	2520	13	5.15
1910	2907	20	6.88
	13,028	66	5.06
1898 - 1910		121	4.99
1911	2633	5	1.90
1912	2335	4	1.71
1913	2521	11	4.19
1914	2435	10	4.10
1915	3308	5	1.51
	13,332	35	2.70
1916	3063	8	2.61
1917	3457	6	1.73
1918	3765	13	3.45
1919	3938	11	2.79
1920	4125	5	1.21
	18,348	43	2.36
1921	2309	6	2.60
1922	2301	1	.43
1923	2728	6	2.20
1924	2472	5	2.02
1925	2472	2	.81
	12,282	20	1.61

(Continued)

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11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents (Continued)

TABLE I (Cont'd.)

YEAR	NO. MEN EMPLOYED	NO. OF FATALITIES	FATALITY RATE
1926	2119	55	25.96
1927	1969	4	2.03
1928	1784	4	2.25
1929	2000	4	2.00
1930	2566	5	1.95
	10,438	72	6.90
1931	1651	3	1.82
1932	630	0	0.00
1933	631	2	3.17
1934	1073	4	3.74
1935	1313	2	1.53
	5,298	11	2.05
1936	2125	2	.94
1937	2763	1	.36
1938	2590	3	1.17
1939	2457	1	.41
1940	2756	5	1.88
	12,691	12	.94
1941	3570	5	1.40
1942	3562	2	.56
1943	3609	4	1.11
1944	3584	3	.84
1945	3078	1	.32
	17,403	15	.86
1946	2791	0	0.00
1947	3942	7	1.78
1948	4003	3	.75
1949	4191	1	.24
1950	4344	5	1.15
	19,271	16	.83
1951	4975	2	.25
1911 - 1951	114,038	226	1.98

BASED ON PER THOUSAND EMPLOYEES

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11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents (Continued)

TABLE II

CLASSIFICATION OF CAUSES OF FATAL ACCIDENTS FROM DECEMBER 1, 1898 TO DECEMBER 31, 1951

A.	Fall Of Ground	114	
	Run Of Mud Or Sand	60	
	Fall Of Chunk Of Ore From Chute	2	
	Stray Chunk Or Stick Down Raise Or Stope	4	180
B.	Shaft Accidents:		
	Falling Down Shaft	16	
	Rock Or Timber Falling Down Shaft	3	
	Struck Or Caught By Cage, Skip, Bucket, Tool	8	
	Falling From Cage, Skip Or Bucket	11	
	Falling From Ladder In Shaft	5	
	Carried Or Pushed Into Shaft By Car	3	
	Jumping On Or Off Cage, Skip Or Bucket	3	
	Struck By Crosshead	5	
	Struck By Falling Material	2	56
C.	Use Of Explosives:		
	Explosion Of Powder	16	
	Premature Blast	3	
	Fall Of Ground Or Timber Due To A Blast	4	
	Overcome By Gas	3	
	Miscellaneous Causes	2	28
D.	Mine And Railroad Cars:		
	Caught By Haulage Cars	15	
	Riding Or Attempting To Ride Cars	6	
	Falling With Car From Trestle	4	
	Run Over By Railroad Car	8	
	Struck By Locomotive	2	
	Miscellaneous Causes	1	36
E.	Miscellaneous Causes:		
	Falling In Raise, Stope Or Pocket	10	
	Electric Shock	11	
	Falling From Ladder, Trestle, Etc.	8	
	By Moving Machinery	7	
	Mine Fires	3	
	Stockpile Slide	3	
	Slipping And Falling	1	
	Miscellaneous Causes	4	47
	TOTALS		347

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11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents (Continued)

TABLE III

CLASSIFICATION OF FATAL ACCIDENTS - 1911 TO 1951, INCLUSIVE, BY THE CENTRAL SAFETY COMMITTEE

I.	Trade Risk		124
II.	Negligence Of The Company		
	Violation Of Rules	6	
	Failure To Provide Safety Devices	7	
	Improper Method Of Doing Work	12	
	Failure To Provide Tools Or Safe Places To Work ..	5	
	Failure To Instruct Men	5	
	Improper Act Or Selection Of Improper Method Of Doing Work (By Foreman)	1	36
III.	Negligence Of Workmen		
A.	Injured Men:		
	Improper Act Or Improper Method Of Work	26	
	Violation Of Rules	10	
	Failure To Use Tools Or Appliances Provided	4	
	Failure To Use Safety Devices	3	43
B.	Other Workmen:		
	Improper Act Or Improper Method Of Work	14	
	Violation Of Rules	4	
	Failure To Use Tools Or Appliances Provided	1	19
A-B.	Injured Men And Other Workmen:		
	Improper Act Or Improper Method Of Work	1	1
II-5 & III-A-3 III-B-3	Failure To Instruct Men By Foreman And Violation Of Rules By Injured Man And Partner	1	1
II-5 & III-A-4 III-B-4	Failure To Instruct Men As To Method Of Work And Improper Act Or Selection Of Improper Method Of Doing Work By Injured Workman And Other Workman .	2	2
	TOTALS		226

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries

INTERPRETATION OF INJURY RATES

That injury frequency rates are much more significant than sets of abstract figures punctuated with decimal points is forcefully recognized when they are interpreted in terms of employees.

Using an average of 2,000 hours per employee per year, 1,000,000 hours represents the yearly exposure of about 500 employees. An injury frequency rate of 10.0 per 1,000,000 man-hours, then, indicates 10 disabling injuries per year among each 500 employees, or 1 injury among 50. In a plant with a frequency rate of 20.0, approximately one employee out of every 25 is suffering a disabling injury each year.

The severity rate is the number of days lost and charged per each 1,000 hours worked. Because of the inclusion of time charges, which generally are in excess of the actual number of days lost, it is incorrect to say that the rate represents days lost in relation to a given number of employees.

The severity rate actually is a single rate which measures both the frequency and severity of injuries. Whereas the frequency rate is determined by counting each injury as 1, regardless of the seriousness of the case, the severity rate is determined by counting each injury the number of times indicated by its time charge--i.e., according to its relative severity.

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

A total of 1,691 injuries were reported during the year, of which 1,289 were slight with no lost-time. 264 injuries were of less than seven days lost time and 132 were compensable.

At underground mines we had a total of 101 compensable injuries. Slipping and stumbling caused most injuries with a total of 18. Falls of ground, which in the past used to account for the greatest number of underground injuries, was second this year with 13, but lead with the greatest severity. Falls of ground accidents dropped almost 50% from a year ago. Haulage caused 11 injuries, one more than in 1950. Considerable effort has been used to prevent this type of injury but the human element must be considered here. Rules and safe practices are very often disregarded by young men who operate haulage trains and because it is impossible to watch these men at all times we probably will continue to have this type of accident.

Other underground injuries are well divided among many causes. Noteworthy is the fact that we had only one electrical accident during the year and none in 1950.

On surface at underground mines there were 12 compensable injuries or one less than in 1950. These came from 8 different causes, one of which was the fatal accident at Mather Mine, "B" Shaft.

At open-pit mines there were 21 compensable injuries, which again are pretty well divided among 10 causes. Persons falling (slipping and stumbling) caused 4 of these injuries with icy and wet conditions being responsible for most falls.

At other operations there were 4 injuries, one from moving machinery and three from handling materials.

The frequency rate of all compensable injuries for the year is 12.69 compared to 16.09 for 1950 and the severity is 2.08 compared to 3.97 for 1950.

Briefly other comparisons on compensable injuries are:

		Frequency	Severity
Underground	1951 -	15.58	2.90
	1950 -	21.73	4.87
Open-Pit	1951 -	9.82	.745
	1950 -	5.32	3.72
All Other Operations	1951 -	2.48	.245
	1950 -	3.64	.205

The complete accident statistics are shown in Table No. XI.

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE IX

CLASSIFICATION OF COMPENSABLE INJURIES

CLASSIFICATION	AGNEW	ATHENS	CAMBRIA-JACKSON	CANISTEO	CLIFFS SHAFT	HAWKINS	HILL-TRUMBULL	HOLMAN CLIFFS	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	NEGAUNEE	OHIO	SARGENT	SPIES-VIRGIL	STHSE. & SHOPS	WANLESS	TOTAL
I. Trade Risk, Incidental and Non-Preventable					3	3	1	2	2		2	3	1		1	1		1	20
II. Negligence Of Company:																			
1. Failure To Use Safety Devices Provided																			0
2. Failure To Use Proper Tools Provided																			0
3. Violation Of Rules																			0
4. Improper Act Or Selection Of Method Of Doing Work(By Foreman)																			0
5. Failure To Instruct Men As To Hazards, Method, Etc.			1			2													3
6. Failure To Provide Safety Devices												1	1						2
7. Failure To Provide Tools, Appliances Or Places To Work					2	2				1		1							6
III. Negligence Of Workman:																			
A. Injured Workman																			
1. Failure To Use Safety Devices Provided					1														1
2. Failure To Use Proper Tools, Etc. Provided				1							1			2					4
3. Violation Of Rules	2		1		2		1		2	1		2					1		12
4. Improper Act Or Method Of Doing Work	1	7			16	3	1	1	3	7	18	9		1	2	1	3		73
B. Other Workman																			
1. Failure To Use Safety Devices Provided																			0
2. Failure To Use Proper Tools, Etc. Provided																			0
3. Violation Of Rules		1									1								2
4. Improper Act Or Method Of Doing Work															1				1

(Continued - Next Page)

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE IV (Continued From Previous Page)

CLASSIFICATION OF COMPENSABLE INJURIES

COMBINED CLASSIFICATIONS	AGNEW	ATHENS	CAMBRIA-JACKSON	CANISTEO	CLIFFS SHAFT	HAWKINS	HILL-TRUMBULL	HOLMAN CLIFFS	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	NEGAUNEE	OHIO	SARGENT	SPIES-VIRGIL	STHSE. & SHOPS	WANLESS	TOTAL
III-A-4 and III-B-4				1						1	4	3							9
III-A-3 and III-B-3									1										1
II-5, III-A-4 and III-B-4									1										1
III-A-4 and II-7							1				1								2
III-A-3 and III-B-4											1								1
TOTALS *	3	8	2	2	24	10	4	3	9	10	28	19	2	1	5	3	4	1	138

* Totals Are For This Page And Preceding Page.

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE V

NUMBER OF MAN-SHIFTS WORKED
AND TONS OF ORE PRODUCED PER FATALITY

YEAR	NUMBER OF FATALITIES	NUMBER OF MAN-DAYS WORKED PER FATALITY	NUMBER OF TONS OF ORE MINED PER FATALITY
1932	0	189,000 *	486,750 **
1933	2	94,689	398,357
1934	4	80,477	451,046
1935	2	196,883	1,136,215
1936	2	283,945	1,850,898
1937	1	765,702	5,216,879
1938	3	163,434	385,954
1939	1	564,433	3,713,389
1940	5	142,878	1,156,387
1941	5	182,340	1,456,528
1942	2	512,356	3,808,258
1943	4	269,351	1,624,315
1944	3	331,090	1,995,787
1945	1	915,666	5,970,577
1946	0	747,079 *	4,416,253 **
1947	7	153,031	1,130,679
1948	3	386,965	2,869,090
1949	1	1,013,442	7,162,324
1950	5	233,060	1,647,066
1951	2	679,740	4,507,045
TOTALS	53	15,636,934	103,636,314
20 Year Average -	2.65	295,036	1,955,402

* Man-Days Worked During Year Without Fatality

** Amount Of Ore Mined During Year Without Fatality

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE VI

RESUME OF ALL INJURIES & FATALITIES

MINE OR PLANT	Slight	Less Than 7 Days	7 Days Or More	Fatalities	TOTAL
AGNEW	59	12	3		74
ATHENS	84	24	8		116
ATKINS	25	1	0		26
CAMBRIA-JACKSON	31	8	2		41
CANISTEO	78	6	2		86
C.P.& L. CO.	9	0	0		9
CLIFFS SHAFT	98	28	24		150
GENERAL ROLL	9	0	0		9
HAWKINS	82	17	10		109
HILL-TRUMBULL	70	6	4		80
HOLMAN CLIFFS	64	2	3		69
LLOYD	20	8	8	1	37
MAAS	82	26	10		118
MATHER MINE, "A" SHAFT	231	63	28		322
MATHER MINE, "B" SHAFT	132	35	18	1	186
MISCELLANEOUS	1	0	0		1
MISCELLANEOUS-HIBBING	5	0	0		5
NEGAUNEE SHAFT	19	11	2		32
OHIO	5	0	1		6
RESEARCH LABORATORY	15	1	0		16
SARGENT	77	9	5		91
SPIES-VIRGIL	25	4	3		32
STHSE. & SHOPS	46	1	4		51
TILDEN	2	1	0		3
WANLESS	20	1	1		22
TOTALS	1,289	264	136	2	1,691

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE VII

CAUSES OF COMPENSABLE INJURIES - UNDERGROUND (INCLUDING FATALITIES)

CAUSE	AGNEW	ATHENS	CAMBRIA-JACKSON	CLIFFS SHAFT	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	NEGAUNEE SHAFT	SARGENT	SPIES-VIRGIL	TOTAL
Fall Of Ground			1	1	3	3	2	2			1	13
Falling Chunks (Shafts, Chutes, Raises)		1		2								3
Rolling Chunks					1		2					3
Persons Falling (Raises, Shafts, Scaffolds)				3			2	2				7
Persons Falling (Slipping & Stumbling)	1	1		5	1	3	5	2				18
Haulage	1			2	2	1	3	2				11
Drilling Equipment				2			3	2				7
Loading Equipment	1			1			2	1				5
Machinery (Moving)		1	1	1				1				4
Hand Tools				1	1	1	1	3		1		8
Flying Objects				1							1	2
Handling Materials		1				1	2	1		1		6
Lifting Or Pulling							1			1		2
Electrical							1					1
From Nails Or Sharp Objects											1	1
Falling Or Moving Material		2		1			1		1	1		6
Explosives		1										1
Miscellaneous				1			1		1			3
TOTALS	3	7	2	21	8	9	26	16	2	4	3	101

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE VII (Cont'd.)

OPEN PITS

CAUSE	CANISTEO	HAWKINS	HILL-TRUMBULL	HOLMAN-CLIFFS	OHIO	WANLESS	TOTAL
Persons Falling (Slipping-Stumbling)		3				1	4
Haulage		1		1			2
Drilling Equipment	1						1
Loading Equipment			1				1
Machinery (Moving)	1						1
Hand Tools			2		1		3
Lifting Or Pulling			1	2			3
Explosives		2					2
Falling Or Moving Material		3					3
Miscellaneous		1					1
TOTALS	2	10	4	3	1	1	21

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE VII (Cont'd.)

SURFACE (Underground Mines)

CAUSE	ATHENS	CLIFFS SHAFT	LLOYD	MAAS	MATHER "A"	MATHER "B"	SARGENT	TOTAL
Falling Chunks - (Shafts, Chutes, Raises)						1		1
Persons Falling (Slipping-Stumbling)		1		1				2
Haulage			1				1	2
Machinery (Moving)		1						1
Hand Tools		1						1
Handling Materials						1		1
Lifting Or Pulling					1	1		2
Falling Or Moving Material	1				1			2
TOTALS	1	3	1	1	2	3	1	12

OTHER OPERATIONS

CAUSE	GARAGE, STHSE. & SHOPS	TOTAL
Machinery (Moving)	1	1
Handling Materials	3	3
TOTALS	4	4

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE VIII

FREQUENCY RATES, ALL COMPENSABLE INJURIES

YEAR	TOTAL MAN DAYS WORKED	NUMBER OF COMPENSABLE INJURIES NON-FATAL	FATAL	FREQUENCY * RATE
1935	393,967	35	2	11.74
1936	567,891	33	2	7.70
1937	765,701	58	1	9.65
1938	491,303	46	3	12.49
1939	564,542	44	1	9.96
1940	714,391	59	5	11.19
1941	918,300	79	5	11.43
1942	1,024,713	75	2	9.39
1943	1,077,402 ¼	171	4	20.30
1944	993,272 ½	121	3	15.61
1945	915,665 3/4	107	1	14.74
1946	747,079	101	0	16.89
1947	1,071,219	149	7	18.20
1948	1,160,896 ¼	145	3	15.94
1949	1,013,442	126	1	15.66
1950	1,165,301 ½	145	5	16.09
1951	1,359,479 3/4	136	2	12.69

* Based On One Million Man-Hours Of Labor.

TABLE VIII-A

SEVERITY RATES, ALL COMPENSABLE INJURIES

YEAR	NON-FATAL DAYS LOST	RATE	FATAL DAYS LOST	DAYS LOST ALL INJURIES	SEVERITY * RATE
1935	3,225	1.023	12,000	15,225	4.830
1936	3,509	.772	12,000	15,509	3.413
1937	7,881	1.286	6,000	13,881	2.266
1938	6,290	1.600	18,000	24,290	6.181
1939	3,264	.723	6,000	9,264	2.051
1940	3,442	.602	30,000	33,442	5.852
1941	5,403	.735	30,000	35,403	4.819
1942	5,851	.500	12,000	17,851	2.177
1943	10,355	1.201	24,000	34,355	3.986
1944	7,759	.976	18,000	25,759	3.242
1945	7,624	1.041	6,000	13,624	1.860
1946	7,994	1.337	0	7,994	1.337
1947	9,946	1.161	42,000	51,946	6.062
1948	14,526	1.564	18,000	32,526	3.502
1949	5,833	.719	6,000	11,833	1.390
1950	7,063	.757	30,000	37,063	3.976
1951	10,657	.979	12,000	22,657	2.083

* Based On Days Lost By Injuries Per 1,000 Man-Hours Of Labor.

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE IX

COMPARISON OF COMPENSABLE ACCIDENTS, INCLUDING FATALITIES BY MINES

Mine Or Plant	FREQUENCY 1950	FREQUENCY 1951	SEVERITY 1950	SEVERITY 1951
AGNEW	38.86	12.32	1.356	.712
ATHENS	24.09	10.19	1.351	.362
ATKINS	18.35	- --	.220	---
CAMBRIA-JACKSON	10.27	3.97	12.579	.325
CANISTEO	5.01	4.67	.241	.530
C.P.& L. CO.	- --	- --	---	---
CLIFFS SHAFT	16.84	21.88	1.079	1.150
GENERAL ROLL	- --	- --	---	---
HAWKINS	3.36	19.68	20.147	1.717
HILL-TRUMBULL	8.36	8.39	.460	.266
HOLMAN CLIFFS	2.67	6.76	.040	.773
LLOYD	20.96	25.42	.868	18.424
MAAS	24.54	10.99	7.704	.320
MATHER MINE, "A" SHAFT	17.73	17.63	.910	2.654
MATHER MINE, "B" SHAFT	23.50	20.30	15.350	7.146
MISCELLANEOUS	- --	- --	---	---
NEGAUNEE SHAFT	- --	10.49	---	1.673
OHIO	- --	19.23	---	.173
SARGENT	58.66	20.16	24.650	.681
SPIES-VIRGIL	22.42	11.16	.551	.695
STHSE. & SHOPS	12.56	7.77	.706	.765
TILDEN	- --	- --	---	---
WANLESS	- --	6.94	---	.104
All Properties	16.09	12.69	3.976	2.083

TABLE X

COMPENSABLE INJURIES INCLUDING FATALITIES

Mine Or Plant	Tons Of Ore Produced	Hours Of Labor	No. Of Fatalities	No. Of Comp. Inj.	Days Lost, Fatalities	Compens. Days Lost	Total Days Lost, Fatalities & Compens.	Frequency	Severity
AGNEW	341,819	243,493		3		173	173	12.32	.712
ATHENS	630,804	784,840 3/4		8		284	284	10.19	.362
CAMBRIA-JACKSON	353,394	504,351		2		164	164	3.97	.325
CLIFFS SHAFT	700,346	1,096,918 3/4		24		1,657	1,657	21.88	1.510
LLOYD	259,082	354,366 3/4	1	8	6,000	522	6,522	25.42	18.424
MAAS	712,474	910,094 1/2		10		291	291	10.99	.320
MATHER MINE, "A" SHAFT	1,157,013	1,587,986		28		4,215	4,215	17.63	2.654
MATHER MINE, "B" SHAFT	478,243	935,918 1/2	1	18	6,000	689	6,689	20.30	7.146
NEGAUNEE SHAFT		190,633 1/4		2		319	319	10.49	1.673
SARGENT	250,650	248,324		5		169	169	20.16	.681
SPIES-VIRGIL	237,589	269,159 3/4		3		187	187	11.16	.695
TOTALS	5,121,414	7,126,086 1/4	2	111	12,000	8,670	20,670	15.58	2.901
ATKINS	172,228	42,852		-		-	-	-- --	---
CANISTEO	924,036	427,901		2		227	227	4.67	.530
HAWKINS	666,848	508,085 1/2		10		872	872	19.68	1.717
HILL-TRUMBULL	805,557	477,240		4		127	127	8.39	.266
HOLMAN CLIFFS	931,513	443,691		3		343	343	6.76	.773
LAKE	2,797	6,097		-		--	-	-- --	---
OHIO		52,081		1		9	9	19.23	.173
TILDEN	103,022	36,855		-		-	-	-- --	---
WANLESS	286,676	143,813		1		15	15	6.94	.104
TOTALS	3,892,677	2,138,615 1/2		21		1,593	1,593	9.82	.745
C.P.& L. CO.		141,944							
GENERAL ROLL		681,988							
MISCELLANEOUS		174,685							
MISCELLANEOUS-HIBBING		97,333							
STHSE. & SHOPS		515,186		4		394	394	7.77	.765
TOTALS		1,611,136		4		394	394	2.48	.245
GRAND TOTALS	9,014,091	10,875,837 3/4	2	136	12,000	10,657	22,657	12.69	2.083

TABLE XI

THE CLEVELAND-CLIFFS IRON COMPANY
SAFETY DEPARTMENT, ACCIDENT STATISTICS, YEAR 1951

Mine Or Plant	Tons Of Ore Produced	Hours Of Labor	No. Of Fatalities	No. Of Compens. Injuries	No. Of Non-Comp. 1 - 7 Days	Days Lost-Fatalities	Compensable Days Lost	Days Lost, Non-Compens., 1 - 7 Days	Total No. Lost-Time Injuries, Incl. Fatals.	Total Days Lost, All Inj. & Fatalities	Frequency	Severity	Average No. Days Lost Per Accident	Position Rating
AGNEW	341,819	243,493		3	12		173	23	15	196	61.60	.805	13.1	6
ATHENS	630,804	784,840 3/4		8	24		284	54	32	338	40.77	.431	10.6	3
CAMBRIA-JACKSON	353,394	504,351		2	8		164	27	10	191	19.84	.378	19.1	1
CLIFFS SHAFT	700,346	1,096,918 3/4		24	28		1,657	70	52	1,727	47.40	1.574	33.2	7
LLOYD	259,082	354,366 3/4	1	8	8	6,000	522	20	17	6,542	47.97	18.480	384.8	11
MAAS	712,474	910,094 1/2		10	26		291	54	36	345	39.56	.379	9.6	2
MATHER MINE, "A" SHAFT	1,157,013	1,587,986		28	63		4,215	150	91	4,365	57.31	2.748	48.0	9
MATHER MINE, "B" SHAFT	478,243	935,918 1/2	1	18	35	6,000	689	74	54	6,763	57.69	7.225	125.2	10
NEGAUNEE SHAFT		190,633 1/4		2	11		319	25	13	344	68.20	1.801	26.5	8
SARGENT	250,650	248,324		5	9		169	21	14	190	56.38	.766	13.6	5
SPIES-VIRGIL	237,589	269,159 3/4		3	4		187	12	7	199	26.02	.739	28.4	4
TOTALS	5,121,414	7,126,086 1/4	2	111	228	12,000	8,670	530	341	21,200	47.85	2.975	62.2	
ATKINS	172,228	42,852		0	1		0	2	1	2	23.36	.047	2.0	3
CANISTEO	924,036	427,901		2	6		227	13	8	240	18.69	.561	30.0	7
HAWKINS	666,848	508,085 1/2		10	17		872	40	27	912	53.14	1.795	33.8	9
HILL-TRUMBULL	805,557	477,240		4	6		127	20	10	147	20.96	.308	14.7	6
HOLMAN CLIFFS	931,513	443,691		3	2		343	8	5	351	11.27	.791	70.2	8
LAKE	2,797	6,097		0	0		0	0	0	0	0.00	.000	0.0	1
OHIO		52,081		1	0		9	0	1	9	19.20	.173	9.0	5
TILDEN	103,022	36,855		0	1		0	2	1	2	23.31	.046	2.0	2
WANLESS	286,676	143,813		1	1		15	1	2	16	13.91	.111	8.0	4
TOTALS	3,892,677	2,138,615 1/2		21	34		1,593	86	55	1,679	25.72	.786	30.5	
C.P.& L. CO.		141,944		0	0		0	0	0	0	0.00	.000	0.0	
GENERAL ROLL		681,988		0	1		0	2	1	2	14.66	.003	2.0	
MISCELLANEOUS		174,685		0	0		0	0	0	0	0.00	.000	0.0	
MISCELLANEOUS-HIBBING		97,333		0	0		0	0	0	0	0.00	.000	0.0	
STHSE. & SHOPS		515,186		4	1		394	3	5	397	9.70	.771	79.4	
TOTALS		1,611,136		4	2		394	5	6	399	3.72	.025	66.5	
GRAND TOTALS	9,014,091	10,875,837 3/4	2	136	264	12,000	10,657	621	402	23,278	36.96	2.140	57.9	

FREQUENCY - $\frac{\text{No. Of Lost-Time Accidents x 1,000,000}}{\text{Man Hours Worked}}$

SEVERITY - $\frac{\text{No. Of Days Lost x 1,000}}{\text{Man Hours Worked}}$

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE XII

SHOWING TIME PERIODS WHEN COMPENSABLE INJURIES OCCURRED

TIME	NUMBER	WORKING PERIOD
8:00 A.M. To 12:00 NOON	47	FIRST HALF OF DAY SHIFT
12:00 NOON To 4:00 P.M.	36	SECOND HALF OF DAY SHIFT
4:00 P.M. To 8:00 P.M.	19	FIRST HALF OF AFTERNOON SHIFT
8:00 P.M. To 12:00 MIDNIGHT	17	SECOND HALF OF AFTERNOON SHIFT
12:00 MIDNIGHT To 4:00 A.M.	9	FIRST HALF OF NIGHT SHIFT
4:00 A.M. To 8:00 A.M.	10	SECOND HALF OF NIGHT SHIFT
TOTALS	138	

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE XIII

PERCENTAGES OF COMPENSABLE INJURIES OF THE VARIOUS AGE GROUPS
MESABA RANGE PROPERTIES, 1951

AGE GROUPS	NO. OF COMP. INJURIES	PERCENTAGE OF EMPLOYEES	PERCENTAGE OF INJURIES	PERCENTAGE OF TIME LOST	FREQUENCY RATING	SEVERITY RATING
18 - 20	2	5.8	7.14	7.27	5	7
21 - 25	3	11.1	10.72	19.47	6	9
26 - 30	1	12.3	3.57	2.49	4	6
31 - 35	1	11.7	3.57	1.25	4	4
36 - 40	-	14.4	-	-	1	1
41 - 45	-	10.8	-	-	2	2
46 - 50	4	9.8	14.28	17.50	7	8
51 - 55	2	7.7	7.14	1.71	5	5
56 - 60	10	9.1	35.72	25.80	9	11
61 - 65	5	6.9	17.86	24.51	8	10
66-Over	-	.4	-	-	3	3
TOTALS	28	100 %	100 %	100 %		

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE XIV

PERCENTAGES OF COMPENSABLE INJURIES OF THE VARIOUS AGE GROUPS
MARQUETTE AND MENOMINEE RANGE PROPERTIES - 1951

AGE GROUPS	NO. OF COMP. INJURIES	PERCENTAGE OF EMPLOYEES	PERCENTAGE OF INJURIES	PERCENTAGE OF TIME LOST	FREQUENCY RATING	SEVERITY RATING
18 - 20	8	5.0	7.27	30.93	3	10
21 - 25	15	10.1	13.64	32.53	8	11
26 - 30	11	12.4	10.00	2.79	5	5
31 - 35	12	14.0	10.91	1.51	6	3
36 - 40	17	15.1	15.45	5.51	9	8
41 - 45	14	13.2	12.74	2.75	7	4
46 - 50	9	9.6	8.18	4.42	4	7
51 - 55	8	7.6	7.27	15.45	3	9
56 - 60	9	6.1	8.18	2.84	4	6
61 - 65	7	6.0	6.36	1.27	2	2
66-Over	0	.9	-	-	1	1
TOTALS	110	100 %	100 %	100 %		

11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE XIV-A

PERCENTAGES OF COMPENSABLE INJURIES OF THE VARIOUS AGE GROUPS
ALL PROPERTIES - 1951

AGE GROUPS	NO. OF COMP. INJURIES	PERCENTAGE OF EMPLOYEES	PERCENTAGE OF INJURIES	PERCENTAGE OF TIME LOST	FREQUENCY RATING	SEVERITY RATING
18 - 20	10	5.2	7.25	28.92	2	9
21 - 25	18	10.4	13.04	31.42	8	11
26 - 30	12	12.4	8.70	2.76	7	10
31 - 35	13	13.4	9.42	1.49	3	2
36 - 40	17	14.9	12.32	5.04	5	6
41 - 45	14	12.5	10.14	2.52	4	3
46 - 50	13	9.6	9.42	5.53	3	7
51 - 55	10	7.6	7.25	14.28	2	8
56 - 60	19	6.9	13.77	4.79	6	5
61 - 65	12	6.3	8.69	3.25	3	4
66-Over	-	.8	-	-	1	1
TOTALS	138	100 %	100 %	100 %		

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE XIV-B

PERCENTAGES OF EMPLOYEES IN VARIOUS AGE GROUPS

YEARS OF AGE (Inclusive)

Mine Or Plant	18-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-Over
AGNEW	3.2	8.8	12.0	9.6	17.6	8.0	8.0	6.4	16.0	9.6	.8
ATHENS	3.8	6.1	11.9	12.5	12.8	15.1	10.7	10.2	7.3	9.0	.6
ATKINS & WANLESS	7.0	12.7	19.7	16.9	22.5	7.1	7.1	2.8	1.4	2.8	-
CAMBRIA-JACKSON	9.4	8.0	7.6	12.9	15.2	17.4	9.4	6.7	6.3	6.7	.4
CANISTEO	3.9	9.9	10.3	14.8	17.3	15.3	10.3	3.9	9.4	4.4	.5
C.P.& L. CO.	1.7	12.1	10.4	12.1	13.8	12.1	15.5	6.9	3.4	8.6	3.4
CLIFFS SHAFT	4.1	8.8	10.1	15.4	15.6	16.2	7.8	10.1	5.7	5.1	1.1
HAWKINS	11.4	15.7	14.0	11.4	10.4	7.4	9.4	8.0	7.0	5.0	.3
HILL-TRUMBULL	2.2	13.0	13.0	13.0	10.9	13.0	10.9	9.3	4.9	9.3	.5
HOLMAN CLIFFS	-	3.8	8.7	8.7	16.3	14.4	14.4	11.5	10.6	10.6	1.0
LLOYD	5.2	12.6	8.8	12.0	10.8	8.2	15.2	11.4	8.8	7.0	-
MAAS	3.5	8.3	8.8	12.1	14.1	11.6	11.1	9.3	9.6	10.3	1.3
MATHER MINE, "A" SHAFT	5.0	12.2	15.9	15.2	14.7	13.2	8.6	5.7	5.4	3.3	.8
MATHER MINE, "B" SHAFT	8.1	12.5	15.2	14.7	19.3	13.3	8.5	4.6	1.8	1.8	.2
NEGAUNEE SHAFT	2.3	10.3	14.9	18.4	17.3	10.4	5.7	4.6	6.9	6.9	2.3
MISCELLANEOUS (HIBBING)	9.1	13.6	11.4	6.8	22.8	6.8	15.9	9.1	4.5	-	-
SARGENT	7.7	4.9	9.6	6.7	11.5	11.5	4.9	11.5	19.2	12.5	-
SPIES-VIRGIL	-	3.6	20.0	14.6	14.6	10.9	8.2	8.2	10.9	9.0	-
STHSE. & SHOPS	4.3	13.0	11.6	12.1	14.0	7.2	11.6	6.8	6.8	10.2	2.4
MESABA PROPERTIES	5.8	11.1	12.3	11.7	14.4	10.8	9.8	7.7	9.1	6.9	.4
MARQ. & MEN. RANGES	5.0	10.1	12.4	14.0	15.1	13.2	9.6	7.6	6.1	6.0	.9
ALL PROPERTIES	5.2	10.4	12.4	13.4	14.9	12.5	9.6	7.6	6.9	6.3	.8

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11. ACCIDENTS AND PERSONAL INJURY

b. All Injuries (Continued)

TABLE XV

SHOWING OCCUPATION OF INJURED WORKERS

COMPENSABLE INJURIES

UNDERGROUND		SURFACE		OPEN-PIT	
Miner	63	Top Lander	1	Truck Operator	2
Miners' Helper	1	Carpenter	2	Shovel Operator	3
Motorman	5	Blacksmith	2	Shovel Oiler	1
Motor Brakeman	7	Blacksmith Helper	1	Blacksmith Helper	1
Cage-Tender	4	Top Tram Engr.	1	Locomotive Engr.	1
Scraper Operator	6	Drill Sharpener	1	Laborer	1
Timberman	2	Laborer	4	Truck Maintenance	1
Shift Boss	2	Machinist	2	Drill Operator	1
Electrician	1	Welder	2	Locomotive Brakeman	1
Trammer	2	Sampler	1	Surface Foreman	1
Welder	1			Drill Helper	1
Trackman	2			Sampler	1
Trackmans' Helper	1			Carpenter	1
Scraper Repair Foreman	1			Machine Operator	1
Carpenter	1			Clerk	1
Chuteman	1			Dumpman	1
Diamond Drill Operator	1			Blaster	1
TOTALS	101		17		20

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection

During the year two men were transferred to the Safety Department and one man was retired.

Mr. Marvin A. Swanson, who formerly was an underground shift-boss at the Lloyd Mine, was transferred to the Safety Department on March 16, 1951.

Mr. Robert C. Silas was transferred to the department on the same date from the Mather Mine, "A" Shaft where he had been a miner. Mr. Silas is taking care of dust sampling and analysis and assisting in ventilation work. Both men have done very well since starting with the department.

Mr. Harry F. Rogers retired on December 31, 1951 after many years service with the company. He started with the Safety Department in 1937 after many years as Mining Captain at the Spies-Virgil and Athens Mines.

Mr. T. W. Hill, Ventilation Engineer, was being prepared to do mine safety inspection as well as ventilation work.

On the Mesaba Range safety inspections are made by G. R. Whittington, Safety Supervisor, who also takes care of compensation work, and by Roy Gram and Alfred Hurley, Safety Inspectors.

All these men make routine inspections of all operating and idle properties. Reports are submitted on all inspections but do not include any hazard or unsafe condition which is corrected by the work supervisor.

Idle Property

Considerable time is required to keep idle property free from hazards. On the Marquette Range the Safety Inspectors check idle property each spring and fall when there are no leaves on the trees, which makes it easy to see all fences, pits and shafts.

Reports of any damage at idle properties are sent to Mr. Julian Payen, who with his crew repairs the damage.

Each year considerable fencing is damaged by heavy snows, children and adults. When possible, the more shallow pits are filled with earth.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Fire Patrol Inspection

Most fire patrols on surface are made by the watchmen and police. During the past year there were only a few minor fires reported. Lightning did strike a transformer station of The Cliffs Power & Light Company located at the Inland Steel Company's Morris Mine. Fire destroyed the entire installation.

At underground properties fire patrols inspect the entire mine after the last shift preceeding any idle period and at least once every 24-hours thereafter. This is one of the very important inspections and should prevent any major fire.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XVI

1951

Mine Or Plant	Violations Of Standards	Safety Suggestions	Recommendations	Fire Hazard	Total
ATHENS	20	5	4		29
CAMBRIA-JACKSON	22	3	2		27
CLIFFS SHAFT	34	20	12	1	67
DIAMOND DRILLS		2	3		5
GEN. STHSE. & SHOPS		1	1	2	4
LLOYD	9	3	1	1	14
MAAS	37	7	4		48
MATHER MINE, "A" SHAFT	25	7	4		36
MATHER MINE, "B" SHAFT	12		1	2	15
NEGAUNEE SHAFT	1	2	2	1	6
SPIES-VIRGIL	6	6	3		15
RESEARCH LAB. & PELLET.PLANT	1	1	2		4
POWER PLANT		1	2		3
TOTALS	167	58	41	7	273

TABLE XVII

1950

Mine Or Plant	Violations Of Standards	Safety Suggestions	Recommendations	Fire Hazard	Total
ATHENS	9	10	3	1	23
CAMBRIA-JACKSON	13	18	4	1	36
CLIFFS SHAFT	14	21	8	1	44
DIAMOND DRILLS		1	1		2
GEN. STHSE. & SHOPS	3	4	4	2	13
ISHPEMING HOSPITAL	1	4	3	2	10
LLOYD	10	3	2		15
MAAS	21	15	8	2	46
MATHER MINE, "A" SHAFT	15	18	8		41
MATHER MINE, "B" SHAFT	2	3	3		8
SPIES-VIRGIL	2	1	1	1	5
TOTALS	90	98	45	10	243

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Blasting Inspections

These inspections should be made by shift bosses at blasting time each week of one or more contracts and at least once every two months of all contracts. This is one method of keeping safe blasting procedure before the miners and bosses at all times. Corrections can be made of any unsafe practice and instructions given to new employees.

A total of 981 inspections were made during the year with 143 violations reported. Most of the violations were failure to use tamping. The Athens and Spies Mines failed to report any inspections during the entire year. The Negaunee Shaft did not report but all blasting was under the supervision of a foreman.

All Superintendents have been asked in writing to urge compliance of this very important safety rule.

11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XVIII

NUMBER OF INSPECTIONS MADE DURING THE BLASTING PROCEDURE IN VARIOUS MINING CONTRACTS

MINE	NO. OF INSPECTIONS	NO. OF VIOLATIONS REPORTED
Athens	0	0
Cambria-Jackson	58	43
Cliffs Shaft	184	10
Lloyd	13	4
Maas	99	5
Mather Mine, "A" Shaft	482	69
Mather Mine, "B" Shaft	145	12
Negaunee Shaft *	0	0
Spies-Virgil	0	0
TOTALS	981	143

* Sinking Shaft
(Boss Always Present)

11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Rules & Regulations

A total of 725 surface and underground rule books were distributed during the year. Most of these were to new employees who sign the receipt for the same and these receipts are returned to the Safety Dept. Other rule books go to employees who change from surface to underground or vice versa.

A revision of the rule books will be made in the near future to care for new rules and eliminate obsolete rules.

All new rules decided on by the Central Safety Committee are listed in the committee proceedings and it is the duty of the Superintendent or Head of Department to advise his supervisors of the changes.

Considerable work was done on new open-pit rules for the Mesaba Range and these rules will soon go to the printers. Similar rules will be made up for the Marquette Range in the near future.

Underground rules for the Mesaba Range are also in the making but will require more study to make them fit the operations.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XIX

RULE BOOKS DISTRIBUTED AT MICHIGAN MINES AND PLANTS

Mine Or Plant	SURFACE	UNDERGROUND	TOTAL
ATHENS	5	39	44
CAMBRIA-JACKSON	2	44	46
C.P.& L. CO.	6	-	6
CLIFFS SHAFT	3	67	70
ENGR. & GEOL. DEPTS.	1	5	6
LLOYD	2	32	34
MAAS	8	46	54
MATHER MINE, "A" SHAFT	9	111	120
MATHER MINE, "B" SHAFT	24	152	176
NEGAUNEE SHAFT	11	23	34
OHIO	54	-	54
SPIES-VIRGIL	-	8	8
STHSE. & SHOPS	64	-	64
TILDEN	5	-	5
MISCELLANEOUS	3	1	4
TOTALS	197	528	725

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Inspection Reports From Mines & Plants

All safety inspections are not made by members of the Safety Department. There are twelve (12) inspections made by foremen and others at the various properties. All the inspections these men make are reported in writing to the Mine Superintendent and Safety Dept. for checking. Dividing these inspections among the bosses and supervisors makes them more conscious of safety and serves a dual purpose in this way.

These inspections include:

HOISTING ROPES (Daily)
SKIP & CAGE ROADS (Twice A Week)
SAFETY CATCHES ON CAGES (Monthly)
LADDER ROADS (Weekly)
SLACK ROPE ALARM (Monthly)
HOISTING ENGINES (Monthly)
FIRE EXTINGUISHERS (Twice A Year)
FIRE EQUIPMENT (Four Times A Year)
FIRE PREVENTION (Once A Year)
BLASTING INSPECTIONS (Six Times A Year - Each Contract)
OLD STOPE INSPECTIONS (Cliffs Shaft Mine)
FIRE PATROL INSPECTIONS (Underground)

Fire-fighting equipment must be inspected at regular intervals. The Safety Department also inspects this equipment during routine trips. All reports of inspections by foremen are sent to the Safety Department for checking.

Table XX shows the inspections by Mines & Plants.

11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Following are tables showing the kind and number of safety inspection reports made by the mine and plant foremen, which were received and checked by this department.

TABLE XX

Type Of Inspection	Ag-new	Ath ens	Camb. Jack.	Cliffs Shaft	Lloyd	Maas	Mather Mine, A-Shaft	Mather Mine, B-Shaft	Neg. Shaft	Sar-gent	Spies-Virgil	Total
HOISTING ROPES	52	297	273	292	561	275	317	301	241	52	191	2,852
SKIP & CAGE ROADS	51	103	120	82	59	41	52	48	7	-	30	593
LADDER ROAD	52	51	10	82	29	41	48	48	-	45	28	434
CAGE SAFETY CATCHES	12	12	9	18	22	12	11	12	-	-	13	121
SLACK ROPE ALARM	-	10	9	12	7	5	9	-	-	-	12	64
HOIST INSPECTION	-	24	12	24	33	31	25	34	15	-	24	222
FIRE EXTINGUISHERS	2	2	2	2	2	2	2	2	2	2	2	22
FIRE EQUIPMENT	4	1	4	-	-	3	4	-	-	4	-	20
FIRE PREVENTION	2	9	9	14	6	16	5	5	21	6	11	104
HOIST ENGR. SPEC. REPORT	50									46		96
C.O. ALARM						12		3				15
TOTALS	225	509	448	526	719	438	473	453	286	155	311	4,543

Mine Or Plant	Fire Extinguishers	Fire Prevention	Fire Equipment	Total
ATKINS	2	-	1	3
CANISTEO	2	9	4	15
C.P.& L. CO.	14	8		22
GENERAL OFFICE (ISHPEMING)	2	-		2
HAWKINS	2	36	4	42
HIBBING OFFICE	2	1		3
HILL-TRUMBULL	2	16	4	22
HOLMAN CLIFFS	2	17	4	23
ISHPEMING HOSPITAL	2	-		2
NEGAUNEE DISPENSARY	2	-		2
PELLETIZING PLANT	1	1		2
PRINCETON	2	4		6
RENTED BUILDINGS	2	-		2
RESEARCH LABORATORY	1	1		2
STHSE., SHOPS & GARAGE	2	6		8
TILDEN	2	14		16
WANLESS	2	10	4	16
TOTALS	44	123	21	188

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XXI

TYPES AND TOTALS OF FIRE EXTINGUISHERS INSTALLED AT VARIOUS PROPERTIES

Mine Or Plant	2½ Gal. Soda-Acid	2½ Gal. Non-Freeze	2½ Gal. Foam Type	1 - 1¼ Qt. Vaporizing	1 - 3½ Gal. Vaporizing	4 lb. Dry Powder	15 lb. Dry Powder	20 - 30 lb. Dry Powder	10 - 15 - 30 lb. Carbon Dioxide	Automatic Carbon Dioxide	150 lb. Dry Powder - Engine	TOTAL
AGNEW	1	1		3	1		3	2				11
ATHENS	8	13		22	1		4	4				52
CAMBRIA-JACKSON	9	3		11	3			10				36
CANISTEO	6		1	45			10	8				70
CLIFFS SHAFT	14	7	2	37	3			5				68
GEN. STHSE. & SHOPS	14	21	1	45	3						1	85
HAWKINS	11			30	13		5	6				65
HILL-TRUMBULL	2			27	1		14	7				51
HOLMAN CLIFFS	9			64			6	18				97
LLOYD	8	2	1	26	4		4					45
MAAS	6		1	21	6		3	4				41
MATHER MINE, "A" SHAFT	10	2		49				23				84
MATHER MINE, "B" SHAFT	9			30		1	4	27				71
NEGAUNEE SHAFT	7	3		19	3		6					38
SARGENT	2			11	1		1	2				17
SPIES-VIRGIL	3	12		18	3		6	5				47
TILDEN	1	6		37	1		3					48
WANLESS	2			7	1		2	1			1	14
McCLURE PLANT, CP&L CO.				3	2			2				7
CARP PLANT, CP&L CO.				4	1			2	1			8
HOIST PLANT, CP&L CO.				2	2			2				6
REPUBLIC PLANT, CP&L CO.				1	1			1	1			4
ESCANABA PLANT, CP&L CO.				1	1			1	1			4
AuTRAIN PLANT, CP&L CO.				1	2			1	1			5
DIESEL PLANT, CP&L CO.			5	3							1	9
HIBBING OFFICE	4		1		1							6
ISHPEMING ~~OFFICE~~ HOSP.	9			13								22
NEGAUNEE DISPENSARY	4	1		7								12
ISHPEMING GEN. OFFICE	7			8								15
RENTED HOUSES	1			17								18
PRINCETON	1			3	1							5
GWINN SUB-STATION				3				1				4
STEAM PLANT, CP&L CO.				2					12	5		19
RESEARCH LABORATORY	4			5				6				15
TOTALS	152	71	12	575	55	1	71	138	16	5	3	1,099

11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Disciplinary Action

A total of 219 reports on disciplinary actions were received by this office and reported in Table XXII. Losing too much time from work brought 54 lay-offs. Reporting to work under the influence of liquor was next in line, causing 29 lay-offs. Twenty-seven (27) men were disciplined for violations of rules; 18 for excessive absenteeism due to alcoholism; 17 for insubordination, 22 for sleeping on the job; 15 for violating the "No Smoking" rule, etc.-

The "No Smoking" rule was changed during the year from immediate discharge to two warning lay-offs and the third time - discharge. This change may help some in that some supervisors in the past were reluctant to enforce the old rules because of sympathy for some older employee who might be caught smoking. This is a supposition, but is believed to be true. Now at least the man will not lose his job until the third time he is caught.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XXII

CAUSES AND NUMBER OF DISCIPLINARY ACTIONS

Mine Or Plant	Excessive Absenteeism Due To Alcoholism	Reporting To Work Under The Influence Of Liquor	Violation Of Rules	Violation Of "No Smoking" Rule	Losing Too Much Time	Leaving Job Without Authority	Insubordination	Sleeping On The Job	Horse-Play	Carelessness In Performing Work	Fighting underground	Reporting Falsely On Work Performed	Loafing at work	TOTAL
ATHENS	1	2	1	4	5	3								16
CAMBRIA-JACKSON			1	3	6	2	3	1						16
CLIFFS SHAFT	8		1	1	10		1		1	1				23
GEN. STHSE. & SHOPS	1	1	1											3
LLOYD		2		1	2						2			7
MAAS			3		9	2	3							17
MATHER MINE, "A" SHAFT	4	10	5	3	13	2	5	20		1			10	73
MATHER MINE, "B" SHAFT	4	6	4	3	6		4			3	2			32
NEGAUNEE SHAFT		2	1											3
PELLETIZING PLANT		1						1						2
DIAMOND DRILLS					2		1					2		5
SPIES-VIRGIL					1									1
CANISTEO		2	2							1				5
HILL-TRUMBULL		1	2							1				4
HOLMAN CLIFFS		2	1							1				4
HAWKINS			3							2				5
WANLESS			2							1				3
TOTALS	18	29	27	15	54	9	17	22	1	11	4	2	10	219

11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Central Safety Committee

This committee met 12 times during the year. At each meeting accidents for the past month are classified and discussed, after which, various subjects are taken up. Briefly the subjects for 1951 were:

January 12 - Goggle cleaning equipment.
Safe handling of steel sets underground.

February 9 - Clearance of shaft runners and wearing shoes on skips and cages.

March 9 - Monthly inspection of underground man-hoists by the Mechanical Department the same as surface hoists.
Clothing charges at various properties - all charges will be the same.
Procedure for going back to work after losing 6 days - clear through Dr. Waldie
Haulage tail-lamps on underground trains.

April 20 - Jacks for underground locomotives.
Use of side support for ground in all mining contracts.
Approved use of 2½-in. pipe for raise stages. Pipe to be equipped with flange.
Request for Safety Inspectors to discuss with Capt. or Supt. findings on all trips.

May 23 - Steel lifting clamps and track-jacks.

June 8 - Dust counts - collaring holes dry.
Change of cradle in safety hats.
Eimco #40 accidents and possible elimination of same.

July 20 - Mine rescue training.
Control switches for Mather "B" mine-fan on the "A" side as well as on the "B" Shaft side and automatic closing fire door between the two mines.
Discussion of fires which occurred in Pickands Mather Co. mines on the Gogebic Range.
C.I.O. representatives who will travel with company Safety Inspectors.
Possible new rule for cutting subs in raises.

August 10 - Phones for underground haulage locomotives.
Cap lamp battery belts.

(Cont'd.)

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Central Safety Committee (Cont'd.)

September 14 - Foot baths - ruled out.
Plastic gloves for underground.
New type felt shoes with safety toes for surface men during cold weather.
DuPont blasting switches, power time and battery. Both satisfactory - Battery type very good and almost fool-proof.

October 19 - Heavy-duty truck operations. Spinning of steering wheels causing injuries. Power steering will eliminate these. All new trucks are so equipped.
Discussion of accident when shaft broke on a drill rig. - shaft crystallized.

November 9 - DuPont electric blasting unit demonstrated.
Committee voted 100% to discontinue use of Master Fuse Lighters.
Safety glasses used by shift boss caught in blast exhibited. Good proof of glasses ability to save eyes from injury.
Treatment of axe and pick handles with pentachlorophenol solution in mineral salts discussed. To date, no dermatitis caused.

December 14 - Occupational hernias - reports should be made promptly.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Lake Superior Mines Safety Exchange

Safety Exchange meetings are held only four times a year, usually the day previous to a Lake Superior Mines Safety Council meeting. There are 10 companies operating in the Lake Superior District who are members of the Exchange. Each company is permitted to ask two questions on safety each quarter of the year and these are answered before the next meeting, at which time the problem is discussed. Emergency problems can be sent out at any time.

Lake Superior Mines Safety Council

The council met eleven (11) times during the year:-

January 11, 1951	-	Virginia, Minnesota
February 8, 1951	-	Caspian, Michigan
March 8, 1951	-	Ironton, Minnesota
April 5, 1951	-	Ironwood, Michigan
May 3, 1951	-	Duluth, Minnesota
May 17-18, 1951	-	Duluth, Minnesota (Annual Meeting)
July 12, 1951	-	Duluth, Minnesota
August 17, 1951	-	Duluth, Minnesota
September 13, 1951	-	Ely, Minnesota
November 8, 1951	-	Grand Rapids, Minnesota
December 6, 1951	-	Ishpeming, Michigan

Company employees who presented papers at some of these meetings are:

Arthur Olson, District Electrician - "Cooperation Of The Shift Boss In Promoting Safety With Electrical Equipment Underground"

Hugh Leach, Superintendent - "General Safety"

John Sheppard, Engineer - "Safety In Plant Designing"

Attendance at the meetings was slightly above 1950 but the annual meeting had an attendance of 702, or two less than in 1950.

This is known as the largest organization of its kind in the country and has the finest safety programs in the mining industry.

11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

National Safety Council

Our company has been a member of this organization for 40 years and is a charter member. We have taken part in many of the programs and have assisted the council in many ways. I have been a member of the Program Committee, Chairman Of The Visual Aids and Poster Committee and at present time, am 1st Vice-Chairman and a member of the Executive Committee.

Each year the annual meetings attract several thousands of persons from all over the United States and many foreign countries. We have received and are receiving valuable information from the council. The last annual meeting was held October 8-12, 1951 and was attended by 6 employees from the Michigan District and 4 employees from the Mesaba Range.

Safety "Banner Flag"

The underground operation to win the "Banner Flag" for 1951 was the Cambria-Jackson Mine with a severity rating of .378.

The winner in open-pit operations was the Tilden Mine with a 0.00 severity rating.

The independent unit winner was The Cliffs Power & Light Company, also with a 0.00 severity rating. The C.P.& L. Co. has now operated for 30 months without a lost-time injury.

Many of the mines and plants had enviable safety records during the year. The Maas Mine, with a severity rating of 0.379, must be considered as having an excellent record because of the fact that it operated a total of 910,094 man-hours and hoisted 712,474 tons of ore plus development rock.