

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYa. Fatal Accidents (Continued)

TABLE I

FATAL ACCIDENT RECORD
THE CLEVELAND-CLIFFS IRON CO. AND CLIFFS POWER & LIGHT CO.
1898-1950, INCLUSIVE

<u>YEAR</u>	<u>NO. MEN EMPLOYED</u>	<u>NO. OF FATALITIES</u>	<u>FATALITY RATE</u>
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)

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYa. Fatal Accidents (Continued)

TABLE I (Cont'd.)

<u>YEAR</u>	<u>NO. MEN EMPLOYED</u>	<u>NO. OF FATALITIES</u>	<u>FATALITY RATE</u>
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
1911 - 1950	109,063	224	2.06

BASED ON PER THOUSAND
EMPLOYEES

Safety Department

Annual Report

Year 1950

11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents (Continued)

TABLE II

CLASSIFICATION OF CAUSES OF FATAL ACCIDENTS FROM DECEMBER 1, 1898 TO DECEMBER 31, 1950

A.	Fall Of Ground	113	
	Run Of Mud Or Sand	60	
	Fall Of Chunk Of Ore From Chute	2	
	Stray Chunk Or Stick Down Raise Or Stope	<u>4</u>	179
B.	<u>Shaft Accidents:</u>		
	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	<u>2</u>	56
C.	<u>Use Of Explosives:</u>		
	Explosion Of Powder	16	
	Premature Blast	3	
	Fall Of Ground Or Timber Due To A Blast	4	
	Overcome By Gas	3	
	Miscellaneous Causes	<u>2</u>	28
D.	<u>Mine And Railroad Cars:</u>		
	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	<u>1</u>	36
E.	<u>Miscellaneous Causes:</u>		
	Falling In Raise, Stope Or Pocket	9	
	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	<u>4</u>	46
	TOTALS		<u>345</u>

Safety Department

Annual Report

Year 1950

11. ACCIDENTS AND PERSONAL INJURY

a. Fatal Accidents (Continued)

TABLE III

CLASSIFICATION OF FATAL ACCIDENTS - 1911 TO 1950, INCLUSIVE, BY THE CENTRAL SAFETY COMMITTEE

I.	Trade Risk		124
II.	<u>Negligence Of The Company</u>		
	Violation Of Rules	6	
	Failure To Provide Safety Devices	6	
	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)	<u>1</u>	35
III.	<u>Negligence Of Workmen</u>		
A.	<u>Injured Men:</u>		
	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	<u>3</u>	43
B.	<u>Other Workmen:</u>		
	Improper Method Of Doing Work	14	
	Violation Of Rules	4	
	Failure To Use Tools Or Appliances Provided	<u>1</u>	19
A-B.	<u>Injured Men And Other Workmen:</u>		
	Improper Act Or Selection Of Improper Method Of Doing Work	<u>1</u>	1
II-5 & III-A-3 III-B-3	Failure To Instruct Men By Foreman And Violation Of Rules By Injured Man And Partner	<u>1</u>	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 .	<u>1</u>	<u>1</u>
	TOTALS		224

Safety Department

Annual Report

Year 1950

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.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

Accident statistics for the year disclose that we have had 366 lost-time injuries during the year. This includes every injury where the injured failed to report for work the day following the injury.

The 366 lost-time injuries compares with 355 for the year of 1949, but the difference in man-hours worked is 9,322,411 for 1950 and 8,107,935 for 1949.

Falls of ground injuries were the most frequent of compensable injuries (24) and caused the greatest amount of lost-time, including three fatalities.

Falling or moving material, other than ground, caused 17 compensable injuries; persons falling (slipping & stumbling) caused 14 injuries. Most of the slipping and falling accidents occurred where the walking was good.

Underground haulage caused 10 injuries, some quite severe. Haulage will always be a serious hazard because of sudden derailment and lack of room because of crushing ground in cross-cuts. Nearly everything known has been done to safe-guard this operation but it still requires sane thinking on the part of employees to prevent these accidents.

Rolling chunks, which caused 9 injuries, are nearly 100% preventable. Nearly all these injuries were caused in scraping troughs in transfers or slices. Loose chunks should be barred down with bars not less than seven feet long, but to save time, men will use a pick and expose themselves to the hazard.

Loading at chutes also caused 9 injuries, such as chunks rolling over the car onto the loaders' feet and chunks striking the bar or blowpipe and it in turn, striking the loader.

Other underground compensable injuries classified as to causes are well distributed and are listed under Table VII, continuation of which classifies Surface Operations at Underground Mines, Open Pits and Miscellaneous.

Two of the three explosive accidents were caused by violation of rules when the miners failed to leave the place when the hot-wire fuse lighters burned through and then other lighters were ignited to complete lighting all fuses in the round. The blast went off and both miners were injured.

The cause of the third explosive accident is not definitely known but is believed to have been caused when fuse spit through the side and ignited powder which had spilled in the bore-hole while charging the hole.

None of the explosive injuries were serious but all three could have caused instant death.

TABLE IV
CLASSIFICATION OF COMPENSABLE INJURIES

CLASSIFICATION	AGNEW	ATHENS	ATKINS	CAMBRIA-JACKSON	CANISTEO	CLIFFS SHAFT	HAWKINS	HILL-TRUMBULL	HOLMAN CLIFFS	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	SARGENT	SPIES-VIRGIL	STHSE. & SHOPS	TOTALS
I. Trade Risk, Incidental and Non-Preventable	4	6	1	1		5	1	1	1	3	5	7	2	4	1	1	43
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)								2							1		3
5. Failure To Instruct Men As To Hazards, Method, Etc.																	0
6. Failure To Provide Safety Devices					1						1						2
7. Failure To Provide Tools, Appliances Or Places To Work						2								1			3
III. Negligence Of Workman:																	
A. Injured Workman																	
1. Failure To Use Safety Devices Provided																	0
2. Failure To Use Proper Tools, Etc. Provided	1																1
3. Violation Of Rules	2	1								1	3			2	1		10
4. Improper Act Or Method Of Doing Work	1	6	1	3		7				2	11	13	4	6	2	1	57
B. Other Workman																	
1. Failure To Use Safety Devices Provided														1			1
2. Failure To Use Proper Tools, Etc. Provided														1			1
3. Violation Of Rules																	0
4. Improper Act Or Method Of Doing Work	1										1		2	1	1		6

11. ACCIDENTS AND PERSONAL INJURY

b. ALL Injuries

(Continued)

Year 1950

Annual Report

Safety Department

(Continued - Next Page)

TABLE IV (Continued From Previous Page)

CLASSIFICATION OF COMPENSABLE INJURIES

COMBINED CLASSIFICATIONS	AGNEW	ATHENS	ATKINS	CAMBRIA-JACKSON	CANISTEO	CLIFFS SHAFT	HAWKINS	HILL-TRUMBULL	HOLMAN CLIFFS	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	SARGENT	SPIES-VIRGIL	STHSE. & SHOPS	TOTALS
III-A-4 and III-B-4		5		1		3				2	2	2	2			1	18
III-A-3 and III-B-3												1					1
II-4 and III-B-4					1												1
II-3 and II-6						1											1
II-5 and III-A-4 and III-B-4											1		1				2
TOTALS *	9	18	2	5	2	18	1	3	1	7	21	27	11	15	5	5	150

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

Year 1950

Annual Report

Safety Department

* Totals Are For This Page And Previous Page.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

TABLE V

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

<u>YEAR</u>	<u>NUMBER OF FATALITIES</u>	<u>NUMBER OF MAN-DAYS WORKED PER FATALITY</u>	<u>NUMBER OF TONS OF ORE MINED PER FATALITY</u>
1931	3	165,137	529,680
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
<u>TOTALS</u>	54	13,998,958	90,372,988
20 Year Average -	2.70	259,239	1,858,759

* Man-Days Worked During Year Without Fatality

** Amount Of Ore Mined During Year Without Fatality

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

TABLE VI

RESUME OF ALL INJURIES & FATALITIES

<u>MINE OR PLANT</u>	<u>Slight</u>	<u>Less Than 7 Days</u>	<u>7 Days Or More</u>	<u>Fatal- ities</u>	<u>TOTAL</u>
Agnew	84	17	9		110
Athens	74	27	18		119
Atkins	38	2	2		42
Cambria-Jackson	21	18	4	1	44
Canistee	79	3	2		84
C.P.& L. Co.	7	0	0		7
Cliffs Shaft	88	25	18		131
General Roll	8	1	0		9
Hawkins	45	3	0	1	49
Hill-Trumbull	62	4	3		69
Holman Cliffs	64	3	1		68
Lloyd	42	13	7		62
Maas	86	18	20	1	125
Mather Mine, "A" Shaft	207	46	27		280
Mather Mine, "B" Shaft	46	12	10	1	69
Miscellaneous	2	0	0		2
Negaunee	2	0	0		2
Sargent	83	18	14	1	116
Spies-Virgil	16	1	5		22
Sthsa & Shops	30	4	5		39
Tilden	0	0	0		0
Wanless	22	1	0		23
TOTALS	1,106	216	145	5	1,472

Safety Department

Annual Report

Year 1950

384
32 X 3

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

TABLE VII

CAUSES OF COMPENSABLE INJURIES - UNDERGROUND (INCLUDING FATALITIES)

CAUSE	ACNEW	ATHENS	CAMBRIA-JACKSON	CLIFFS SHAFT	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	NEGAUNEE	SARGENT	SPIES-VIRGIL	TOTAL
Fall Of Ground	1	9	1		2	4	4	2		1		24
Falling Chunks (Shafts, Chutes, Raises)				2		1	1				1	5
Rolling Chunks	1	1		1	1	1	2			2		9
Persons Falling (Raises, Shafts, Scaffolds)				1	1		1	1		2		6
Persons Falling (Slipping & Stumbling)	2			3		4	2	1		1	1	14
Haulage		1		3	2	1	2			1		10
Drilling Equipment								1		1		2
Loading Equipment		1		1			1	2				5
Machinery (Moving)								1				1
Hand Tools				1			1			1		3
Handling Materials						1	3					4
Lifting Or Pulling	1									3		4
Burns							1					1
Explosives	2			1								3
Falling Or Moving Material		3	1	1		5	4	2			1	17
Loading At Chutes	1	2		2		3	1					9
Miscellaneous		1	2	1			2					6
TOTALS	8	18	4	17	6	20	25	10	0	12	3	123

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYb. All Injuries

(Continued)

TABLE VII (Cont'd.)

SURFACE (Underground Mines)

CAUSE	AG- NEW	CAMB. JACK.	CLIFFS SHAFT	LLOYD	MAAS	MATH. "A"	MATH. "B"	SAR- GENT	SPIES	TOTAL
Falling Or Moving Material				1		1		2		4
Handling Materials						1	1		1	3
Persons Falling (Slipping-Stumbling)	1	1	1					1	1	5
Electrical Burns					1					1
TOTALS	1	1	1	1	1	2	1	3	2	13

OPEN PITS

CAUSE	ATKINS	CANISTEO	HAWKINS	HILL-TRUMBULL	HOLMAN	CLIFFS	TOTAL
Falling Or Moving Material		1		2			3
Persons Falling (Slipping-Stumbling)	1	1		1			3
Rolling Chunks	1						1
Handling Materials						1	1
Flying Objects			1				1
TOTALS	2	2	1	3		1	9

OTHER OPERATIONS

CAUSE	GARAGE, STHSE. & SHOPS	TOTAL
Persons Falling (Slipping-Stumbling)	1	1
Persons Falling From Staging	2	2
Moving Machinery	2	2
TOTALS	5	5

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYb. All Injuries

(Continued)

TABLE VIII

FREQUENCY RATES, ALL COMPENSABLE INJURIES

<u>Year</u>	<u>Total Man Days Worked</u>	<u>Number Of Compensable Injuries</u>		<u>Frequency * Rate</u>
		<u>Non-Fatal</u>	<u>Fatal</u>	
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 $\frac{1}{4}$	171	4	20.30
1944	993,272 $\frac{1}{2}$	121	3	15.61
1945	915,665 $\frac{3}{4}$	107	1	14.74
1946	747,079	101	0	16.89
1947	1,071,219	149	7	18.20
1948	1,160,896 $\frac{1}{4}$	145	3	15.94
1949	1,013,442	126	1	15.66
1950	1,165,301 $\frac{1}{2}$	145	5	16.09

* Based on One Million Man-Hours of Labor.

TABLE VIII-A

SEVERITY RATES, ALL COMPENSABLE INJURIES

<u>Year</u>	<u>Non-Fatal</u>		<u>Fatal</u>	<u>Days Lost</u>	<u>Severity * Rate</u>
	<u>Days Lost</u>	<u>Rate</u>	<u>Days Lost</u>	<u>All Injuries</u>	
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

* Based on Days Lost By Injuries Per 1,000 Man-Hours of Labor.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYb. All Injuries

(Continued)

TABLE IX

COMPARISON OF COMPENSABLE ACCIDENTS, INCLUDING FATALITIES
BY MINES

<u>Mine Or Plant</u>	<u>FREQUENCY</u>		<u>SEVERITY</u>	
	<u>1949</u>	<u>1950</u>	<u>1949</u>	<u>1950</u>
AGNEW	34.87	38.86	1.141	1.356
ATHENS	22.03	24.09	.843	1.351
ATKINS	11.65	18.35	2.329	.220
CAMBRIA-JACKSON	21.89	10.27	1.386	12.579
CANISTEO	9.22	5.01	.556	.241
C.P. & L. CO.	6.91	- -	.311	- -
CLIFFS SHAFT	13.45	16.84	.295	1.079
GENERAL ROLL	- -	- -	- -	- -
HAWKINS	7.42	3.36	.200	20.147
HILL-TRUMBULL	20.99	8.36	.574	.460
HOLMAN CLIFFS	2.53	2.67	.248	.040
LLOYD	47.08	20.96	1.163	.868
MAAS	20.98	24.54	8.714	7.704
MATHER MINE, "A" SHAFT	21.77	17.73	.814	.910
MATHER MINE, "B" SHAFT	4.24	23.50	.034	15.350
MISCELLANEOUS	- -	- -	- -	- -
NEGAUNEE	12.46	- -	1.969	- -
SARGENT	17.05	58.66	.328	24.650
SPIES-VIRGIL	13.43	22.42	1.683	.551
STHSE. & SHOPS	3.04	12.56	.021	.706
TILDEN	- -	- -	- -	- -
All Properties	15.66	16.09	1.390	3.976

TABLE X

COMPENSABLE INJURIES INCLUDING FATALITIES

MINE OR PLANT	Tons Of Ore Mined	Hours Of Labor	No. Of Comp. Inj.	No. Of Fatalities	Days Lost, Compens.	Time Charges	Total Days Lost	Frequency	Severity	Average Days Lost Per Inj.
AGNEW	319,303	231,563 $\frac{1}{2}$	9		314		314	38.86	1.356	34.9
ATHENS	612,000	746,857 $\frac{3}{4}$	18		708	300	1,008	24.09	1.351	56.0
CAMBRIA-JACKSON	445,071	487,038	4	1	126	6,000	6,126	10.27	12.579	1225.2
CLIFFS SHAFT	641,562	1,069,082 $\frac{1}{4}$	18		1,154		1,154	16.84	1.079	64.1
LLOYD	221,636	334,168 $\frac{1}{4}$	7		290		290	20.96	.868	41.4
MAAS	633,444	855,879	20	1	594	6,000	6,594	24.54	7.704	314.0
MATHER MINE, "A" SHAFT	1,251,963	1,523,599 $\frac{3}{4}$	27		1,386		1,386	17.73	.910	51.3
MATHER MINE, "B" SHAFT	48,118	468,073	10	1	584	6,600	7,184	23.50	15.350	653.1
NEGAUNEE		62,915 $\frac{3}{4}$	0		0		0	0.00	0.000	0.0
SARGENT	292,778	255,756 $\frac{1}{2}$	14	1	303	6,000	6,303	58.66	24.650	420.2
SPIES-VIRGIL	205,619	223,077	5		123		123	22.42	.551	24.6
TOTALS	4,671,494	6,258,010 $\frac{1}{2}$	132	4	5,582	24,900	30,482	21.73	4.871	230.9
ATKINS	436,726	109,373	2		24		24	18.35	.220	24.0
CANISTEO	760,480	398,782 $\frac{1}{2}$	2		96		96	5.01	.241	48.0
HAWKINS	672,786	297,851 $\frac{1}{2}$	0	1	0	6,000	6,000	3.36	20.147	6000.0
HILL-TRUMBULL	641,295	358,724 $\frac{1}{2}$	3		90	75	165	8.36	.460	55.0
HOLMAN CLIFFS	879,753	374,880	1		15		15	2.67	.040	15.0
TILDEN	107,465	43,359 $\frac{1}{2}$	0		0		0	0.00	0.000	0.0
WANLESS	65,334	107,678	0		0		0	0.00	0.000	0.0
TOTALS	3,563,839	1,690,648	8	1	225	6,075	6,300	5.32	3.725	700.0
C.P. & L. CO.		142,698	0		0		0	0.00	0.000	0.0
GENERAL ROLL		Est. 590,288 $\frac{3}{4}$	0		0		0	0.00	0.000	0.0
MISCELLANEOUS		163,570 $\frac{3}{4}$	0		0		0	0.00	0.000	0.0
MISC. - HIBBING		79,040	0		0		0	0.00	0.000	0.0
STHSE. & SHOPS		398,155 $\frac{1}{2}$	5		131	150	281	12.56	.706	56.2
TOTALS		1,373,753	5		131	150	281	3.64	.205	56.2
GRAND TOTALS	8,235,333	9,322,411 $\frac{1}{2}$	145	5	5,938	31,125	37,063	16.09	3.976	247.1

Safety Department
 Annual Report
 Year 1950

THE CLEVELAND-CLIFFS IRON COMPANY
SAFETY DEPARTMENT, ACCIDENT STATISTICS, YEAR 1950

Mine Or Plant	Tons Of Ore Mined	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	319,303	231,563 ½		9	17		314	37	26	351	112.26	1.516	13.5	7
ATHENS	612,000	746,857 ½		18	27		1,008	54	45	1,062	60.25	1.435	23.6	6
CAMBRIA-JACKSON	445,071	487,038	1	4	18	6,000	126	39	23	6,165	47.23	12.659	268.0	9
CLIFFS SHAFT	641,562	1,069,082 ½		18	25		1,154	60	43	1,214	40.22	1.135	28.2	5
LLOYD	221,636	334,168 ½		7	13		290	33	20	323	59.84	.966	16.2	3
MAAS	633,444	855,879	1	20	18	6,000	594	32	39	6,626	45.57	7.743	169.9	8
MATHER MINE, "A" SHAFT	1,251,963	1,523,599 ¾		27	46		1,386	111	73	1,497	47.91	.983	20.5	4
MATHER MINE, "B" SHAFT	48,118	468,073	1	10	12	6,000	1,184	34	23	7,218	49.14	15.423	313.8	10
NEGAUNEE		62,915 ¾		0	0		0	0	0	0	0.00	0.000	0.0	1
SARGENT	292,778	255,756 ½	1	14	18	6,000	303	41	33	6,344	129.05	24.810	192.5	11
SPIES-VIRGIL	205,619	223,077		5	1		123	3	6	126	26.46	.565	21.0	2
TOTALS	4,671,494	6,258,010 ½	4	132	195	24,000	6,482	444	331	30,926	52.89	4.942	93.4	
ATKINS	436,726	109,373		2	2		24	2	4	26	35.56	.236	6.5	4
CANISTEO	760,480	398,782 ½		2	3		96	8	5	104	12.54	.261	20.8	5
HAWKINS	672,786	297,851 ½	1	0	3	6,000	0	7	4	6,007	13.43	20.171	1,501.5	7
HILL-TRUMBULL	641,295	358,724 ½		3	4		165	8	7	173	19.51	.482	21.6	6
HOLMAN CLIFFS	879,753	374,880		1	3		15	9	4	24	10.67	.064	2.7	3
TILDEN	107,465	43,359 ½		0	0		0	0	0	0	0.00	0.000	0.0	1
WANLESS	65,334	107,678		0	1		0	1	1	1	9.28	.009	1.0	2
TOTALS	3,563,839	1,690,648	1	8	16	6,000	300	35	25	6,335	14.78	3.746	253.4	
C.P.& L. CO.		142,698		0	0		0	0	0	0	0.00	0.000	0.0	
GENERAL ROLL		590,288 ¾		0	1		0	2	1	2	1.69	.003	2.0	
MISCELLANEOUS		163,570 ¾		0	0		0	0	0	0	0.00	0.000	0.0	
MISC., HIBBING		79,040		0	0		0	0	0	0	0.00	0.000	0.0	
STHSE. & SHOPS		398,155 ½		5	4		281	18	9	299	22.61	.751	33.2	
TOTALS		1,373,753		5	5		281	20	10	301	7.28	.219	30.1	
GRAND TOTALS	8,235,333	9,322,411 ½	5	145	216	30,000	7,063	499	366	37,562	39.26	4.029	102.6	

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYb. All Injuries

(Continued)

TABLE XII

SHOWING TIME PERIODS WHEN
COMPENSABLE INJURIES OCCURRED

<u>TIME</u>	<u>NUMBER</u>	<u>WORKING PERIOD</u>
8:00 A.M. To 12:00 NOON _____	45 _____	FIRST HALF OF DAY SHIFT
12:00 NOON To 4:00 P.M. _____	40 _____	SECOND HALF OF DAY SHIFT
4:00 P.M. To 8:00 P.M. _____	27 _____	FIRST HALF OF AFTERNOON SHIFT
8:00 P.M. To 12:00 MIDNIGHT _____	19 _____	SECOND HALF OF AFTERNOON SHIFT
12:00 MIDNIGHT To 4:00 A.M. _____	10 _____	FIRST HALF OF NIGHT SHIFT
4:00 A.M. To 8:00 A.M. _____	9 _____	SECOND HALF OF NIGHT SHIFT
TOTALS _____	150 _____	

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

Safety Department
Annual Report
Year 1950

TABLE XIII
PERCENTAGES OF COMPENSABLE INJURIES OF THE VARIOUS AGE GROUPS
MESABA RANGE PROPERTIES, 1950

AGE GROUPS	NO. OF COMP. INJURIES	PERCENTAGE OF EMPLOYEES	PERCENTAGE OF INJURIES	PERCENTAGE OF TIME LOST	FREQUENCY RATING	SEVERITY RATING
18 - 20	1	5.2	3.0	.05	2	2
21 - 25	2	14.1	6.1	.57	3	4
26 - 30	3	11.8	9.1	.39	4	3
31 - 35	4	12.1	12.1	1.16	5	6
36 - 40	5	13.3	15.2	46.94	6	10
41 - 45	1	9.8	3.0	46.45	2	9
46 - 50	0	8.5	-		1	1
51 - 55	4	7.3	12.1	.80	5	5
56 - 60	9	9.8	27.3	2.25	7	8
61 - 65	4	8.1	12.1	1.39	5	7
TOTALS	33	100%	100%	100%		

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

Year 1950

Safety Department
Annual Report

TABLE XIV

PERCENTAGES OF COMPENSABLE INJURIES OF VARIOUS AGE GROUPS
MARQUETTE AND MENOMINEE RANGE PROPERTIES - 1950

Age Groups	NO. OF COMP. INJURIES	PERCENTAGE OF EMPLOYEES	PERCENTAGE OF INJURIES	PERCENTAGE OF TIME LOST	FREQUENCY RATING	SEVERITY RATING
18 - 20	5	3.8	4.3	1.49	2	2
21 - 25	16	10.7	13.7	3.28	9	8
26 - 30	18	12.7	15.4	54.87	10	11
31 - 35	14	13.9	12.0	2.05	8	5
36 - 40	13	14.8	11.1	1.87	7	4
41 - 45	14	12.8	12.0	2.30	8	6
46 - 50	10	9.7	8.5	3.86	5	9
51 - 55	8	7.2	6.8	25.56	4	10
56 - 60	12	7.0	10.2	1.80	6	3
61 - 65	7	6.6	6.0	2.92	3	7
66-Over		.8	-	-	1	1
TOTALS	117	100%	100%	100%		

11. ACCIDENTS
AND
PERSONAL
INJURY

TABLE XIV-A

PERCENTAGES OF COMPENSABLE INJURIES OF VARIOUS AGE GROUPS
ALL PROPERTIES - 1950

AGE GROUPS	NO. OF COMP. INJURIES	PERCENTAGE OF EMPLOYEES	PERCENTAGE OF INJURIES	PERCENTAGE OF TIME LOST	FREQUENCY RATING	SEVERITY RATING
18 - 20	6	4.2	4.0	.99	2	2
21 - 25	18	11.6	12.0	2.34	7	5
26 - 30	21	12.5	14.0	35.88	8	11
31 - 35	18	13.4	12.0	1.74	7	3
36 - 40	18	14.4	12.0	17.58	7	9
41 - 45	15	12.0	10.0	17.69	6	10
46 - 50	10	9.4	6.7	2.51	3	7
51 - 55	12	7.2	8.0	16.92	5	8
56 - 60	21	7.7	14.0	1.96	8	4
61 - 65	11	7.0	7.3	2.39	4	6
66-Over	0	.6	-	-	1	1
TOTALS	150	100%	100%	100%		

b. All Injuries

(Continued)

Year 1950

Annual Report

Safety Department

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYb. All Injuries

(Continued)

TABLE XIV-B

PERCENTAGES OF EMPLOYEES IN VARIOUS AGE GROUPS

YEARS OF AGE (Inclusive)

<u>Mine Or Plant</u>	<u>18-20</u>	<u>21-25</u>	<u>26-30</u>	<u>31-35</u>	<u>36-40</u>	<u>41-45</u>	<u>46-50</u>	<u>51-55</u>	<u>56-60</u>	<u>61-65</u>	<u>66-Over</u>
AGNEW	0	12.0	12.0	7.4	12.0	5.6	9.3	11.1	16.7	13.9	0
ATHENS	1.5	7.8	13.4	11.0	13.0	14.3	11.6	9.3	6.7	10.8	.6
ATKINS & WANLESS	15.1	21.2	19.2	15.8	15.1	6.2	2.1	1.3	1.3	2.7	0
CAMBRIA-JACKSON	2.2	9.8	7.6	16.1	17.9	15.6	8.9	8.0	6.3	6.7	.9
CANISTEO	5.7	11.9	9.0	14.1	20.3	14.1	6.2	5.1	7.4	6.2	0
C.P.& L. CO.	1.6	11.5	6.6	9.8	14.7	19.7	8.2	6.6	8.2	13.1	0
CLIFFS SHAFT	4.9	10.3	10.9	14.6	17.1	11.9	9.9	6.0	6.6	7.2	.6
HAWKINS	7.1	11.7	11.7	13.6	10.4	5.2	9.7	10.4	9.1	11.1	0
HILL-TRUMBULL	4.7	18.1	10.2	12.6	8.4	13.0	10.7	6.5	6.5	9.3	0
HOLMAN CLIFFS	1.6	14.0	10.9	9.8	14.4	12.5	11.9	8.4	9.8	6.7	0
LLOYD	4.8	13.2	11.4	9.6	7.8	11.9	11.3	10.8	8.4	9.6	1.2
MAAS	3.6	8.2	9.9	13.3	15.0	10.2	10.5	9.7	9.9	8.2	1.5
MATHER MINE, "A" SHAFT	4.4	13.1	16.7	15.6	13.9	12.9	8.4	5.7	5.9	2.6	.8
MATHER MINE, "B" SHAFT	4.7	14.3	14.6	15.5	19.0	15.2	9.0	4.3	2.5	.9	0
NEGAUNEE	0	3.9	9.8	19.6	13.7	17.7	7.8	5.9	9.8	11.8	0
SARGENT	1.6	7.2	11.2	9.6	12.8	7.2	8.0	10.4	23.2	8.8	0
SPIES-VIRGIL	0	3.1	18.6	13.4	8.2	12.4	11.3	8.2	13.4	11.4	0
STHSE. & SHOPS	6.4	11.2	10.1	10.6	14.9	7.4	9.6	8.0	8.5	11.2	2.1
MESABA PROPERTIES	5.2	14.1	11.8	12.1	13.3	9.8	8.5	7.3	9.8	8.1	0
MARQ. & MEN. RANGES	3.8	10.7	12.7	13.9	14.8	12.8	9.7	7.2	7.0	6.6	.8
ALL PROPERTIES	4.2	11.6	12.5	13.4	14.4	12.0	9.4	7.2	7.7	7.0	.6

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

b. All Injuries

(Continued)

TABLE XV

SHOWING OCCUPATION OF INJURED WORKERS

COMPENSABLE INJURIES

<u>UNDERGROUND</u>		<u>SURFACE</u>		<u>OPEN-PIT</u>	
Miners _____	77	Lander _____	1	Laborer _____	2
Timbermen _____	4	Brakemen _____	1	Truck Driver _____	1
Scraper Operator _____	6	Shovel Operator _____	2	Truck Mechanic _____	2
Motormen _____	8	Hoist Engineer _____	2	Operator _____	1
Motor Brakemen _____	8	Policemen _____	1	Foremen _____	1
Foremen _____	4	Cage Rider _____	1	Car Dropper _____	1
Electrical Foremen _____	1	Blacksmith _____	2	Mechanic _____	1
Skiptender _____	2	Laborer _____	3		
Cagetender _____	1	Dia. Drill Helper _____	2		
Chutemen _____	2	Steel Worker _____	1		
Timber Trammers _____	3	Machinist _____	1		
Miners' Helpers _____	3	Timber Frammer _____	1		
Trammers _____	2				
Pipeman _____	1				
Pumpmen _____	1				
	<hr/>		<hr/>		<hr/>
	123		18		9

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection

Routine safety inspections were made of all operating properties on the Michigan Range by Thomas Tippet, Harry Rogers and myself. Mr. Tippet transferred from the Safety Department to the Lloyd Mine on May 26th, 1950.

Inspection reports turned in on safety inspections include only hazards which supervisors fail to notice and correct in the presence of the inspector or those which the previous shift failed to take care of.

On the Mesaba Range, Alfred Hurley, Roy Gram and George Whittington did the safety inspection work. I made several trips to the Mesaba Range and made most of the inspections with Alfred Hurley as Mr. George Whittington must also handle compensation work as well as safety and was not always available.

Cooperation of supervisors during the year has been very good on all ranges.

Idle Property

Together with Mr. Julian Payen, I made inspections of all idle property. These inspections were made early in the spring before the leaves grow on the trees and late in the fall after the leaves have fallen. This makes it easy to find test-pits and see greater stretches of fencing. Considerable repairs were made to old fences. Heavy snows during the winter broke down fences in outlying districts. Young boys cause considerable damage to fences when these fences are placed around water holes in old open pits where they sneak in to swim during the summer months. When the Lake Mine open-cut was completed, Mr. Payen fenced the hazardous places and put in road blocks on haulage roads to the pit. We also put a permanent concrete cover over the old Lake Shaft. Some small test pits were filled near the Buffalo Location in Negaunee. At the old Webster Mine we put a stronger wooden cover over the test-pit which was sunk a year ago.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Fire Patrol Inspections

Inspections are made at all underground properties of all fire hazards, on the last shift preceding an idle period and once every 24 hours thereafter until the mine resumes normal operation. The purpose of these inspections is to catch any fire in the incipient stage and put it out before it has a chance to gain any head-way. In most cases, the inspectors are the shift bosses, but other men are also assigned to this work. These men also check all electrical switches to make sure they are open and any other hazard which they may note and a written report is made to the mine superintendents.

The surface inspections are made by the watchmen or policemen. During the past year there were no incipient fires reported, either underground or on surface. If these inspections are made conscientiously by the men, there is little chance of any fire getting out of control.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)

TABLE XVI

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

TABLE XVII

1949

Mine Or Plant	Violations Of Standards	Safety Suggestions	Recommendations	Fire Hazard	Total
ATHENS	21	17	8	2	48
CAMBRIA-JACKSON	20	16	4		40
DIAMOND DRILLS			4	2	6
GEN. STHSE. & SHOPS		1	1	2	4
LLOYD	11	11	1		23
MAAS	16	22	6	4	48
MATHER MINE, "A" SHAFT	24	14	11		49
MATHER MINE, "B" SHAFT	1	1	2		4
SPIES-VIRGIL	6	4		1	11
TOTALS	99	86	37	11	233

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

c. Safety Inspection (Continued)

Blasting Inspections

A total of 1,054 blasting inspections were made by Shift Bosses during the year in the Michigan underground mines. 206 violations of safe practices were reported with most violations being failure to use tamping in the blast holes. Shift Bosses are required to check the blasting procedure of each mining contract at least six times a year. Purpose of these inspections is to make sure miners are using the correct safe procedure and to correct any mistakes being made. It also has a tendency to keep the miners more on the alert.

Nearly all blasting done at the Spies-Virgil and Mather "B" Mines was with electricity. Much blasting at all mines is done with prima-cord. The tendency is towards more controlled blasting and the sooner this happens the less danger there will be of men walking into a blast.

A new and safer blasting machine is now being tried out at the Mather Mine, which appears to be the answer to many of our isolated work places and probably will take the place of much of the power-line blasting and will be much more economical.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)

TABLE XVIII

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

<u>MINE</u>	<u>NO. OF INSPECTIONS</u>	<u>NO. OF VIOLATIONS REPORTED</u>
Athens	0	0
Cambria-Jackson	81	66
Cliffs Shaft	331	39
Lloyd	17	7
Maas	192	38
Mather Mine, "A" Shaft	421	55
Mather Mine, "B" Shaft	0	0
Negaunee	0	0
Spies-Virgil	12	1
TOTALS	<u>1,054</u>	<u>206</u>

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Rules & Regulations

No attempt was made during the year to revise our surface or underground rule book because mining methods and equipment are changing so rapidly. This revision is due at some later date. All changes in rules or safe practices made by Management or the Central Safety Committee are printed in the proceedings of the Committee and sent to all concerned and passed on to supervisors.

A total of 717 underground and surface rule books were distributed during the year. Most of these went to new employees.

The Mesaba Range mines post most rules on bulletin boards, places of work and in trucks. The underground mines are in the process of making new rule books to correspond with their conditions. These rules should be ready for the printer early in 1951.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection

(Continued)

TABLE XIX

RULE BOOKS DISTRIBUTED AT MICHIGAN MINES AND PLANTS

<u>MINE OR PLANT</u>	<u>SURFACE</u>	<u>UNDERGROUND</u>	<u>TOTAL</u>
Athens	0	23	23
Cambria-Jackson	1	20	21
C.P.& L. Co.	27	2	29
Cliffs Shaft	6	74	80
Engr. & Geological	6	9	15
Lloyd	3	30	33
Maas	5	54	59
Mather Mine, "A" Shaft .	11	215	226
Mather Mine, "B" Shaft .	19	121	140
Negaunee	8	2	10
Spies-Virgil	0	10	10
Storehouse & Shops	47	10	57
Tilden	14	0	14
TOTALS	147	570	717

Safety Department

Annual Report

Year 1950

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 Department 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)

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.	Sar-8 Gent	Spies-Virgil	Total
HOISTING ROPES	52	303	260	281	507	258	303	94	46	52	195	2,351
SKIP & CAGE ROADS	46	114	129	36	77	55	48	52			53	610
LADDER ROAD	50	56	12	38	26	43	48	46		49	47	415
CAGE SAFETY CATCHES	11	12	6	14	24	12	10	9	2		13	113
SLACK ROPE ALARM		10	6	12	4	5	7				13	57
HOIST INSPECTION		24	12	24	24	24	24	31	24		24	211
FIRE EXTINGUISHERS	2	2	2	2	2	2	2	2	2	2	2	22
FIRE EQUIPMENT	4	3	2			2	4		1	4		20
FIRE PREVENTION	2		10	19	6	12	5	11	25	6	11	107
HOIST ENGR. SPEC. REPORT	52									45		97
C.O. ALARM						11						11
TOTALS	219	524	439	426	670	424	451	245	100	158	358	4,014

Mine Or Plant	Fire Extinguishers	Fire Prevention	Fire Equipment	Total
ATKINS	2	5	4	11
CANISTEO	2	9	4	15
C.P. & L. CO.	16	8		24
GENERAL OFFICE (ISHPEMING)	2			2
HAWKINS	2	34	4	40
HIBBING OFFICE	2	2		4
HILL-TRUMBULL	2	16	4	22
HOLMAN CLIFFS	2	17	4	23
ISHPEMING HOSPITAL	2	2		4
NEGAUNEE DISPENSARY	2	2		4
PRINCETON		3		3
RENTED BUILDINGS	2			2
STHSE., SHOPS & GARAGE	2	12		14
TILDEN	2	14		16
WANLESS	2	8	4	14
TOTALS	42	132	24	198

11. ACCIDENTS AND PERSONAL INJURY
c. Safety Inspection

(Continued)

Year 1950

Annual Report

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. 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 & 1½ Qt. Vaporizing	1 Gal. Vaporizing	2 to 3½ Gal. Vaporizing	15 lb. Dry Powder Type	20 lb. Dry Powder Type	30 lb. Dry Powder Type	Carbon Dioxide	150 lb. Dry Powder. Engine	TOTAL
AGNEW	1	1		3		1			2			8
ATHENS	8	9		19		1	4	4				45
ATKINS	1			8	2		1				1	13
CAMBRIA-JACKSON	13			12	2			8				35
CANISTEO	4		1	41			9	12				67
CLIFFS SHAFT	13	7	2	37		3		5				67
GEN. STHSE. & SHOPS	14	19	1	46		3						83
HAWKINS	12			20	4	4	4		5			49
HILL-TRUMBULL	2			27	2	1	18	14				64
HOLMAN CLIFFS	5			63			6	17				91
LLOYD	8	2	1	27		4	4					46
MAAS	6		1	21		6	3	2				39
MATHER MINE, "A" SHAFT	9	2		42				22				75
MATHER MINE, "B" SHAFT	5			21			1	2	17			46
NEGAUNEE	7	3		19		3	6					38
SARGENT	2			11		1	1	2				17
SPIES-VIRGIL	2	13		18		4	6	5				48
TILDEN	1	5		37		1	3					47
WANLESS	2			8			3	1				14
McCLURE PLANT				3		2		2				7
CARP PLANT				4		1		2	1			8
HOIST PLANT				1		2		2				5
REPUBLIC PLANT				1		1		1	1			4
ESCANABA PLANT				1		1		1	1			4
AUTRAIN PLANT				1		2		1	1			5
DIESEL PLANT			5	3							1	9
HIBBING OFFICE	4		1			1						6
ISHPEMING HOSPITAL	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								3
STEAM PLANT, C.C.I.				2					12			14
TOTALS	141	62	12	547	10	43	69	16	111	16	2	1,029

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Disciplinary Action

This action is one of the undesirable duties of supervisors but must be done in order to keep employees under control on the job and promote safety. As usual, alcoholism is the cause for most disciplinary action. Fifty of the 109 cases show either absenteeism because of alcohol or reporting to work under the influence of alcohol. Only 8 employees received lay-offs during the year compared to 17 during the previous year. Five men left the job without permission compared to 48 last year. Violations of no-smoking rule were committed six times during each of the last two years.

Totals were 109 for 1950 and 148 for 1949.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection

(Continued)

TABLE XXII

CAUSES AND NUMBER OF DISCIPLINARY ACTIONS

CAUSE	ATHENS	CAMBRIA-JACKSON	CLIFFS SHAFT	GEN. STOREHOUSE	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	PELLETIZING PLANT	SPIES-VIRGIL	TOTAL
Excessive Absenteeism Due To Alcoholism	5	1	7	1	3	7	7				31
Reporting To Work Under The Influence Of Liquor			2		1		7	3	1	5	19
Violation Of Rules Leaving Job Without Authority	1	3					4				8
Stealing Company Property			1				1	2		1	5
Sleeping On The Job		1					17				18
Violation Of "No Smoking Rules"		2	2				2				6
Carelessness In Performing Work			1	1			6	1		1	10
Loafing At Work							3				3
Insubordination		1		2			3	1			7
Damaging Equipment							1				1
TOTALS	6	8	13	4	4	7	51	7	1	8	109

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Central Safety Committee

The purpose of this committee is to classify all compensable accidents and set up rules for safe practices. All safety matters are discussed and proceedings printed for all members. Members are Management, Superintendents and Heads of various Departments.

A very brief summary of subjects discussed during the 12 meetings held during the year follows:

Underground Mine Fire, Blueberry Mine, North Range Mining Company

Possible use of Plexiglas for lens of floodlights, underground locomotives and warning signals.

Increased use of safety eye glasses - Cambria-Jackson Mine started 100% use of safety glasses on January 30th and Brownstone Shops on Feb. 1st.

Periodic check on length of electric cap lamp cords - short cords causing hazards.

Arrangements for Linde Air Products representative to conduct meetings on safe use of Oxy-Acetylene welding equipment.

Arrangements for start of safety eye-glass inspection and fitting.

Rule: All drilling in sub-level stopes to be done from under timber in the future except at Cliffs Shaft and Spies-Virgil Mines.

Discussion of the use of asbestos blankets to catch cuttings and hot metal from welding and cutting when working where there are fire hazards. Welders will also have fire extinguishing equipment.

The "No Smoking" rule for underground was again discussed and it was decided that in the future that violations of this rule will mean a five-day lay-off and then discharge, without exception.

For the benefit of our safety eye-glass program, a man at each mine will be trained to fit glasses. The warehouse man at each mine is the most likely man to handle this job. Most of these men have already received training in the fitting of glasses by a representative of the American Optical Company, who conducted classes at all operations.

Reco color-hoods were discussed and the Storekeeper was instructed to contact the manufacturer and have 1,000 color-hoods made up for our company. These are the hoods which are used as safety warnings in haulage drifts.

A discussion on Fenwell thermostatic controls for compressors showed that various compressors developed more heat than others and for that reason, some of the thermo-controls are set higher than others, but all are set under the flash-point of oils used.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Central Safety Committee (Cont'd.)

When discussing fire control underground and fire fighting equipment, each superintendent gave a brief summary on water lines on each level underground and in the shaft. This was done as a check-up on the company policy to have 2-inch water lines for fire fighting on each level.

Nylon rope tail-lines for safety belts were discussed with the idea of possible replacement of manila ropes. The nylon rope is considerably stronger, is not affected by acids and alkalines and does not become hard to handle when wet.

New type, double-pad respirator was demonstrated and approved for use underground by the committee.

A new ruling on the transportation of explosives by miners states, "Powder shall be carried only in powder bags provided for that purpose". The reason for this change in rules is because of the hazard connected with the paper cartons in which the powder is shipped to the mines. These cartons become damp and come apart, allowing the powder to spill. There has always been danger of blasting powder being left in collapsed paper cartons.

Lamp brackets on Mine Safety Appliances Co. safety hats have pulled out because of poor screws being used. As a committee of one, I reported this to the Mine Safety Appliances Co. and had the condition corrected.

Tests were made on nylon rope at the Mather Mine, "A" Shaft, and these tests were reported to the committee by the Asst. Mine Supt.

Arrangements were made with mine superintendents for mine rescue training to start in December.

Discussion of heavy-duty truck tire maintenance and the hazard connected with it was brought before the committee members and known safer methods of maintenance were approved.

Protecting persons in the vicinity of arc welding was discussed and information on necessary protection was approved by the committee.

Merits and de-merits of the plastic framed safety goggles were discussed and it was decided in favor of the plastic-framed goggle.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Lake Superior Mines Safety Exchange

The Lake Superior Mines Safety Exchange met four times during the year. These meetings were held the day previous or the day following the meetings of the Lake Superior Mines Safety Council in order to save travel and expense. Each of the eleven member companies are permitted to ask two questions on safety during each three-month period. Answers to these questions are returned in writing and later discussed at the meetings. Attendance at these meetings is limited to one or two men from each company. To save on travel, I have attended those meetings in Michigan and Mr. George Whittington, Safety Supervisor on the Mesaba Range has attended meetings in his district.

I feel that this is a very valuable safety exchange as we are entitled to ask questions about subjects on which we have no information, but other companies may have information or experience on these different subjects.

Lake Superior Mines Safety Council

There were ten regular meetings of the council during the year, held as follows:

Jan. 26, 1950	-	Hibbing, Minnesota
Feb. 9, 1950	-	Caspian, Michigan
Apr. 6, 1950	-	Ironwood, Michigan
May 4, 1950	-	Duluth, Minnesota
May 18-19, 1950	-	Duluth, Minnesota (Annual Meeting)
Aug. 25, 1950	-	Duluth, Minnesota
Sept. 14, 1950	-	Grand Rapids, Minnesota
Sept. 22, 1950	-	Duluth, Minnesota
Nov. 10, 1950	-	Ely, Minnesota
Dec. 6, 1950	-	Ishpeming, Michigan

C.C.I. Co. men who presented papers at meetings and their subjects:

Harry C. Swanson, Mining Engineer, Mather Mine, "B" Shaft -
"Safety In Shaft Sinking At The Mather Mine, "B" Shaft"

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

Robert M. DeGabrielle, Mining Engineer, Athens Mine -
"Safety In Raising and Raise Repair"

John Bjerne, Mining Captain, Mather Mine, "B" Shaft -
"Panel Discussion - Foreman's Responsibility For The Safety Of Employees"

Guilio Guiliani, Mobile Equipment Supervisor -
"Preventative Maintenance Of Motorized Equipment"

(Continued)

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

c. Safety Inspection (Continued)

Lake Superior Mines Safety Council (Cont'd.)

During the past year, monthly meetings and the annual meeting had the largest attendance of any year on record.

This increase indicates that the various mining companies are vitally interested in the meetings and safety.

The safety papers presented at these meetings required a lot of hard work but the excellent safety messages were well worth the effort.

Every member company in the Lake Superior District and the U.S. Bureau of Mines spared no effort to make meetings a success.

Papers presented at these meetings are being mimeographed and sent to all company supervisors.

National Safety Council

Our company has been a member of this organization since September, 1913, which is the first year of organization. The year previous, this same group met at Milwaukee, Wisconsin from September 30th to October 5th as the "First Cooperative Safety Congress" and it was held under the auspices of the Association of Iron and Steel Electrical Engineers. Mr. William Connibear, who formerly headed The Cleveland-Cliffs Iron Company Safety Department, presented a paper, "System of Safety Inspection of The Cleveland-Cliffs Iron Company", at this meeting.

We have received valuable information from this organization and have contributed considerable to it. During recent years, we have had much more and better service for the iron mining industry. This was brought about by separating the coal mining from the mining section with only one joint meeting a year. Information, posters, visual aids, etc., have greatly improved. Along with other mining men of the Lake Superior District, I have served in a number of official capacities, such as member of committees, Chairman of the Visual Aids and Poster Committee, and now as 2nd Vice-Chairman.

Those of our company who attended the annual meeting in Chicago last October are: James Westwater, Supt. - Mather Mine, who presented a paper on, "Safety In Shaft Sinking At The Mather Mine, "B" Shaft", Tom Hill - Ventilation Engineer, H.C. Moulton, Supt. - Maas Mine, Allen Hjelt, Mng. Captain - Mather Mine, "A" Shaft, G. R. Whittington, Safety Supervisor, Roy Gram, Safety Inspector, Arne Hill, Mng. Captain, Sargent Mine and Russell Barkla, General Mechanical Foreman - Mesaba Range.

Safety "Banner-Flag Awards"

Listed below are the properties which had the best safety record for the Year of 1950 and have the privilege of flying the "Banner Flag" during the year. Award of this honor is based on the severity rating, or severity rating and greatest number of man-hours if severity rating is the same at one or more properties.

- Underground Operation - Negaunee Mine - Severity Rating - 0.00
- Open Pit Operation - Tilden Mine - Severity Rating - 0.00
- Independent Unit - C.P. & L. Co. - Severity Rating - 0.00

(Continued)

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection (Continued)Safety "Banner-Flag Awards" (Cont'd.)

Many other operations had excellent records during 1950. Every supervisor should study the accident statistics for 1950, which were compiled and sent out by the Safety Department and note facts, such as - One property with four lost-time injuries, including a fatal accident; time charges for the fatal accident amounted to 6,000 days, with the other three injuries causing a total loss of only seven days. Total lost-time for the operation was 6,007 days.

Many of our accidents are potential severe or fatal accidents. The minor accidents should be investigated by supervisors as thoroughly as the serious ones, because a real serious hazard may exist.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

c. Safety Inspection (Continued)

Safety Bonuses

The purpose of this bonus is to make the supervisor safety conscious. Penalties imposed are to remind the supervisor that he has been lax in his safety work. During 1950 a total of \$6,160.34 was paid to supervisors. Total penalties were \$212.09. 105 supervisors participated in the plan. Of the nine mines and The Cliffs Power & Light Co., which have the safety bonus plan, only four superintendents penalized supervisors for infractions of rules or safe practices. By being too lenient the superintendent defeats the purpose of the bonus plan. If the superintendent and mining captain made a close check of each supervisor each month and also checked the Safety Inspector's reports and proceedings and classification of accident reports of the Central Safety Committee and followed the rules for superintendents, I believe there would be more penalties imposed. I recommend that this be done at each mine so we can really call it a "Safety Bonus" rather than a "Bonus".

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

c. Safety Inspection

(Continued)

TABLE XXIII

SAFETY BONUSSES PAID TO FOREMEN

<u>Mine Or Plant</u>	<u>Amount</u>	<u>Men Participating</u>	<u>Amount Of Penalties Imposed</u>
ATHENS	\$ 867.25	14	None
CAMBRIA-JACKSON	518.10	11	\$ 27.26
C.P.& L. CO.	92.51	3	None
CLIFFS SHAFT	1,227.48	17	None
LLOYD	337.55	6	31.07
MAAS	783.47	12	150.51
MATHER MINE, "A" SHAFT	1,609.83	23	None
MATHER MINE, "B" SHAFT	446.60	10	None
NEGAUNEE	56.54	5	None
SPIES-VIRGIL	221.01	4	3.25
TOTALS	\$6,160.34	105	\$ 212.09

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYc. Safety Inspection

(Continued)

TABLE XXIV

OCCUPATIONS OF MEN PARTICIPATING IN BONUS

TITLE	ATHENS	CAMERIA-JACKSON	C.P.& L. CO.	CLIFFS SHAFT	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	NEGAUNEE	SPIES-VIRGIL	TOTAL
SHIFT BOSS	11	8		13	3	8	20	6	3	2	74
TIMBER FOREMAN	1	1		1	1	1		1			6
MACHINERY FOREMAN	1	1		1	1	1	1	1	1	1	9
ELECTRICAL FOREMAN							1	1			2
U.G. MECH. FOREMAN				1							1
SURFACE FOREMAN	1	1		1	1	2	1	1	1	1	10
DIST. ELEC. FOREMAN			2								2
STEAM PLANT FOREMAN			1								1
TOTALS	14	11	3	17	6	12	23	10	5	4	105

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

Underground mine ventilation has varied from very good to only fair in some mines. All mines are equipped with main mine fans and all, with the exception of the Lloyd Mine, have the latest model main mine fans. At some of the larger mines, booster fans are used in remote and hard-to-ventilate places. Auxiliary fans with vent-tube or spiral metal tubing are provided for dead-ended drifts and raises. For ventilation of raises, we have attempted to use high-pressure, high-speed fans with 6" and 8" spiral metal tubing. The 8" spiral metal tubing, of course, gives the best results and when kept to within a short distance of the breast of the raise, gives excellent results.

For drift headings the standard equipment is usually a No. 40 or 45 Sturtevant Planovane fan with from 12" to 16" spiral vent-tubing. We attempt to keep rock headings on suction with a small auxiliary fan located close to the breast, driving the air across the breast to clear the dust and gases and push back to the intake of the larger vent-tubing. When the large suction tubing is to within 40' of the breast, and the small auxiliary fan can sweep the breast with air, the dust counts can be kept below the recommended maximum limits and smoke and gases from blasting can usually be cleared in 15 minutes to a half hour, in even the most remote places.

A brief account of the ventilation at each mine follows:

ATHENS MINE

The Athens Mine is equipped with an American Blower, double-width, high-speed fan, Size 9, Class 2. Its present output is 82,500 cubic feet of air per minute with a total water gauge of 5.6". The fan is located on the 10th Level and all air is forced upwards through the workings with the main discharge on the 4th Level and some exhaust air on each of the levels above the 10th Level. By keeping all air-lock doors in good condition, the ventilation has been very well distributed through the mine and at the present time is probably the best in the history of the mine. The mine is not equipped with enough auxiliary fans of the modern type and size, for the best ventilation of development headings. There is some recirculation of air, but it has not been a problem during the past year.

CAMBRIA*JACKSON MINE

The Cambria-Jackson Mine is equipped with a Jeffrey, No. 42 Fan, with a rated output at the present time of 46,000 cubic feet of air per minute with 1" water gauge. The fan is located on the 6th Level with a split on that same level, allowing a small portion of air to ventilate a small area above the 6th Level and the greater portion travelling through the 7th Level, where it discharges up the hoisting shaft. Leakage of air through caves from the Mather Mine, "A" Shaft, helps to ventilate the West end of the workings. The total amount of air coming from the Mather Mine, "A" Shaft, has been approximately 2,000 cubic feet of air per minute through the raise connection with the Mather 3rd Level, with as much as 20,000 at times coming from the caved area. The average amount of air coming through the caves and raise has been approximately 12,000 cubic feet of air per minute. Ventilation of the new development on the 7th

(Cont'd.)

417

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

d. Ventilation (Continued)

CAMBRIA-JACKSON MINE (Cont'd.)

Level has been through the use of a No. 45, Sturtevant Fan, plus auxiliary fans. Distribution of air at times has been very good and because of failure to keep air-ways open, it has been poor at times. Main intake air to the mine comes from caved area in old workings. To date, there has been very little change in the openings of these caves but there has been some sloughing of ground under this main opening.

CLIFFS SHAFT MINE

The main mine fan at the Cliffs Shaft Mine, located on the East end of the 6th Level, adjacent to the old incline mine, is a Jeffrey Aerodyne, Jr., Size 9, Fan with fixed blades. Its rated capacity is 100,000 cubic feet of air per minute at 1.5" water gauge. At the present time, the fan is handling approximately 130,000 cubic feet of air per minute, of which, approximately 10,000 cubic feet per minute recirculates around the fan pillar. Both "A" and "B" Shafts are upcast with a total volume of air up "A" Shaft of 54,088 cubic feet per minute and 56,670 cubic feet per minute coming up "B" Shaft. The distribution of air through the mine is exceptionally good. A close check of air travelling through the mine shows that air will actually by-pass both shafts on the lower levels and start to exhaust into the shaft on the 3rd, 2nd and 1st levels, with the greater portion of air entering the shafts at the 1st Level. A booster fan is located on the 5th Level, "A" Shaft to ventilate six different contracts; this has been the only dead-spot in the mine. Auxiliary fans are used only for the ventilation of development headings. Conditions have been exceptionally good.

LLOYD MINE

The main mine fan is a Sturtevant No. 60, selected for 25,000 cubic feet of air per minute at .5" water gauge. Its present output of 18,000 cubic feet of air per minute is because of the fact that the fan is now doing considerably more work than what it was selected for. A booster fan located on the 8th Level is handling 16,300 cubic feet of air per minute. This air is drawn from the Lloyd Shaft through a winze to the 9th Level and through the mining area and discharged into a raise leading to Section 6 Shaft, which is the exhaust shaft. Both the main mine fan and booster fans can be, and are reversed to keep ice from forming in the shaft. Distribution of air in the working areas has been very poor at times. Even with auxiliary fans, it has been difficult to ventilate some contracts enough to keep the dust counts below the maximum standards. The mine is well-equipped with auxiliary fans.

MAAS MINE

The Maas Mine fan, located on the surface at the Negaunee No. 2 Shaft, is a Jeffrey Aerodyne, Size 8H-72, and was selected for 125,000 cubic feet of air per minute at 4.5" water gauge in the No. 7 blade-position. At present, with blades in No. 4 position, it is delivering 110,000 cubic feet of air per minute at 4.8" water gauge. Air enters the Negaunee Mine where

(Cont'd.)

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation (Continued)MAAS MINE (Cont'd.)

it is forced through the various levels down to the 13th Level, where the air splits and part enters Negaunee 4th Level and the other main split to the Maas Mine is on the 14th Level Negaunee and enters the Maas, 6th Level. Only enough air is permitted to exhaust up the Negaunee Shaft to ventilate all levels from the 9th to the 14th. At the present time, the distribution of air in the Maas Mine is extremely good. There is only one small mining area which shows any sign of heat or insufficient ventilation. Two American Blower booster fans are used to ventilate remote mining places. The mine is well-equipped with auxiliary fans. Improvement could be made by the use of larger vent-tubing in the vented places.

MATHER MINE, "A" SHAFT

The main mine fan at the Mather Mine, "A" Shaft, is a Model H-56-36, 5' diameter, La-Del Troller, Axivane, selected for 80,000 cubic feet of air per minute at 4" water gauge. The fan operation on November 2nd, shows the fan was handling 97,528 cubic feet of air per minute with 5,400 cubic feet of air per minute circulating around the fan pillar with a total volume of 92,000 cubic feet of air per minute entering the mining areas. At the present time, approximately 20,000 cubic feet of air per minute exhausts to the Cambria-Jackson Mine and about 35,000 cubic feet of air per minute enters Mather Mine, "B" Shaft. A booster fan is located on the 6th Level between "A" and "B" Shafts, to handle this air. This total of about 55,000 cubic feet of air per minute is approximately the amount of fresh air that enters the mine. The rest of the air is recirculated because it has been impossible to prevent it because of shaft sinking and development work at the Mather Mine, "A" Shaft. Distribution of the air has been fairly good. Auxiliary fans are in use in every area, in mining contracts where necessary, with a good reserve of auxiliary fans, with sizes ranging from 5 to 25 H.P. and from low-speed, low-pressure fans to high-speed, high-pressure fans. Very little, if any, vent-tubing is used on these fans. The use of spiral-weld steel pipe has been found to be much more economical and efficient and is used for all purposes. Ventilation of raises has been exceptionally good in this mine through the use of high-speed, high-pressure fans and 6" and 8" spiral-weld metal pipe. Nearly all main drift headings are ventilated through use of No. 45 Sturtevant fans drawing air from the breast, and small Coppus, 5 H.P. fans, high speed & high-pressure, sweeping the breast of the heading to force air back to the intake of the large tubing. The ventilation system of both the Mather "A" and Mather "B" will be changed in the near future so as to take all air down Mather "B" Shaft and exhaust up Mather "A" Shaft. This should eliminate entirely the recirculation of air in the mine.

MATHER MINE, "B" SHAFT

Ventilation of Mather Mine, "B" Shaft, which is in the development stage, is handled by an American Blower booster fan which is located on the 6th Level. This fan, at the present time, is handling about 35,000 cubic feet of air per minute and the air exhausts up Mather "B" Shaft. Ventilation

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation (Continued)MATHER MINE, "B" SHAFT (Cont'd.)

of all development headings and mining areas is through the use of No. 45 Sturtevant fans and modern Joy Axivane Fans and the high-speed, high-pressure Coppus fans. At the present time, the ventilation system is very good. The entire ventilation system of the mine will be changed when the main mine fan is installed on the 6th Level between Mather Mine, "B" Shaft, and Mather Mine, "A" Shaft, with the fresh air being taken down the Mather "B" Shaft and exhausted into Mather "A" Shaft.

NEGAUNEE MINE

The Negaunee Mine, which has been idle during the year is furnished air from the same fan which ventilates the Maas Mine, with just enough air permitted to leak out on each level to ventilate the main drifts and the station plats.

SPIES-VIRGIL MINE

The main mine fan of the Spies-Virgil Mine is a Jeffrey Aerodyne 8H-42 selected for 20,000 cubic feet of air per minute at 3.5" water gauge in No. 4 blade position. At the present time it is handling 18,656 cubic feet of air per minute; with the exception of a few thousand cubic feet of air which enters the 4th Level, all air enters the 6th Level from the Spies Shaft. The air enters the bottom of the mining area and it passes through the stopes to the 1330 Sub, then to the air shaft and to surface, where the fan is located. Distribution of this air has been very good and is controlled by air doors on the 6th Level. Very few auxiliary fans have been necessary to ventilate this mine. For ventilation of the 8th Level development drift, a No. 45 Sturtevant Fan is being used to draw the air from the breast. A second No. 45 fan is in reserve and will be placed in tandem with the other fan in order to ventilate this drift as it is being driven into the mining area. There is no recirculation of air in the mine.

SARGENT & AGNEW MINES

These two mines, which are very shallow, have natural ventilation, with the air coming from drifts which connect with open-pits and the air exhausts up the shafts. Coppus and American Blower Fans are used to ventilate slices and some work areas. Ventilation and distribution of air are very good in both mines.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

(Continued)

Dust Analysis

Average light field counts of all samples of dust taken over the years since 1933 show improvement. For 1950, six mines have improved the dust counts and three have increased their counts.

Averages in ore and rock are shown in TABLE XXIX and are interesting. The Athens, Cliffs Shaft, Maas and Tilden Mines have very favorable averages in both ore and rock. At the Cambria Mine, ore and rock dusts counts are nearly alike.

The Lloyd and Spies Mines both continue with dust counts over the recommended limits, partly because of poorer ventilation standards and also, because of the dry, brittle rock and ore.

The use of dust respirators underground has increased each year and are required for many of the jobs, but many of the employees have become dust conscious and are willing to wear the respirators anytime they suspect any amount of dust. The respirators also have been improved to the extent that breathing through them is not a hardship anymore.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

(Continued)

The tables on this and following pages give location and various occupations where dust counts were taken; also, total averages of counts since 1933, when the first counts were taken.

TABLE XXV

DUST SAMPLES COLLECTED—ROCK AND ORE WORK

<u>Mine Or Plant</u>	<u>1950</u>		<u>1950 Total</u>	<u>1933 - 1950 Total</u>
	<u>In Ore</u>	<u>In Rock</u>		
ATHENS	22	20	42	725
CAMBRIA-JACKSON	19	24	43	269
CLIFFS SHAFT	8	27	35	1,699
LLOYD	23	32	55	697
MAAS	8	31	39	669
MATHER MINE, "A" SHAFT	14	48	62	658
MATHER MINE, "B" SHAFT	12	28	40	112
** NEGAUNEE	-	-	-	769
** PRINCETON	-	-	-	85
SPIES-VIRGIL	9	4	13	142
TILDEN	9	-	9	63
MISCELLANEOUS	-	-	-	111
TOTALS	124	214	338	5,999

** Closed Down.

Safety Department

422

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

(Continued)

TABLE XXVI

VARIOUS OCCUPATIONS WHERE DUST SAMPLES WERE COLLECTED

Occupation	ATHENS	CAMBRIA-JACKSON	CLIFFS SHAFT	LLOYD	MAAS	MATHER MINE, "A" SHAFT	MATHER MINE, "B" SHAFT	NEGAUNEE	SPIES-VIRGIL	TILDEN	Totals
DRILLING	12	17	26	17	24	30	23	-	9	-	158
SCRAPING	13	16	2	14	8	5	5	-	4	-	67
USING AIR LOADER TO FILL CARS	4	-	4	8	-	12	3	-	-	-	31
BLASTING	1	-	-	-	1	1	2	-	-	-	5
TIMBERING	2	1	-	1	2	4	1	-	-	-	11
HAND SHOVELING	2	2	-	4	-	2	-	-	-	-	10
BARRING BACK	-	1	-	1	-	1	-	-	-	-	3
BLOWING CARS	2	2	-	2	2	1	-	-	-	-	9
LOADING CARS AT CHUTE	1	-	-	1	1	-	-	-	-	-	3
GENERAL MINE AIR	2	3	1	3	1	1	4	-	-	-	15
CHARGING HOLES	3	-	2	1	-	1	1	-	-	-	8
BREAKING CHUNKS	-	1	-	3	-	-	1	-	-	-	5
CRUSHING ORE	-	-	-	-	-	-	-	-	-	4	4
LOADING AT POCKET	-	-	-	-	-	-	-	-	-	5	5
GRINDING BITS (6th Level)	-	-	-	-	-	4	-	-	-	-	4
TOTALS	42	43	35	55	39	62	40	-	13	9	338

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

(Continued)

TABLE XXVII

AVERAGE LIGHT FIELD COUNT OF ALL SAMPLES TAKEN

<u>Mine Or Plant</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>	<u>1937</u>	<u>1938</u>	<u>1939</u>	<u>1940</u>	<u>1941</u>	<u>1942</u>
ATHENS		32.90	14.12	28.32	26.69	12.85	12.59	9.89	7.28	25.80
CAMBRIA-JACKSON*										
CLIFFS SHAFT	17.94	14.56	8.29	8.98	15.53	9.86	10.36	7.77	8.18	7.55
LLOYD		9.90	12.42	39.25	20.25	10.84	13.47	11.73	8.05	6.95
MAAS		7.46	27.55	35.75	150.98	11.24	36.90	8.71	17.29	8.46
MATHER MINE, "A" SHAFT*									2.42	5.58
MATHER MINE, "B" SHAFT*										
NEGAUNEE		53.80	17.77	33.25	59.06	56.26	25.49	10.79	14.02	17.02
PRINCETON*										
SPIES-VIRGIL					70.61	26.99	1.80	8.40	6.97	
TILDEN				67.52	285.27	74.60	60.40		49.60	
GARDNER MACKINAW		27.77		8.61	48.53					
MISCELLANEOUS			8.66	3.00	6.80	14.73				3.00

* Not In Operation During This Period
(Mather "A" in Operation - 1941 & 1942)

(Table Cont'd. - Next Page)

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

(Continued)

TABLE XXVII (Cont'd.)

AVERAGE LIGHT FIELD COUNT OF ALL SAMPLES TAKEN

<u>Mine Or Plant</u>	<u>1943</u>	<u>1944</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>
ATHENS	4.90	8.33	6.64	4.17	7.39	7.49	7.07	4.71
CAMBRIA-JACKSON	12.10	6.21	17.05	11.99	9.30	13.81	6.86	9.50
CLIFFS SHAFT	5.99	6.23	8.18	6.34	8.64	5.12	6.26	3.46
LLOYD	5.01	14.45	6.49	9.38	11.17	12.97	11.72	11.32
MAAS	12.48	8.78	8.17	9.29	6.08	21.08	10.55	4.45
MATHER MINE, "A" SHAFT	6.64	7.57	8.39	7.72	10.88	9.50	8.40	7.01
MATHER MINE, "B" SHAFT					2.23	4.16	2.46	6.68
NEGAUNEE*	4.65	11.81	11.92	6.67	7.05	5.48		
PRINCETON*	10.59	6.32	8.48					
SPIES-VIRGIL		5.59	14.22	3.59	11.65	5.24	10.12	18.78
TILDEN			24.18	66.92	33.65	2.93	4.38	3.74
GARDNER MACKINAW*								

* No Longer In Operation
(Negaunee Being Readied For Further Mining)

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

d. Ventilation

(Continued)

TABLE XXVIII

COMPARISON OF DUST COUNTS IN RAISING TO DRIFTING

<u>Mine</u>	<u>Average In Raising</u>	<u>Average In Drifting</u>	<u>General Average</u>
ATHENS	4.73	4.35	4.71
CAMBRIA-JACKSON		13.76	9.50
CLIFFS SHAFT	5.33	2.42	3.46
LLOYD	25.48	6.99	11.32
MAAS		4.39	4.45
MATHER MINE, "A" SHAFT	22.18	5.01	7.01
MATHER MINE, "B" SHAFT	15.91	5.05	6.68
SPIES-VIRGIL		25.26	18.78

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYd. Ventilation

(Continued)

TABLE XXIX

AVERAGES IN ORE COMPARED TO AVERAGES IN ROCK

<u>Mine</u>	<u>Average In Ore</u>	<u>Average In Rock</u>	<u>General Average</u>
ATHENS	4.99	4.60	4.71
CAMBRIA-JACKSON	10.68	9.13	9.50
CLIFFS SHAFT	5.07	2.82	3.46
LLOYD	15.73	5.39	11.32
MAAS	4.22	4.41	4.45
MATHER MINE, "A" SHAFT	9.76	5.99	7.01
MATHER MINE, "B" SHAFT	12.60	4.27	6.68
SPIES-VIRGIL	22.36	10.71	18.78
TILDEN	3.74		3.74

428

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

e. Mine Safety and Mine Rescue Courses

Mine Rescue Training

During the month of December, 163 employees received Mine Rescue Training. Training was also arranged for January month, at which time initial mine rescue training will be conducted on the Marquette and Menominee Ranges. On completion of this training, all mines with the exception of the Negaunee Mine will have two or more complete mine rescue crews.

Total number of men trained at the present time is 55 Initial Mine Rescue and 147 Additional Mine Rescue. Seventy (70) of these men do not pass the physical standards as set up by the U.S. Bureau of Mines, Safety & Health Division, but most can use the new type Chemox apparatus or All-Service gas masks. Also, most of these men are supervisors and would be necessary at their mine in case of fire. Only physical defect of these men is either some teeth missing, overweight or eyes not up to standard. Only 26 of the men have had experience at mine fires, but this is still a large enough crew to have good leaders in case of a real bad fire.

Training men at the new Mine Rescue Station at Mather Mine, "B" Shaft, was a real pleasure for both instructors and men. With all equipment and facilities in one building, there was no wasted time and training in smoke and gas was as close to actual underground fire-fighting as it is possible to make it. More than one hour per eight-hour day is gained for each man trained. According to outside persons well versed in mine rescue, our station is probably the most efficient in the country.

Mine Fires - Underground & Surface

There were no fires reported during the year, either on surface or underground, for which we are grateful.

At the Spies Mine, water temperatures in #6 Stope have raised from 67° and 77° on July 19, 1950 to 122° and 128°. As yet, there is no indication of sulphur-dioxide gas, but brattices are being built to isolate the stope which will be exhausted soon.

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYe. Mine Safety And Mine Rescue Courses (Cont'd.)

TABLE XXXI

MINE RESCUE TRAININGDECEMBER 4th TO 22nd, 1950

<u>Mine</u>	<u>No. Of Men</u>
ATHENS	17
CAMBRIA-JACKSON	20
CLIFFS SHAFT	13
ENGINEERING DEPARTMENT	6
LLOYD	8
MAAS	18
MATHER MINE, "A" SHAFT	41
MATHER MINE, "B" SHAFT	33
NEGAUNEE	7
<u>TOTAL</u>	<u>163</u>

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURY

e. Mine Safety And Mine Rescue Courses (Cont'd.)

TABLE XXXII

FIRST-AID SUPPLIES DISTRIBUTED

<u>MATERIAL</u>	<u>NO. DISTRIBUTED</u>
Merthiolate Pads (Band-Aids)	55,400
Ounces Of Merthiolate	154
1" Roller Bandage	225
2" Roller Bandage	222
3" Roller Bandage	166
Rolls Of Adhesive Tape	78
Picric Acid Gauze Pads (For Burns)	127
Plain Gauze Pads	471
Leather Finger Cots	90
Merthiolate Applicators	2,356
Ounces Of Aromatic Spirits Of Ammonia	19
Ounces Of Absorbent Cotton	16
Tubes Of Unguentine	32
Triangular Bandages	30
Pairs Of Scissors	2
Bottles, 1 Oz. (Medicine)	52
Elasto-Plasts (Elastic Band-Aids)	360
TOTALS	59,800

Safety Department

Annual Report

Year 1950

11. ACCIDENTS
AND
PERSONAL
INJURYf. Miscellaneous

Our goggle-fitting program has been going along good and it seems we shall have close to 100% wearing of safety goggles without a rule to cover it. All mines are equipped with goggle-fitting sets and warehouse men are trained to do the fitting.

Classes on electrical blasting were held at the Mather Mine, "B" Shaft, for electricians and supervisors. Classes were conducted by the Electrical Foreman.

Safety meetings are being held at all properties, including the Research Laboratory. Special meetings were held for the underground mines on the Mesaba Range and I addressed all these meetings.

Investigation of hazards in connection with heavy duty truck tires and air brake systems was completed and recommendations made.

A demonstration of first-aid fire extinguishers was conducted near the Cambria-Jackson Mine for supervisors. A pit three feet deep and twenty-two feet square was filled with old crankcase oil and gasoline and ignited. Various types of extinguishers were used. Another demonstration is planned for the early summer of 1951.

Assistance was given the Ishpeming High School in their safety program and ventilation of the Manual Arts Building.

Safety Department members served on committees in connection with the Company's Centennial celebration and Business, Industrial & Education Day.

TABLE XXXIII

COMPARISON OF FREQUENCY, SEVERITY RATINGS
TAKEN FROM AVAILABLE STATISTICS

11. ACCIDENTS
AND
PERSONAL
INJURY

f. Miscellaneous

(Continued)

Safety Department

Annual Report

Year 1950

	<u>FREQUENCY</u>	<u>SEVERITY</u>		<u>FREQUENCY</u>	<u>SEVERITY</u>
1949 National Rating, All Mining, Including Coal	38.36	5.96			
1949 " " , Coal Mining	41.48	6.84			
1949 " " , Metal Mining	48.08	6.62			
1949 Lake Superior District Mines, 26 Companies	19.33	3.10			
1950 Lake Superior Mines Safety Exchange (Not Incl. C.C.I.)	8.90	2.331	1949 - LAKE SUPERIOR DIST.		
1950 Lake Superior Mines Safety Exchange (Incl. C.C.I.)	10.56	2.728			
				<u>FREQUENCY</u>	<u>SEVERITY</u>
1950 The Cleveland-Cliffs Iron Co., Compensable Injuries	16.09	3.976			
1950 " " " " , All Injuries	39.26	4.029	19.33	3.10	
1950 " " " " , Open-Cut Mining	13.59	4.200	11.61	2.16	
1950 " " " " , Concentrating Plants	22.83	.699	21.53	11.52	
1950 " " " " , Top Slicing	121.45	13.747	38.36	3.23	
1950 " " " " , Sub-Level Caving	52.39	5.889	34.72	4.80	
1950 " " " " , Stoping	37.92	1.037	22.90	3.22	
1950 " " " " , Block Caving	47.90	.982			
1950 " " " " , Shaft Sinking & Mine Development	43.31	13.593	4.73	0.35	
1950 " " " " , General Shops	22.61	.751	5.08	1.58	
1950 " " " " , C.P. & L. Co.	0.00	.000			
1950 " " " " , General Roll	1.69	.003			
1950 " " " " , Miscellaneous	0.00	.000			

ANNUAL REPORT OF THE MINING ENGINEERING DEPARTMENT FOR THE YEAR
ENDING DECEMBER 31, 1950

The maps and sections of the operating mines of the Company and its affiliates for 1950 show the underground and surface workings as of December 31st. Previously our annual report maps were posted as of November 30th of each year. This was because these annual report maps were used for the report to the Michigan State Tax Commission showing ore reserves as of December 31st. The Michigan State Legislature, however, changed the time of placing valuations on property to January 1st of each year instead of April 1st, which necessitated the advancing by three months the preparation of our ore reserve estimates. This time advancement prevented the use of annual report maps for our ore reserve estimates so that it seemed advisable to prepare the annual report books as of the end of the year.

The books of maps, views, drill records, etc., which accompany this report, show the work done during 1950 in all the properties by the Cleveland-Cliffs Iron Company, either for itself or as an operating company for others. The mine maps show, in red, the areas mined or developed during the year while the cross-sections of open pits show, in red, the undisturbed formation at the end of the year. The record of drilling and explorations are shown in maps and sections of the drill holes in color.

Books were prepared for the various companies in either bound or looseleaf form. The mines included in the various books are shown in the following table:

<u>Company</u>	<u>Mines</u>	
	<u>For Itself</u>	<u>As Operating Agent</u>
The Cleveland-Cliffs Iron Company	Agnew Cambria-Jackson Canisteeo Cliffs-Shaft Hawkins Lloyd Maas Sally Sargent Spies-Virgil Tilden Wanless-Woodbridge	Athens Atkins Hill-Trumbull Holman-Cliffs Mather
The Mesaba-Cliffs Mining Company Partners: Hanna Iron Ore Company Inland Steel Company Jones & Laughlin Steel Corporation Pittsburgh Steel Company Wheeling Steel Company		Hill-Trumbull Holman-Cliffs
The Athens Iron Mining Company for Pickands Mather & Company		Athens
The Negaunee Mine Company Partner: Bethlehem Steel Company		Mather

Loose-leaf books were prepared for other companies containing the properties in which they were interested, as follows:

<u>Company</u>	<u>Mines</u>
Arthur Iron Mining Company	Atkins, Hill-Trumbull, North Star and Bingham Lease of Holman-Cliffs.
Inland Steel Company	Atkins.
International Harvester Company	Agnew, Hawkins and Sargent.
Teal Lake Iron Mining Company	Cambria.

Similar loose-leaf books were prepared for Mine Superintendents covering their mines in order that they might have some definite record of the operation of that property. These loose-leaf books were as follows:

<u>Name</u>	<u>Mine</u>
Grover J. Holt, Manager	Agnew, Atkins, Canisteo, Hawkins, Hill-Trumbull, Holman-Cliffs, Sally, Sargent, and Wanless-Woodbridge.
J. J. Foucault, Superintendent	Agnew, Sargent.
E. L. Bemis, "	Canisteo.
P. P. Swanson, "	Hawkins.
H. J. Leach, "	Hill-Trumbull.
W. A. Pakkala, "	Holman-Cliffs.
Roland Erickson, "	Atkins, Wanless-Woodbridge.
John Trosvig, "	Athens.
W. R. Atkins, "	Cambria-Jackson.
S. W. Sundeen, "	Cliffs-Shaft.
Onni Marjama, "	Lloyd, Spies-Virgil.
H. O. Moulton, "	Maas, Tilden.
J. S. Westwater, "	Mather.

B. MAP REPORTS

During the year many map reports were prepared for the operating properties and fee-owners or affiliated companies. This report only refers to the sets prepared for the Michigan properties. Each month two sets of mine maps were prepared showing, in red, the work done during the previous month. One set was for the mine superintendent and the other for the Manager of Michigan Mines. Every mining captain, foreman and shift boss receive prints of the levels and sub-levels of their territory. These were trimmed and folded to fit the pocket so they can be taken underground. These maps for the operating personnel constitutes a tremendous output for the Department, there being between 600 and 700 maps prepared each month.

There were other map reports prepared for various parties during the year as follows:

ATHENS MINE

Two sets of working maps, scale 1" = 50', were sent monthly, except December, to the offices of the Pickands Mather & Company, one to Duluth and the other to Ironwood. A set of maps showing the work done on the Corbit Lease for each half year were forwarded to the Detroit Trust Company, Detroit, for the fee-owner of the Corbit Lease, as of June 30th and December 31st. As there was no mining along the Athens-Lucky Star boundary, no maps were prepared for the Jones & Laughlin Ore Company.

CLIFFS-SHAFT MINE

One set of geological maps of the Bancroft and Section 10 Leases, scale 1" = 50', were forwarded to the Duluth office of the Oliver Iron Mining Company after each quarterly survey. These maps show, in color, the work done in the mine during each quarter. The set for the last quarter of the year showed not only the mining done for the year but the areas used in making the estimate of ore reserves for the Michigan State Tax Commission. A copy of the calculation sheets of the ore reserve estimate was also forwarded to the Duluth office of the Oliver Company.

MATHER MINE

A complete set of prints of the working maps of the Mather Mine, "A" and "B" Shafts, were forwarded to Dr. Donald M. Fraser, Chief Geologist of the Bethlehem Steel Company, quarterly as of March 31st, June 30th, September 30th and December 31st.

MICHIGAN STATE TAX COMMISSION

The estimates of ore reserves for the year 1950, together with maps and calculations, were forwarded to Mr. F. G. Pardee, Mine Appraiser, during the early part of October, 1950. The maps were posted as of August 31st and estimates adjusted as of October 1st, 1950. At the end of the year, a final adjustment was made to bring the estimates up to December 31st. A supplementary estimate of Mather "B" reserves was made to include a substantial tonnage of ore developed by drilling after August 31st. The maps showing the areas as forwarded to Mr. Pardee were from the working tracings, scale 1" = 50'.

At the end of the year a set of annual report maps was prepared showing the areas included in the ore reserve estimates as furnished the State Tax Commission. One set was prepared for the Cleveland office and the other for the Engineering Department as a permanent record, the large maps being too bulky to be kept as a permanent record.

C. REMARKS ON MISCELLANEOUS DOCUMENTS

All documents affecting the Company's lands and rights passed through the Mining Department for approval. These were all referred to Mr. Brewer and, occasionally to Mr. Derby where mineral rights or interests were involved. These documents were entered on the Engineering Department records and initialed. Most of these documents originated in other Departments but have to receive the Mining Department's approval before execution.

The following table shows the number and classification of documents which passed through the Engineering Department during the year:

<u>Classification</u>	<u>Number Received</u>	<u>Last File Number</u>
Mining Leases	6	94
Miscellaneous Documents	36	1851
Easements	2	468
Rights of Way	1	225
Surface Leases	70	6354
Sales	63	4357
Tax Histories	2	726

The following is a summary of the various classifications as shown:

MINING LEASES

The following mining leases were executed during the year. Some were the results of negotiations carried on for a considerable period of time.

Lease No. 89 - Minnesota

The NW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Section 18, 56-23, Itasca County, Minnesota, was leased from the Gilbert Mining Company, et al, to the Mesaba-Cliffs Mining Company under date of February 1, 1950. This is an extension of the Hill-Trumbull Mine.

Lease No. 90 - Michigamme River District

The minerals in 750.21 acres of Section 2, 46-30 and Sections 20, 28, 34 and 35, 47-30, Marquette County, Michigan, were leased from the State of Michigan (State Lease No. 42) to The Cleveland-Cliffs Iron Company, dated April 1, 1950. This lease covering lands along the Michigamme River Northwest of Republic was taken in the hopes of finding a sufficient quantity of low grade material that might be amenable to concentration in sufficient quantities to warrant a large scale operation.

Lease No. 91 - Boyington

Government Lot 3, Section 18, 43-34 and the SE $\frac{1}{4}$ of Section 13, 43-35, Iron County, Michigan, was leased from Mr. Philip L. Boyington and wife to The Cleveland-Cliffs Iron Company dated May 1st, 1950. This property lies immediately North of the Spies Mine. It was hoped that the Bates Mine ore body might extend in this area.

Lease No. 92 - Cascade

A. - N $\frac{1}{2}$ of NW $\frac{1}{4}$ of Section 29, 47-26, except West 20 rods and the NW $\frac{1}{4}$ of Section 32, 47-26.

B. - NW $\frac{1}{4}$ and SE $\frac{1}{4}$ of Section 19, and entire Section 20, 47-26.

These are sub-leases and the result of considerable negotiations with the Cascade Corporation who lease the property from the Pittsburgh & Lake Superior Iron Company. The property involved was covered by two leases for the reason that the area covered by "A" was for high grade ore only, whereas the area under lease "B" is low grade formation which may be amenable to beneficiation. The mining conditions imposed under the original lease from the Pittsburgh & Lake Superior Iron Company to the Cascade Corporation were unsuited to present day operations. It was necessary,

therefore, for these two companies to change their agreement before we could take the lease. Our leases were executed after the underlying leases had been approved and executed.

Lease No. 93 - Norman

The $W\frac{1}{2}$ of $E\frac{1}{2}$ and the $E\frac{1}{2}$ of $W\frac{1}{2}$ of Section 30, 47-30, Marquette County Michigan, was leased from the Norman Iron Company by The Cleveland-Cliffs Iron Company dated April 1st, 1950. This is part of the Michigamme River Area and is an extension of the State Lease No. 90 mentioned above.

Lease No. 94 - Bunker Hill

A copy of the lease dated May 1st, 1924, whereby the Bunker Hill Mining Company leased its property to The Cleveland-Cliffs Iron Company and Interstate Iron Company, was received and filed. We did not have any copy of this lease in our files previously.

MISCELLANEOUS DOCUMENTS

This classification covers all types of documents covering interest or rights in land relating to operating mines, or so-called mineral lands. Nineteen of these documents covered various rights acquired in the Minnesota properties. There were 13 documents involving Michigan mineral lands and the other documents covered miscellaneous rights in Minnesota.

EASEMENTS

These are transmission line rights of way secured by the Cliffs Power & Light Company and entered on our records. One easement covered the extension of the Sawyer Airport in Forsyth Township and the other for the rebuilding of the line to the Volunteer Mine at Palmer.

RIGHTS OF WAY

This file covers railroad rights of way and is maintained for a quick reference for what mineral reservations may have been reserved in the various railroad rights of way.

SURFACE LEASES

These leases originate in the Land Department and cover the use of Company lands for residences, camps, gardens, farms, etc. It is very advisable that these documents pass through the Mining Department to be sure that no new lease is issued that might interfere with Mining Department plans.

SALES

These documents are conveyances of Company lands off the mineral formation and cover also rights of way, campsites, etc. They also cover the transfer of inter-company property.

TAX HISTORIES

Such tax histories as are acquired in the course of securing title opinions on various properties are placed in this file. The two entered this year were covered by the purchase of the Ohio Mine property in Baraga County.

ABSTRACTS OF TITLE

The title of all property purchased is approved by Bell & Davidson. In many cases, complete abstracts are obtained and other times just the title is examined in the office of the Register of Deeds. Any abstracts of title received are forwarded to the Cleveland office for filing along with the document covering the transaction.

During the past several years, information regarding land ownerships has been secured by Mr. Brewer in Marquette, Baraga, Iron, Dickinson and Menominee Counties. These ownerships were obtained mostly at the request of the Geological Department as a basis to where geological explorations might be made, where there is a possibility of securing under lease or purchase favorable mineral lands. No abstract of title is obtained at this time, merely the name of the record owner. In some cases this record is not correct or is incomplete due to complicated ownerships. However, it is sufficient until subsequent geological information warrants more investigation as to the title. Sets of these maps were prepared and are being kept up to date and have proved of immense value to the various departments.

D. THE FORCE

The personnel of the Engineering Department has gradually increased throughout the year due to the ever-increasing demand for underground surveys, the general expansion of the Company's exploration activities and other developments, such as the Cliffs 8th Addition.

The block caving, sub-level caving, and radial drill stoping methods of mining now used in most of our operating mines require a great deal more supervision and surveying by transit than was ever required by the top-slicing method. It has been found that the underground surveyor-helper system takes care of this work quite satisfactorily. Under the new system, the mining engineer spends more time planning the development for the caving method of mining, while the surveyor and helpers carry out the actual survey work under the direction of the engineer.

In March, 1950, Mr. H. Walter Rembold left the Department and was transferred to the Geological Department as Operating Engineer for the Diamond Drilling Division. Messrs. J. F. Magnuson, K. C. Olson, B. H. Peterson and R. L. Sundeen, Mining Engineers, entered the Department during the year. Mr. LeRoy Hosking, construction engineer, entered the Department about the middle of the year to do the lay-out work and engineering details in conjunction with the new Cliffs Eighth Addition.

Mr. Ralph K. Oja, George R. Magnuson and Martin D. Tasson were inducted into the armed services during the latter part of the year. These men were replaced with other personnel.

The following table shows the personnel of the Department, their position at the end of the year and the period of employment:

<u>Name</u>	<u>Position</u>	<u>Entered</u>	<u>Left</u>	<u>1950 Employment</u>
Carl Brewer	Recorder			12 Months
Robert M. DeGabriele	Engineer			12 "
John M. Haivala	"			12 "
Grant T. Hollett	"			12 "
Maxwell H. Madsen	"			12 "
H. Walter Rembold	"		March 31st	3 "
Kenneth C. Olson	"	March 20th		9 $\frac{1}{2}$ "
John F. Magnuson	"	March 1st		10 "
Bernhardt H. Petersen	"	Nov. 13th		1 $\frac{1}{2}$ "
Robert L. Sundeen	"	Dec. 16th		1 $\frac{1}{2}$ "
W. Harlow Stannard	Draftsman			12 "
Anselm Mantyla	"			12 "
George B. Manzoline	"			12 "
Donald W. Carlson	Clerk			12 "
Clifford H. Amel	Surveyor			12 "
Edgar G. Curtis	"			12 "
P. Daniel Isaacson	"			12 "
C. Arthur Koski	"			12 "
F. Alfred Koski	"			12 "
Ernest A. Oja	"			12 "
Ralph K. Oja	"		Oct. 20th	10 "
John R. Sleeman	"			12 "
Clarence P. Ayotte	"			12 "
Robert E. Anderson	Helper			12 "
Clyde C. Anderson	"	Dec. 4th		1 "
Herbert S. Kelly	"			12 "
William E. Kumpu	"	Dec. 4th		1 "
William M. Leaf	"	July 5th		6 "
Alexander McAfee	"	Sept. 7th		4 "
Louis R. Miller	"			12 "
Alfred B. Nault	"			12 "
Raymond E. Oja	"			12 "
Russell J. Paull	"			12 "
George R. Magnuson	"	Mar. 14th	Sept. 30th	6 $\frac{1}{2}$ "
Thomas Riberdy	"	Oct. 23rd	Jan. 12th	2 "
Martin D. Tasson	"		Dec. 31st	12 "
Raymond S. Windsand	"			12 "
Roy H. Thomas	"	Nov. 20th		1 $\frac{1}{2}$ "
Ralph C. Goethe	"	June 26th	Sept. 19th	2 $\frac{1}{2}$ "
Raymond T. Ronquist	"	July 5th	Sept. 15th	2 $\frac{1}{2}$ "
LeRoy Hosking	Engineer	June 1st	Aug. 26th	3 "

The next table shows the length of service in the Engineering Department of those employed at the end of the year:

<u>Name</u>	<u>Date Entered</u>	<u>Length of Service</u>	
Carl Brewer	August, 1906	32 years,	3 months
Robert M. DeGabriele	December, 1945	5 "	1 "
John M. Haivala	March, 1943	7 "	10 "
Grant T. Hollett	August, 1940	10 "	4 $\frac{1}{2}$ "
Maxwell H. Madsen	September, 1943	7 "	4 "
John F. Magnuson	March, 1950		10 "
Kenneth C. Olson	March, 1950		9 $\frac{1}{2}$ "
Bernhardt H. Petersen	November, 1950		1 $\frac{1}{2}$ "
Robert L. Sundeen	December, 1950		1 $\frac{1}{2}$ "
W. Harlow Stannard	November, 1940	10 "	2 "
Anselm Mantyla	July, 1948	2 "	5 $\frac{1}{2}$ "
George B. Manzoline	December, 1947	3 "	1 "
Donald W. Carlson	August, 1936	11 "	1 "
Edgar G. Curtis	February, 1944	6 "	11 "
P. Daniel Isaacson	November, 1940	5 "	4 $\frac{1}{2}$ "
C. Arthur Koski	June, 1941	6 "	1 "
F. Alfred Koski	January, 1936	9 "	9 "
Clifford H. Amel	May, 1944	6 "	7 $\frac{1}{2}$ "
Clarence P. Ayotte	April, 1948	2 "	8 $\frac{3}{4}$ "
Alfred B. Nault	September, 1946	4 "	3 $\frac{1}{2}$ "
Ernest A. Oja	March, 1943	7 "	10 "
John R. Sleeman	February, 1947	3 "	10 $\frac{1}{2}$ "
Clyde C. Anderson	December, 1950		1 "
Robert Earl Anderson	July, 1948	2 "	6 "
Herbert S. Kelly	May, 1948	2 "	7 "
William E. Kumpu	December, 1950		1 "
William M. Leaf	July, 1950		6 "
Alexander McAfee	September, 1950		4 "
Louis R. Miller	August, 1945	5 "	3 $\frac{1}{2}$ "
Raymond E. Oja	October, 1946	4 "	4 "
Russell J. Paull	March, 1947	3 "	9 "
Martin D. Tasson	August 1948	2 "	5 "
Roy H. Thomas	November, 1950		1 $\frac{1}{2}$ "
Raymond S. Windsand	December, 1947	3 "	1 $\frac{1}{2}$ "

In the above table, the "Length of Service" covers only that period the men were employed in the Engineering Department. Some of them have been in other Departments and at the mines at one time or another. Time spent in the Armed Services is not included in this table.

The following table shows the number of days worked, days overtime, sick and absent during the year, of all those who were in the Department:

<u>Name</u>	<u>Days Worked</u>	<u>Overtime</u>	<u>Sick</u>	<u>Absent</u>
Carl Brewer	252		1	7
Grant T. Hollett	254	4 $\frac{1}{2}$		10 $\frac{1}{2}$
John M. Haivala	256	3		7
Max H. Madsen	253	1		8
John F. Magnuson	212 $\frac{1}{2}$	2	1	5
Kenneth C. Olson	204 $\frac{1}{2}$	2 $\frac{1}{2}$		
Bernhardt H. Petersen	28	1		
H. Walter Rembold	69 $\frac{1}{2}$			
Robert L. Sundeen	8			
Robert M. DeGabriele	237 $\frac{1}{2}$	$\frac{1}{2}$	5	9
Edgar G. Curtis	250	12	5	8
P. Daniel Isaacson	269	22 $\frac{1}{2}$		4
C. Arthur Koski	253 $\frac{1}{2}$	12 $\frac{1}{2}$		10
F. Alfred Koski	241 $\frac{1}{2}$			
W. Harlow Stannard	249 $\frac{1}{2}$			10 $\frac{1}{2}$
Anselm Mantyla	247		8	5
George B. Manzoline	254		1	5
Donald W. Carlson	247		5	8
Clifford H. Amel	240	$\frac{1}{2}$	1	10 $\frac{1}{2}$
Clarence P. Ayotte	270	27		8
Alfred B. Nault	238 $\frac{1}{2}$	3 $\frac{1}{2}$		6
Ernest A. Oja	237 $\frac{1}{2}$	$\frac{1}{2}$	3	12
Ralph K. Oja	218 $\frac{1}{2}$	17 $\frac{1}{2}$		6
John R. Sleeman	252 $\frac{1}{2}$	7 $\frac{1}{2}$		6
Clyde C. Anderson	18			
Robert E. Anderson	248	6		9
Ralph C. Goethe	42		16	
Herbert S. Kelly	243 $\frac{1}{2}$	5 $\frac{1}{2}$		13
William E. Kumpu	19			
William M. Leaf	121 $\frac{1}{2}$	3 $\frac{1}{2}$	3	3
Alexander McAfee	84	5		
George R. Magnuson	150	10		
Louis R. Miller	245 $\frac{1}{2}$		3 $\frac{1}{2}$	11
Raymond E. Oja	239 $\frac{1}{2}$	1 $\frac{1}{2}$	4	9
Russell J. Paull	252	9 $\frac{1}{2}$		8 $\frac{1}{2}$
Thomas E. Riberdy	41		5	1
Raymond T. Ronquist	31			2
Martin D. Tasson	240 $\frac{1}{2}$	6 $\frac{1}{2}$	10	6
Roy H. Thomas	29	2		
Raymond S. Windsand	241	2	1	11
LeRoy Hosking	59			

The following table shows the distribution of time spent underground, in the field, and in the office:

<u>Name</u>	<u>Underground</u>	<u>Field</u>	<u>Office</u>	<u>Total</u>
Carl Brewer		19	233	252
Grant T. Hollett	83	37	134	254
Robert M. DeGabriele	70	51	116½	237½
John M. Haivala	169	29	58	256
Maxwell H. Madsen	115	11	127	253
John F. Magnuson	126	8	78½	212½
Kenneth C. Olson	86	6	112½	204½
Bernhardt H. Petersen	16		12	28
H. Walter Rembold	38	6½	25	69½
Robert L. Sundeen	5		3	8
Edgar G. Curtis	140	6	104	250
P. Daniel Isaacson	163	11	95	269
C. Arthur Koski	178	9	66½	253½
F. Alfred Koski	188½	21	32	241½
W. Harlow Stannard		5	244½	249½
Anselm Mantyla		5	242	247
George B. Manzoline		1	253	254
Donald W. Carlson			247	247
Clifford H. Amel		164½	75½	240
Clarence P. Ayotte	177	6	87	270
Alfred B. Nault	186	22	40½	238½
Ernest A. Oja		164	73½	237½
Ralph K. Oja	123½	9	86	218½
John R. Sleeman	118	52	82½	252½
Clyde C. Anderson	9		9	18
Robert E. Anderson	116	56	76	248
Ralph C. Goethe		40	2	42
Herbert S. Kelly	158	16	69½	243½
William E. Kumpu	10		9	19
William M. Leaf	56	18½	47	121½
George R. Magnuson	93	6	51	150
Alexander McAfee	59	3½	21½	84
Louis R. Miller			245½	245½
Raymond E. Oja		179½	60	239½
Russell J. Paull	151	9	92	252
Thomas E. Riberdy	28		13	41
Raymond T. Ronquist		28	3	31
Martin D. Tasson		209½	31	240½
Roy H. Thomas	22		7	29
Raymond S. Windsand	161	6	74	241
LeRoy Hosking			59	59

The following summary covers the work done by the various men in the Department and shows the mines to which they were assigned. The more special jobs at the various properties are reviewed under the heading Mines and Miscellaneous.

CARL BREWER, Recorder, supervised the work in the Department for almost the entire year, but the greater portion of his time was spent in connection with the acquisition of lands, preparation of mining leases, deeds and other documents. Prior to the Centennial Celebration held in June his time was taken up as Co-Chairman of the Centennial Committee. Mr. Brewer spent a great deal of time determining ownerships with reference to the lands in Section 13, 43-35, Iron County, and also on the lands of the Norman Iron Company and other properties in the Michigamme River District. He also completed the revision of the standard form of leases and worked with the County Treasurer's Department in correcting the land descriptions and revising of the Mining Department's tax list. The preliminary work of the platting and planning of the Cliffs 8th Addition required considerable time. In the latter part of the year, he relinquished the supervision of the Engineering Department to Mr. Grant T. Hollett, District Engineer, in order to give his full time to land details, much of which is made up of the accelerated program of exploration or probable low grade ore properties.

GRANT T. HOLLETT, District Engineer, was the mining engineer at the Mather Mine "A" Shaft throughout the greater portion of the year. His duties consisted of the planning and inspection of the construction of the new and third stocking area, planning the new revised track lay-out for stockpile loading purposes, and the revisions of the skip dumping arrangements in the headframe. Problems of shaft sinking below the 7th Level, exploration and development of ore bodies above the 6th Level, the engineering work required by the new conveyor belt drift, storage raises and trench lay-out of the new 7th Level, occupied a large portion of his time. Mr. Hollett also supervised the 6th Level drifting program which holed into the Mather "B" Shaft drift in the early part of June, the work of watching lines and grades and the checking by check surveys took up some of his time during the early summer. Mr. Hollett was placed in charge of the grading and road building project at the Research Laboratory. He also spent some time at the Ohio-Norwood, Webster-Portland properties supervising the ditch-blasting program which was done to drain the area in which exploration drills were placed. During the Centennial Celebration, Mr. Hollett acted as co-chairman of the fire-works committee.

ROBERT M. DEGABRIELE, Mining Engineer, was responsible for the engineering duties at the Athens Mine during the entire year and at the Negaunee Mine when the shaft re-construction was started about the middle of the year. At the Athens Mine, he supervised the drawing of the block caving area in the ore body above 8th Level and assisted in the mining and development planning, working with the Superintendent and Captain on this work. At the Negaunee Mine, he assisted in the planning and laying out of the changes in the installation of the new steel sets in the circular section of the shaft and the revisions of the present surface plant in order to adapt it to the new hoist and engine house equipment.

JOHN M. HAIVALA, Mining Engineer, did the engineering work at both the Lloyd and Spies Mines for the first three months of 1950. He assisted the Mine Superintendent and the mining captains with the development planning of the stoping areas at these properties. He spent considerable time in radial blast hole drilling and the initiation of the shrinkage stope method of mining at the Spies Mine.

At the Lloyd Mine he planned the program of exploring the area to the South of the winze, an area which has ore concentration possibilities due to the known faulting condition. Since March of 1950, Mr. Haivala has been assigned to Mather Mine "B" Shaft. At that property he has been engaged in various activities such as the ventilation problem of the Mather "A" and "B" Shaft 6th Level connection, water control, the design and construction of trench and measuring pockets. He has assisted the mine supervisory personnel in regard to choice and selection of rock drilling and rock drifting equipment and other various underground mining machinery. During the Centennial, Mr. Haivala acted as co-chairman of one of the entertainment committees.

MAXWELL H. MADSEN, Mining Engineer, was in charge of the engineering work at the Cliffs-Shaft Mine throughout the year. He also served as mining engineer at the Tilden Mine and for the Cambria-Jackson 8th Level incline development. At the Cliffs-Shaft Mine, he worked with the superintendent and captain in planning the development of new mining methods and areas, adapting tungsten-carbide bits to hard ore use and also did the necessary engineering work for the installation of the new steel sets at the collar of "B" Shaft.

JOHN F. MAGNUSON, Mining Engineer, entered the Department on March 1st and was placed in charge of engineering duties at the Lloyd and Spies Mines at that time. He carried on the work of planning development, the radial blast hole drilling and shrinkage stope method of mining at the Spies Mine.

KENNETH C. OLSON, Mining Engineer, entered the Department on March 20th and spent the first month or so in acquainting himself with the Maas and Cambria-Jackson Mine where he was placed as mining engineer on April 1st, when Mr. Walter Rembold was transferred to the Geological Department. Since this date he has spent considerable time on the problems pertaining to both the Maas 7th Level development program and the Cambria-Jackson 8th Level.

MR. H. WALTER REMBOLD, Mining Engineer, was in charge of the engineering work at the Cambria-Jackson and Maas Mines during the first part of the year. He was transferred to the drilling division of the Geological Department on April 1st.

BERNHARDT H. PETERSEN, Mining Engineer, entered the Department on November 13th and spent the balance of the year becoming acquainted with the work of the Department at the various mines.

ROBERT L. SUNDEEN, Mining Engineer, became a member of the Department on December 16th and spent the remainder of the year becoming familiar with the activities of the Engineering Department.

W. HARLOW STANNARD, Draftsman, had charge of the drafting work of the Department and compiled the maps and views for the annual report books and ore reserve estimates. He also had under his jurisdiction the issuance of Department surveying supplies and equipment. He made numerous special drawings and maps for the various properties throughout the year.

ANSELM MANTYLA, Draftsman, spent a greater portion of his time in making new tracings and mounted maps for the operating mines and explorations. He also posted many of the annual report tracings and made special drawings as required.

GEORGE B. MANZOLINE, Draftsman, was engaged throughout the year in making new ownership maps and revising the older ones. He also made a large number of special maps and drawings pertaining to the development of the South Michigamme and Humboldt Districts. He posted many of the annual report maps prior to the photographing process.

DONALD W. CARLSON, Clerk, did the stenographic work for both the Engineering and Geological Departments for the entire year. He requisitioned and handled supplies, invoices, etc., did the filing, recorded documents and took care of the general office work for both Departments.

LEROY HOSKING entered the Department on June 1st to work on the plans of the proposed Cliffs 8th Addition. He was transferred on August 26th to the Negaunee Mine where he supervised the construction work of the shaft sinking and also the revamping of the surface buildings.

P. DANIEL ISAACSON, EDGAR G. CURTIS, RALPH K. OJA AND CLARENCE P. AYOTTE, Surveyors, were assigned to the Mather Mine "A" Shaft where they took care of the surveying for both the regular mining and the development work of the new 7th Level and shaft sinking projects. WILLIAM E. KUMPU, GEORGE R. MAGNUSON, ROY H. THOMAS, ALEXANDER McAFEE AND RUSSELL J. PAULL, Helpers, assisted the mine engineer and surveyors in the above mentioned work.

F. ALFRED KOSKI, Surveyor, and ALFRED B. NAULT, Helper, took care of the survey work at Mather Mine "B" Shaft during the year.

C. ARTHUR KOSKI, Surveyor, and HERBERT S. KELLY and RAYMOND S. WINDSAND Helpers, worked at the Cliffs-Shaft, Lloyd and Spies Mines, doing the survey work as needed.

JACK R. SLEEMAN, Surveyor, CLYDE C. ANDERSON, ROBERT E. ANDERSON and WILLIAM M. LEAF, Helpers, did the survey work at the mines in the Negaunee District.

CLIFFORD AMEL and ERNEST OJA, Surveyors, with RAYMOND E. OJA and MARTIN D. TASSON, Helpers, did the surface or field survey work at the South Michigamme, Humboldt, Michigamme River and Cascade Districts. During the summer months they were also assisted by RALPH GOETHE and RAYMOND T. RONQUIST, Helpers.

LOUIS R. MILLER, Printer, took care of the whiteprinting and some of the annual report work.

During 1950, the following men left the Department on the dates shown to enter the armed services:

George R. Magnuson	September 30th
Ralph K. Oja	October 20th
Martin D. Tasson	December 31st

F. COSTS

The next table shows a comparison of costs for the Engineering Department for the last three years:

	<u>1948</u>	<u>1949</u>	<u>1950</u>
Salaries	\$79,449.63	\$91,052.07	\$100,143.54
Auto Expense	3,335.67	3,070.69	3,580.32
Furniture and Fixtures	34.47	-	653.56
Heat, Light and Power	721.25	634.29	556.29
Insurance	149.69	216.47	148.02
Postage	53.90	75.52	94.34
Repairs	41.90	-	3,640.80
Stationery and Printing	809.88	259.62	243.07
Supplies	7,152.02	8,000.02	10,250.34
Taxes	51.65	48.49	49.18
Traveling and Entertainment	1,020.09	1,868.71	866.70
Telephone and Telegraph	132.89	203.54	241.57
Papers and Periodicals	2.50	18.00	3.00
Unemployment Insurance Tax	887.37	1,048.00	1,164.79
General - Unclassified	1,059.60	2,316.14	1,068.00
Old Age Benefit Tax	682.66	822.80	1,343.98
Depreciation	95.37	60.00	64.00
Group Annuity Premiums	-	3,233.49	695.95
TOTALS	\$95,680.54	\$113,381.35	\$124,807.45

H. AUTOMOBILES

The Ford Tudor sedan furnished by Four Wheels, Inc., and received on November 19, 1948 was operated for the first half of the year. It was replaced by a 1950 model Ford Tudor sedan on July 15th. The latter has been operated for the balance of the year and is used mainly for trips to the Spies and Lloyd Mines. The Chevrolet Carry-All #1 was operated throughout the year, mainly by the surface survey crews. The Chevrolet Station-Wagon (1942 model) was used until June 1st by the survey crews at the various mines and was replaced on that date by another Chevrolet Carry-All #2.

The following table shows the mileage covered in 1950, the total mileage to the end of the year or date of disposal, and the date the cars were received in the Department:

<u>Car</u>	<u>Miles</u>		<u>Date Received</u>	<u>Date Disposed of</u>
	<u>1950</u>	<u>Total</u>		
Ford Sedan (1948 model)	10,300	29,877	11/19/48	7/15/50
Ford Sedan (1950 model)	12,103	12,103	7/15/50	
Chevrolet Station-Wagon (1942 model)	1,656	67,142	7/29/43	6/1/50
Chevrolet Carry-All #1	8,282	14,854	6/13/49	
Chevrolet Carry-All #2	6,157	6,157	6/1/50	

I. MINES

The following summary covers special work done at the various properties during the year:

GENERAL

With the exceptions noted below, the Michigan mines, which had been on a five day per week schedule since June 27, 1949, remained on this schedule until August 21st, 1950 when they went back to six days per week. The Cliffs-Shaft Mine increased its schedule to six days per week on February 5th, 1950 but went back to five days on May 15th and then increased again to the six day schedule with the other mines on August 21st. The Spies Mine was operating on a four day per week schedule at the beginning of the year, and increased to a 5 day week on May 15th and to six days on August 21st.

ATHENS MINE

The subsidence surveys were continued throughout the year on the iron pins located in the vicinity of the Athens Mine. Geophones were installed on the 1000' and 4th Level elevations and records taken of subsidence activity in shaft pillars. Movement was noted. Conferences were held with Dr. Leonard Obert of the U. S. Bureau of Mines at College Park, Maryland, in regard to this subsidence problem and the use of geophones.

The development and drawing of block caving area No. 3 in the newly developed ore body above the 8th Level was completed during the year. Drilling exploration of the new ore body North of the main East-West fault dike was continued. The floor of the 10th Level was stripped from the shaft west to the new ore body and new track laid on line and elevation by transit survey. Continuous welded rail was used throughout in this drift. The 10400 and 10500 cross-cuts on the 10th Level were completed, the former extending to the Bunker Hill boundary line on the West.

CAMBRIA-JACKSON MINE

The sinking of the incline winze below the 7th Level was supervised and plans made for the installation of the belt conveyor and 8th Level pockets. Lines and grades were given at frequent intervals during this important development project, which was almost completed at the end of the year. Considerable study was given to the development of the 8th Level and methods of mining the ore tributary to this level. This work was done in connection with the Geological Department because of the peculiar shape of the ore bodies.

The cave at the Cambria-Jackson Mine southwest of the shaft was surveyed in order to determine its proximity to the mine water drainage ditch.

CLIFFS-SHAFT MINE

During 1950 the mine engineer spent most of his time with the Superintendent and Mine Captain, planning new mining and development of drifts, raises and stopes. Regular quarterly surveys were made and maps posted after each of these surveys. Between these quarterly surveys frequent trips were made underground by the survey crews to give lines for drill holes and development work.

A system for determining the average life of tungsten carbide rock drill bits was established during the year. "B" Shaft was plumbed from collar to ledge during the year preparatory to the installation of the steel sets.

LLOYD MINE

The 8th Level was extended to the South by drifting 1300' in iron formation. This drift was driven for exploration purposes and ore seams were encountered in two places along the drift. The gradual depletion of the Lloyd ore body results in the decreasing of survey needs.

MAAS MINE

The winze from the 6th Level to the 7th Level elevation was completed in March - a depth of 101' below the 6th Level floor. The double track 7th Level plat was then cut out both North and South of this winze. Tail track drift was driven to the North and the footwall drift to the South and Southwest was advanced toward the ore body. The survey crews gave lines and grades for this development and also for the routine mining in other parts of the mine.

MATHER MINE "A" SHAFT

The principal development projects during the year were the 6th Level drift connection to the Mather "B" Shaft and the 7th Level winze and conveyor drift. In the early part of the year, check surveys were run and lines and grades carefully watched to insure their accuracy for the holing job of the 6th Level connection. The drifts were connected early in June and the accuracy of the surveys was demonstrated by the fact that the connection was perfect as far as grade and course were concerned. This connection was the most difficult "holing job" in the history of the Lake Superior District. The head-on connection required precise accuracy of the engineering crew to maintain line and grades through approximately 9,000 ft. of drift.

On the 7th Level, surveys were run for development work in the main drift and for the conveyor drift. Special surveys and plumbings were made in the shaft for setting bearer sets below the pentice in preparation for the sinking operations. Surveys in other parts of the mine for stoping, raising and drifting in mining contracts occupied a large amount of the time of the survey crews assigned to this property.

On surface, the construction of the third stocking area was planned and supervised. The revised track lay-out for stockpile loading and the changes of the skip-dumping arrangements in the headframe required assistance of the engineering staff.

MATHER MINE "B" SHAFT

The shaft work required constant attention of the Engineering Department, who gave lines for the installation of steel sets and runners in both skip and cage compartments for the construction of pockets, trenches and other installations on the shaft plats. Lines and grades were given for drifting, raising and other development and occupied a large portion of the time of the survey crew, especially prior to the 6th Level connection with Mather "A". The installation of the permanent skip hoist early in the year speeded up the development.

On surface, lines and grades were given for the stockpile conveyor lay-out, and also for the construction of the tunnels, roads, parking lot and new railroad tracks.

NEGAUNEE MINE

Considerable work was done at this property in connection with the shaft sinking operations and for the installation of steel runners in the skip compartments. The construction of the new engine house and other surface installations was also closely supervised.

SPIES MINE

On surface a settling sump for mine water discharge was laid out. This was done on request of the Conservation Department. The water in the mine continued to present difficult problems because of the acid condition which caused pumps and other equipment to be damaged. Water temperatures are rising constantly and this was watched closely and studied to determine the cause and treatment of such a problem.

TILDEN MINE

Very little survey work was required at the Tilden Mine during the year.

J. MISCELLANEOUS

ORE ESTIMATES

The revision of the time for preparing ore estimates has been outlined under the heading of Michigan State Tax Commission previously in this report. The table below shows a comparison of the tonnages as reported to the Tax Commission. These figures were calculated under the old time-schedule as shown by the date at the column heading:

<u>Mine</u>	<u>As of 9/30/49</u>	<u>Tons</u>	<u>As of 9/30/50</u>
Athens	2,595,038		2,116,173
Cambria-Jackson	1,320,563		1,078,019
Cliffs-Shaft	1,899,317		2,105,343
Lloyd	370,461		229,212
Maas	5,242,625		4,611,552
Mather			
"A" Shaft	12,359,239		10,090,277
"B" Shaft	-		8,373,773
Spies	468,868		550,143
TOTALS	24,256,111		29,154,492

STOCKPILES

Estimates of the ore in stock were made by the Engineering Department at the Cliffs-Shaft, Lloyd, Maas, Mather "A" and Spies Mines during the latter part of September and early October.

The following table shows the comparison of ore in stock on November 1, 1949 and 1950:

<u>Mine</u>	<u>Nov. 1, 1949</u>	<u>Nov. 1, 1950</u>
Athens	1,087	42,243
Cambria-Jackson	6,705	71,918
Cliffs-Shaft	29,241	89,528
Lake	-	58,678
Lloyd	62,528	119,031
Maas	61,206	125,804
Mather "A"	33,365	115,951
Mather "B"	-	298
Spies	<u>72,548</u>	<u>44,248</u>
Totals	266,680	667,699

SHAFT GAUGING

The runners of the Mather "B" Shaft were gauged on February 7, 1950 immediately after their installation. The remainder of the operating shafts at the other mines were gauged just after the beginning of 1951.

HUMBOLDT DISTRICT

The purchase of the lands held under option in this District was completed and surveys run to determine boundary lines between various properties. Most of the lands acquired this year were for tailings basin purposes in anticipation of future beneficiation plant operations in this District.

SOUTH MICHIGAMME DISTRICT

Surveys were run in this district and lines given for drill holes on the Ohio-Norwood, Steward and other properties. Permission was obtained from the Department of Conservation to blast several ditches and beaver dams in order to drain the surface area over the proposed open pits.

NORTH MICHIGAMME DISTRICT

Lines were run North of Highway US-41 for the geophysical work planned and carried out by the Geological Department. Drill holes were located and surveyed as required.

CASCADE DISTRICT

Lines were run in Section 29, 47-26 and iron pins set for use in future operations. The Geological Department ran some geophysical surveys in this District and lines were brushed out and prepared for this work. The lease from the Cascade Corporation covering this work was executed in June. Check levels were run on bench marks, starting in Negaunee and working south along the D. S. S. & A. Railway tracks. Permanent bench marks were established along this line for future reference. Some of these were installed by the Jones & Laughlin Ore Company and four were established by the C. C. I. Co. engineering staff.

TILDEN DISTRICT

Lines were brushed and iron pins established for the geophysical surveys and drilling in this area. Drill holes were staked out and located as the exploration progressed.

SECTION 9, 47-27

Over six miles of lines were surveyed and staked out in the N $\frac{1}{2}$ of Section 9 in anticipation of geophysical work by the Geological Department. These lines were run 200' apart and the stakes were set at 100' intervals.

MICHIGAMME RIVER DISTRICT

An exploration and mining lease on State lands in Section 2, 46-30 and Sections 20, 28, 34 and 35, 47-30 was obtained at public auction on February 24th. The lease, which covers 750.21 acres in this area was received and executed in April. Negotiations were also conducted with the Norman Iron Company for leasing their lands in Section 30, 47-30 to this Company. Surveys were run in this area to determine boundary lines of the various properties involved.

SECTION 12, 47-27

Elevations on the East-West lines in this area were run early in the year prior to the geophysical prospecting work.

IRON RIVER DISTRICT

The lease from Philip L. Boyington on the SE $\frac{1}{4}$ of Section 13, 43-35 was executed on May 1st, 1950. Drilling explorations were started in this area and holes were staked out and located for the Geological Department. Drill holes were also surveyed at the Hill-Top Exploration in Sections 26 and 27, 43-35.

LAKE MINE

The mining operations at the Lake Mine in the early part of the year required considerable attention from the engineering staff, both for lines and grades for roads, stocking area, cross-sectioning of the pit, and estimates of stripping and ore. Also, the construction of the ore loading pocket near the Holmes Mine was planned and supervised.

CLIFFS 8TH ADDITION

Mr. Roy Hosking entered the Department in June and took over the work with Mr. Harry Hall had been doing in planning the Cliffs 8th Addition in Section 34, 48-27 North of Ishpeming. Plans and estimates were made for this plat and maps and profiles prepared in anticipation of opening this plat and presenting it to the City of Ishpeming for approval. Two survey crews worked in this area later in the year, staking out the streets, alleys and lots in preparation for grading.

GROUND WATER LEVELS

Monthly readings of the ground water levels were taken during the year in the water holes at the Mather Mine "A" Shaft. The following table shows a comparison of the readings at the beginning and end of the year with the differences and the original elevations:

<u>Test Hole No.</u>	<u>January 1, 1950</u>	<u>Jan. 1, 1951</u>	<u>Difference 1950</u>	<u>Original Elevation</u>	<u>Total Difference</u>
22	1384.0	1384.2	+0.2	1387.8	-3.6
26	1404.2	1404.9	+0.7	1406.8	-1.9
32	1404.2	1403.8	-0.4	1409.4	-5.6
38	1386.2	1385.1	-1.1	1391.3	-6.2
40	1396.2	1393.0	-3.2	1394.8	-1.8
54	1385.7	1385.3	-0.4	1390.2	-4.9
55	1385.4	1384.5	-0.9	1390.5	-6.0
56	1391.4	1392.6	+1.2	1401.0	-8.4
57	1417.5	*	-	1420.1	-
60	1384.2	1387.4	+3.2	1393.3	-5.9
61	1399.4	1387.8	-11.6	1407.3	-19.5
62	1404.4	1394.8	-9.6	1384.3	+10.5

* Hole No. 57 covered over in 1951 by snow and was not located.

HOLIDAYS

The following holidays were granted during the year:

January 1st - New Year's Day
 May 30th - Memorial Day
 July 4th - Independence Day
 September 4th - Labor Day
 November 23rd - Thanksgiving Day
 December 25-26 - Christmas.

Respectfully submitted,

Carl Brewer *Grant T. Hollett*
 Carl Brewer, Recorder. Grant T. Hollett, District Engineer.

GTH:DWC
 6-9-51.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

ATHENS MINE:

Mechanical equipment in the engine house gave little trouble during the year. The M-G set force feed lubrication system was equipped with auxiliary electric motor driven pump which is pressure switch operated and set to cut in when pressure developed by direct driven pump drops to 12 psi. This arrangement has prevented bearing troubles as experienced last year. The reinforcing ribs of the cage hoist drum shell started to develop some cracks and these were repaired by welding. The west main bearing of the Nordberg compressor wiped during the year and had to be rebabbitted.

Surface subsidence about the plant area has been a subject of grave concern during the year. During September and continuing through to the year's end, ground subsidence under the miners' dry building was very pronounced and that brick building started to break up to the extent that water and steam lines had to be severed from rigid fastenings and allowed to move with the building. Machinery alignment in the engine house was checked from time to time as new cracks appeared in the floor, but no discernible misalignment has been noted.

In the shaft some anxiety was felt about possible rupture of the main 10" water discharge column in the upper portions as the collar of the shaft had moved 8" out of line. A new 8" line was purchased and installed in the drift connecting the Athens and Negaunee mines on the 11th level. Connections were made so that in case of rupture of the Athens water column above this point, the water could be conveyed to Negaunee 10th level where it could be relayed to surface. This installation is ready but had not been used at end of year as it is only for emergency service.

CAMBRIA-JACKSON MINE:

The major project at this property during the year was the sinking of an inclined winze from 8th to 9th level and the installation of a complete 30" belt conveyor system in same. The drive machinery and one third of the conveyor was installed prior to sinking the remaining distance so that the new conveying system could be used to elevate the excavated winze rock. A system of scraping the rock directly on the conveyor belt by means of three-drum tugger hoist was employed and the arrangement worked very well. At year's end the conveying equipment was completely installed, drive machinery and receiving bin completed and work begun on installation of load-end pan feeder and hopper into which main line cars unload.

In the engine house the only major breakdown was in April when a rotor coil blowout on the skip hoist motor caused a one and one-half day loss in production while spare was installed. In July the repaired motor was again installed. A new set of molded asbestos brake blocks were installed on the skip hoist in April.

Replacement of 230 ft. of main compressed air line in shaft was required. Inspection of main water column in shaft indicates replacement of several hundred feet in the near future.

Pumping system worked well during the year; however, the pumping load doubled during the spring breakup and the system was loaded to its capacity for a month's period.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

CLIFFS SHAFT MINE:

In the engine house the major repair job concerned "A" Shaft hoist. Years of operation had allowed the pinion shaft and main shaft bearings to wear to the point where poor engagement of the pinion and main gear was being experienced. This was corrected by rebabbiting the pinion shaft bearings and moving the hoist .092" toward the pinion shaft. The old system of using Lake Bancroft as a cooling pond for engine house cooling water was eliminated and replacement was made by the purchase and installation of a Binks Cooling Tower located on the west side of the engine house. The new system will allow for conditioning of the water to prevent algae growth and other contamination problems presented by using lake water.

A contract was awarded in September to MacDonald & Kaake, contractors, to remodel and enlarge the miners' dry. At the end of the year all outside work had been completed and work was progressing satisfactorily on interior changes. The completion of this project will provide a larger lamp room, new fuse room, additional miners dry facilities, modern toilet facilities and an enlarged and modernized foremen's and shiftbosses' change room.

The most important work completed during the year at this property concerned rehabilitation of "A" Shaft headframe by Intrusion-Prepakt, Inc. and the installation of steel sets and heavy steel lining plates from collar to new bearer sets, also in "A" Shaft. The original shaft had been lined from collar to ledge with 12 x 12 timber, skin to skin. At some later date as these original timbers started to give way, a lining set of the same size timbers was installed. The installation of the steel sets and liners inside of the double wall of fir timbers posed a real problem because of compartment space limitations. The job was successfully completed without shutting down the shaft by working afternoon shifts only, mortising the steel into the old timber on two sides and concreting the other two sides. The project was completed in July and results appear to be very satisfactory.

Considerable work has been done on the design of a new double drum top tram hoist and triple drum tugger hoist for this property. These design jobs have been carried on in conjunction with Lake Shore Engineering Company and 1951 should see new models of each of these units in service.

LAKE MINE DEFERRED:

Mechanical Department assistance to this open pit project consisted of arrangement of Euclid Truck garage and repair facilities in the old Lake Mine boiler house, acquirement and arrangement of pumping equipment and miscellaneous equipment repair service.

LLOYD MINE:

In the engine house the major mechanical repairs consisted of reconditioning of the Sullivan Angle Compound Compressor crankshaft which had worn out of round. All the main bearings of the compressor as well as its driving motor were rebabbitted at the same time and a new H.P. piston rod was installed as the piston was a loose fit on the old rod. Due to excessive rope fleet angle on the left hand side of the skip hoist, the rope had a tendency to climb the sides of the

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

LLOYD MINE: (Continued)

ridges between drum shell grooves and ultimately the ridges broke off from the cast iron shell and allowed the rope to jump a groove when winding at greatest fleet. To correct this condition the ridges were built up with low temperature welding rod and then ground to contour. This means of repair has been successful to date.

The headframe gyratory crusher underwent major overhaul this year. The complete shaft with mantle from the identical unit in the old Negaunee headframe was installed and this unit should be good for many years at this property.

An emergency arose during the spring breakup period this year due to the increased amount of run-off water getting into the mine. Normally the Morris Mine of Inland Steel Company handles our excess water but this year, during the period of maximum inflow, they advised that they were just able to handle their own water and so we had to get busy and install extra centrifugal pumps on the 9th and 7th levels to relay the water to the 5th level. At one time the 5th level Aldrich plunger pump was averaging 719 GPM. This is a very high load factor for an 800 GPM pump. The pumping system was reviewed with the idea of getting equipped so as to be self-contained and an order placed for a new 484 GPM piston pump for the 8th level. This new Wheatley unit was being installed at the year's end and plans also going forward to install centrifugal 500 GPM stand-by on the 5th level to supplement the 800 GPM Aldrich.

The underground winze hoist was equipped with a coupling brake which is operated by a geared limit switch so as to provide overwind protection.

MAAS MINE:

In the engine house some trouble was experienced with overheated main bearings on the new M-G set; however, replacement was made without loss in production. The counterweight rope was retired after 12 years of service. Replacement was recommended on the basis of age rather than condition. The skip hoist gave trouble by having its main gear loosen on the hoist shaft. This is an old trouble and as it had previously been welded, the repair this time was done in a similar manner. It is expected that no further trouble will be experienced because the D.C. drive is much smoother than the original A.C. drive which undoubtedly caused the trouble.

In July an accident occurred which resulted in breakage of the south skip rope, damage to both skips and wreckage of the south skip road near bottom of shaft. The south skip dropped from surface to the shaft bottom. See monthly report for details. The mine was idle from July 5th to 10th, due to accident.

Major pump breakdowns occurred to the Worthington pumps during the year. In one case it was a broken connecting rod and in the other a broken piston rod. Due to installation of new railroad yarding facilities the surface location of the main water discharge pipeline was changed.

A single drum hoist was installed on the 5th level to handle cages in balance from 7th to 6th levels. This arrangement was provided in lieu of deepening the main shaft and all ore from the new 7th level is to be hoisted to the 6th via this transfer hoist. The unit went into hoisting service in June.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

MATHER MINE "A" SHAFT:

The largest single surface project handled by company men at this property this year took place about August 1st when the mine was shut down for 12 consecutive days to install new flow sheet machinery in the headframe consisting of new 6' wide Kennedy Van Saun Rock Feeder, Simplicity Shakeout Screen and Allis-Chalmers 36 x 24 Jaw Crusher. At the same time the dump plates were changed to accommodate a new Lake Shore Engineering Company's bottom dump skip in the south skip road. Prior to the installation of the new equipment the original 16" Allis-Chalmers gyratory crusher was removed. At the end of the year all of this equipment was in successful operation and operating troubles had been ironed out without loss of production.

Installation of new railroad loading pockets on north side of headframe was completed in February.

The throats of the 12' cast steel skip head sheaves were ground for the first time since installation. This was necessary because wear had occurred to the extent that a new 1-7/8" dia. skip rope would no longer bottom in the sheave throat.

The Wisconsin Bridge and Iron Company completed the erection of No. 3 ore stock trestle and same is in service. At the end of the year two of the three new style Larry Cars had been received but had not been placed in service.

The largest underground project this year concerned the design and procurement of equipment for the 2500 ft. long belt conveying system on the 7th level. Excavation of discharge raises and conveyor drifts got under way and some of the equipment started to arrive before the end of the year.

A semi-permanent centrifugal pump station was erected on the 7th level to relay water to the main pump station on the 6th level. The connecting drift between "A" and "B" shafts on 6th level was completed and the 6th level pump station at "A" started to take some of the "B" mine water.

The installation of a 6" victaulic coupled pipeline from surface to 7th level was begun. This line is to be used to "shoot" concrete from surface in conjunction with Press-Weld pneumatic concrete placing machine.

Trial installations of arched steel sets in heavy ground show economies over standard steel supports and orders have been processed for a considerable tonnage of 5x5-16# and 6x6-15.5# arched steel sets.

Considerable experimental work has been done with rotary blast hole drilling equipment and it is indicated that there are many types of ground that can be drilled more economically with rotary drills utilizing tungsten carbide tipped auger steel than with the conventional type of percussion tool.

MATHER MINE "B" SHAFT:

The year 1950 brought the culmination of many long range projects at this new property. On January 25th the Nordberg cage hoist was turned over for the first time and on February 8th the 20,500# counterweight was installed and balanced cage hoisting was employed. The main M-G set with 87 ton flywheel was

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

MATHER MINE "B" SHAFT: (Continued)

operated for the first time on February 28th. Many adjustments had to be made to the Westinghouse rototrol equipment and it was not until March 20th that the Nordberg skip hoist erection was complete, skips and skip ropes installed and balanced hoisting begun. A 222.6 cu. ft. Kimberley type skip was installed in the west skip compartment and a 211 cu. ft. experimental bottom dump skip was placed in the east skip road. Both skips were equipped with rubber tired guide rollers. The temporary engine house was abandoned in February shortly after No. 1 compressor and the cage hoist were placed in service. No. 2 compressor was also erected.

In the crusher house the erection of the rock feeders, shakeout screen and jaw crusher was completed after temporary heating facilities had been installed. The contractor completed the crusher house building and that was followed by completion of the Galbestos enclosure about the headframe.

A. H. Proksch & Son had sufficiently completed the miners' dry by June 16th so that the move could be made from the overcrowded temporary dry. The new boiler installation was the first to be completed and No. 1 was on the line in early February. The move into permanent new offices and shops was made in December and shortly afterwards the temporary quarters were torn down. At the end of the year many equipment installations in the new shops were temporary but permanent erection was proceeding satisfactorily.

In November the Bethlehem Steel Company started the erection of the main north run of the belt stocking conveyor trestle. Walker Jamar Company completed the installation of the shaft air heating system which is housed on surface just north of the shaft collar.

Underground, the installation of fir guides in skip and cage roads proceeded as scheduled so as to be ready in advance of skip and cage placement. A pumping station was cut on the 4th level and two 125 GPM 8-stage Ingersoll-Rand centrifugal pumps were installed to handle the clear water on automatic start and stop from flooded suction.

The permanent high pressure water column was installed from 10th level to surface prior to removal of sinking hoist facilities. This 10" column was completely installed by the end of September.

NEGAUNEE SHAFT:

Dismantling of the double drum, double clutched second-hand Allis-Chalmers hoist was begun at Jackson, California, on February 9th. The last carload of equipment left the west on March 6th and most of the revolving parts were shipped direct to Lake Shore Engineering Company's plant at Marquette, Michigan, for reconditioning. Close inspection after disassembly showed this hoist to be badly abused and rehabilitation took approximately six months. The decision to convert this A.C. motor driven hoist to D.C. drive was made in early March and the necessary electrical equipment ordered. Also, as it was decided to raise the hoisting speed from 1500 to 2000 fpm a new gear set was ordered.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

NEGAUNEE SHAFT: (Continued)

In September work was started on the dismantling of No. 2 M-G set to clear the wing of the engine house so foundations for Allis-Chalmers hoist could be placed. The old east wing of the engine house was torn down and hoist erection began December 21st. It was necessary to erect a temporary frame enclosure over the hoist so that erection could proceed without major delays caused by heavy snows and cold weather.

Prior to the end of the year the design of the lower portion of the new headframe had been completed, column footings poured and plans made to tear down the old headframe.

Design of repair steel sets for circular portion of shaft as well as new steel sets for shaft extension of 2000 ft. were completed and at the end of the year the bulk of the circular portion of the shaft had been repaired.

Shaft sinking equipment has been ordered and plans made to get under way just as soon as possible.

SPIES MINE:

The greatest single problem at this property this past year has been the handling of acid mine water. At the beginning of the year the acidity of the water on 4th level started to increase and it was combatted by increasing the amount of lime being fed to neutralize same. It was soon realized that lime treatment was not only too expensive but was also inadequate and so orders were placed for acid resistant pumping equipment. First, a 4" Carlon plastic drain line was installed between the 4th and 6th levels in February. In July the first all stainless steel two-stage centrifugal pump was received. This was placed in service on the 4th level and the entire piping system was made acid-proof by utilizing stainless steel valves and rubber lined pipe. This unit worked very nicely, pumping to surface and then we started to get highly acid water in quantity on the 6th level. By the time an acid-proof pumping system could be obtained, severe damage had been sustained by the regular mine pumping system. At times it was touch and go to keep the mine from being flooded. At the year's end the acid water was being handled from 4th and 6th levels to surface through completely acid-proof pumping system utilizing centrifugal pumps. The main line plunger pumps on 4th and 8th levels have been completely overhauled and are being used to handle water that has not been sufficiently contaminated by the acid water so as to corrode away their non-acid resistant parts.

On surface a settling sump was excavated so as to settle out most of the iron ore mud from the mine water. Water entering the sump carries about 30# per 1000 gallons and leaving the sump averages about 2# per 1000 gallons.

A 22' x 20' frame addition to office and warehouse was completed by mine labor to provide additional space for master mechanic, surface foreman and mine captain.

TILDEN MINE:

Only the usual maintenance problems were incurred at this property during the year. All equipment operated successfully during the summer loading season. A new dipper was fabricated and installed on #46 shovel.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

HARD ORE SHOP AREA:

The 30 x 99' addition to the east side of the Blacksmith Shop was completed during late spring and equipment installed to form a steel set production line. This steel set fabricating department has done a very nice job and in spite of rising labor costs, the cost per completed set has not risen over last year's prices.

A 40 x 60' addition to the north end of the Electric and Hoist Repair Shop was started in late September. Foundation troubles developed when excavation ran into black muck and the footings had to be carried down 8' deeper than anticipated. This set the job back and at the end of the year we were still a month away from being ready to erect the structural steel. Foundation contract was awarded to Kielinen & Son of Ishpeming. In the basement of this new addition we will install a new 150 HP boiler which will handle the heating load of all of the shops as well as the oil storage building.

Effective October 1st, A. E. Lillstrom was appointed General Shop Foreman and effective November 1st, Wm. J. Tamblyn, Jr. assumed leadership of the Hard Ore Plumbing Crew on part time basis as Master Plumber.

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

460

COMPARATIVE TABLES

<u>CLIFFS SHAFT MINE:</u> YEAR	TONS ORE AND ROCK HOISTED	CU. FT. AIR USED	CUBIC FT. AIR PER TON HOISTED	GALLONS OF WATER PUMPED	G.P.M.
1941	677,249	1,218,780,000	1,799	343,850,964	655
1942	733 970	1 223 325 000	1 666	339 185 356	643
1943	669 300	1 368 045 000	2 044	376 325 326	718
1944	614 214	1 459 890 000	2 376	448 361 410	851
1945	567 691	1 194 570 000	2 104	444 687 684	848
1946	415 426	968 670 000	2 331	397 294 033	751
1947	562 650	1 527 345 000	2 715	424 721 789	809
1948	603 745	1 607 625 000	2 663	382 905 017	726
1949	504 513	1 124 105 000	2 228	433 229 875	821
1950	679 751	1 619 055 000	2 381	407 263 395	776

ATHENS MINE:

1941	638,178	1,305,945,000	2,116	185,835,174	354
1942	699 590	1 351 440 000	1 931	204 533 558	387
1943	532 590	1 013 220 000	1 902	195 041 792	372
1944	443 576	900 765 000	2 030	162 835 951	308
1945	429 136	873 710 000	2 035	174 073 654	331
1946	376 417	745 605 000	1 990	168 139 933	317
1947	533 366	1 191 510 000	2 234	178 537 561	340
1948	527 876	1 183 970 000	2 243	169 128 786	320
1949	550 977	992 700 000	1 801	176 437 598	334
1950	611 162	1 161 045 000	1 899	199 518 654	380

MAAS MINE:

1941	849,963	1,646,145,000	1,936	595,239,587	1,135
1942	894 963	1 703 655 000	1 905	553 194 582	1 049
1943	782 074	1 916 100 000	2 450	575 868 620	1 098
1944	614 836	1 542 835 000	2 509	578 257 239	1 097
1945	572 652	1 205 145 000	2 104	555 380 166	1 058
1946	487 523	965 880 000	1 981	607 511 502	1 148
1947	721 051	1 506 960 000	2 090	571 767 866	1 090
1948	683 074	1 389 825 000	2 035	569 972 839	1 081
1949	621 946	1 233 540 000	1 983	550 080 422	1 043
1950	659 467	1 374 300 000	2 083	602 179 256	1 148

NEGAUNEE MINE:

1941	1,077,854	1,500,165,000	1,391	338,385,511	644
1942	1 128 737	1 432 260 000	1 268	345 945 101	656
1943	978 130	1 137 375 000	1 162	401 169 615	765
1944	760 871	1 165 140 000	1 531	375 706 897	713
1945	671 220	873 270 000	1 301	357 175 559	681
1946	418 232	542 025 000	1 295	360 778 626	682
1947	531 492	717 300 000	1 350	390 741 304	744
1948	386 215	743 625 000	1 925	402 657 133	757
1949	79 699	233 415 000	2 928	464 467 219	880
1950	0	82 755 000	-	635 580 650	1 212

MECHANICAL DEPARTMENT
ANNUAL REPORT
YEAR 1950

COMPARATIVE TABLES

<u>CAMBRIA-JACKSON MINE:</u> <u>YEAR</u>	<u>TONS ORE AND ROCK HOISTED</u>	<u>CU. FT. AIR USED</u>	<u>CUBIC FT. AIR PER TON HOISTED</u>	<u>GALLONS OF WATER PUMPED</u>	<u>G.P.M.</u>
*1943	155,513	216,657,000	1,393	123,714,000	431
1944	286 761	410 875 000	1 432	196 252 831	372
1945	319 222	386 626 500	1 211	190 159 826	362
1946	303 881	374 013 000	1 230	159 192 131	300
1947	548 027	628 515 000	1 147	190 950 934	363
1948	496 083	548 896 500	1 106	171 964 375	325
1949	438 064	508 050 000	1 159	173 342 402	328
1950	452 035	545 206 500	1 206	197 474 896	376

(*Mine operated by The Cleveland-Cliffs Iron Co. since June 1, 1943 and the above figures are for the last 7 months of the year only.)

LLOYD MINE:

1941	572,778	534,456,000	933	40,031,200	91 (10 Mos.)
1942	588 749	588 451 000	999	39 486 100	74
1943	531 260	525 280 500	988	65 024 800	124
1944	391 057	436 293 000	1 115	51 625 550	97
1945	334 117	419 088 500	1 254	59 943 400	114
1946	243 836	264 838 500	1 086	51 014 600	84
1947	262 395	254 470 500	970	69 182 000	131
1948	128 672	285 111 000	2 216	48 334 500	91
1949	209 161	231 241 500	1 105	50 828 500	96
1950	234 748	354 888 000	1 511	100 272 000	191

MATHER MINE "A" SHAFT:

1943	29,517	(First hoisting in September)			
1944	127 438	425,700,000	3,340	74,006,311	140
1945	258 028	378 600 000	1 467	134 384 517	256
1946	417 677	542 250 000	1 298	97 460 579	184
1947	817 145	1 144 800 000	1 401	133 005 294	253
1948	1 100 225	1 901 700 000	1 728	103 059 168	195
1949	1 154 538	1 207 350 000	1 045	91 876 158	174
1950	1 405 738	1 612 800 000	1 147	215 904 871	411

MATHER MINE "B" SHAFT:

1950	99,832	(First hoisting in August)			
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TILDEN MINE:

1941	302,943
1942	235 207
1943	139 991
1944	214 824
1945	197 476
1946	101 968
1947	168 669
1948	140 692
1949	88 503
1950	107 465

THE CLIFFS POWER & LIGHT CO.
ANNUAL REPORT
YEAR 1950

The total energy generated and purchased during 1950 amounted to 134,812,200 Kwh which was 16.6% more than was generated during 1949. Correspondingly, the sales of energy amounted to 121,523,211 Kwh which was 15.2% more than the sales for 1949. This increase was due partially to the fact that there was a strike period during October and November of 1949, but even without the consideration of this strike period, the increase would have been heavy. Thus, the month of December, 1950, compared with the month of December, 1949, with no strike in effect at either time, showed an increase of 26.1% in the amount of energy generated and purchased. Of this total of 134,812,200 Kwh, 134,624,200 Kwh were generated by our own plants and 188,000 Kwh were purchased. Hydro production amounted to 103,740,400 Kwh, steam production amounted to 28,685,000 Kwh and Diesel production amounted to 2,198,800 Kwh.

The year 1950 proved to be a good year for hydro production as is proven by the output of over 103,000,000 Kwh which is the greatest hydro production that the company has ever had and which is approximately 23,000,000 Kwh above what we consider a normal water year. Rains in the fall of 1949 materially aided the stored water conditions at the end of the year and at the beginning of 1950, we had the equivalent of 27,271,000 Kwh of water in our reservoirs. Snowfall was good and the spring run-off brought our reservoirs to 96.1% of capacity at the end of June. Precipitation changed from above normal to below normal beginning in July and this below normal precipitation continued for the remainder of the year. At the end of December, 1950, our basins contained the equivalent of only 17,766,000 Kwh which amounted to 38.6% of the storage, which was considerably less than we had available at the beginning of the year. This means, of course, that during the year we used more water than actually came to the plants in the form of run-off, but since we have adequate fuel burning capacity to back up our hydro system, the condition is not considered hazardous.

As was stated above, a total of 134,812,200 Kwh were delivered to the transmission system during the year 1950. Of this total, 134,624,200 Kwh were generated in our own plants. Our only source of purchase power at the present time is from the Munising Paper Company at Munising, which source cannot be relied upon for more than 1,000 KW. The delivery of this amount of energy to our transmission system has required that we operate our Steam Plant at full capacity for 24 hours a day during the period that the mines have been on six-day operation. This six-day operation began during the month of August and continued until after the beginning of the year. The indications are that this schedule will continue during 1951. Previous studies of our generating facilities by the Stone & Webster Engineering Corporation indicated that at the time that we reached a production of 134,000,000 Kwh and peak of approximately 25,000 KW, it would be necessary for us to begin the construction of the second addition to our Steam Plant. Both of these conditions were exceeded during 1950 and while we feel that with the present generating facilities, including the ten units at the Diesel Plant, no difficulties will be experienced in meeting our power demands in the immediate future, it will be necessary in 1951 to make a careful study of the situation with the intention of beginning plans and ordering materials for the second unit if the study indicates that the present load growth will continue and if this unit will be necessary for our system any time within the next three years.

RT

Revenue from sale of power amounted to \$1,901,082 during 1950 which was an increase of 18.4% over the previous year. Action was started during 1949 for a rate increase and temporary rate was placed into effect in July of that year. Accordingly, the rates were effective for six months billing during 1949 and were continued throughout 1950. The increased sales and the increase in the rate level for six of the twelve months were both responsible for the increase in revenues obtained from the sale of energy. The rate increase had been brought before the Michigan Public Service Commission early in 1949 and negotiations concerning it continued into 1950. The original increase was granted on a temporary basis for a six month period to extend until January 1, 1950. This period was extended by another six months to be effective until July 1, 1950. After numerous conferences with the Public Service Commission, a rate base was established for the company and the rate increases which had been asked for were made permanent by an order of the Public Service Commission on June 20, 1950.

At the beginning of the year, the construction of the new Steam Plant in Ishpeming was nearing completion. It was finally placed on trial operation in the latter part of February and this trial operation continued well into March. Beginning approximately the first of April, the plant was placed in continuous operation with limited production, the plant being used for regulating the system load in order that maximum amount of power could be obtained from the hydro facilities. However, it was realized in the latter part of August that water conditions were such as to require full production from the Steam Plant and it was accordingly placed on 24-hour operation at a practically full load. This operating schedule has been continued since that time with the plant producing its rated capacity continuously. Performance of this plant has been very satisfactory and both economy and reliability of operation have been good. There were several difficulties which were experienced during the early operations which have been overcome from time to time and there are still a few items in regard to the construction of the boiler particularly which should be changed. The design engineer of the Riley Stoker Corporation was in Ishpeming to go over the installation in August and the necessary materials to effect the changes which he recommended were ordered soon after his visit. Delay in receiving these materials has postponed the shutdown but it is anticipated that in the early part of 1951, a complete shutdown of the plant will be arranged and all of the recommended changes will be made as well as a complete inspection of the entire plant. At the time that the plant was placed in operation, there was left a considerable amount of yard work and painting which had to be done. As long as the summer months permitted work on the yard, work was carried forward and it is now complete with the exception of the landscaping. The painting contract was let in the latter part of the year and had been completed by the end of the year. There remained on this plant at the end of December the addition of the floor covering and the landscaping which would be done in 1951 before the plant could be considered completely constructed.

Intrusion-Prepakt, Inc. had started work repairing the downstream face and wing walls of the Carp Dam in the latter part of 1949. They continued chipping operations on this dam until the latter part of February, at which time they had completed the work and the forces were withdrawn until warm weather would permit placing of the concrete necessary for the repairs. Work was resumed in the last half of June and the repair of the dam was finished during the month of September. The forces were then split up, part of the men going to the AuTrain Dam to make repairs on the upstream face of that structure, and others were placed on the Carp pipeline to repair a bad

leak in the concrete pipe covering the old wooden pipe. Work on these two jobs was completed during October and the crews were moved to the McClure Dam where work was immediately started chipping and preparing the downstream face of this structure for the resurfacing and repair of it. This work on the McClure Dam was still in progress at the end of the year.

At the beginning of 1950, we were in the process of repairing both units at the AuTrain Plant in order that the plant could be placed on a fully automatic basis. It was found after opening these units up that the condition of the runners, wicket gates and other parts was such that a thorough and satisfactory repair could not be made using the parts which were then available. Subsequently we placed orders for new parts which we intended to install in the latter part of 1950. However, we have experienced a series of postponements of deliveries of these materials and they had not arrived at the first of the year. Predictions at the present time are that they will not be delivered until spring of 1951. Efforts are being made to speed this program up, but in view of the war conditions and general delays in receipts of material, it is doubtful whether or not this work can be conducted until some time in the summer of 1951.

With the completion of the Steam Plant and the availability of the Diesel Plant for future power generation, it was decided to cancel the contract with the Wisconsin Michigan Power Company at the first of the year rather than delaying this cancellation until the expiration period of the contract. The Wisconsin Michigan Power Company had previously exercised its option not to renew this contract at its expiration date and since the power would not be necessary between January 1 and the expiration date, the company cancelled the contract in order to avoid the payment of the minimum bill for the unexpired period thereof. After the cancellation of the contract, the Wisconsin Michigan Power Company expressed its intention of removing the line from Gwinn to Phelps which constitutes the tie between the two systems. At our request, this line was left in service, but notification was given us at the end of 1950 that the company needed the materials in that line and would dismantle it soon after the first of the year. Negotiations were entered into again at that time to provide for the line remaining available for emergency use, but no decision had been reached as a result of these negotiations.

Throughout the year of 1950 the company utilized the services of Arthur C. Carlson who provided a crew on the contract basis for the purpose of clearing right of way under our various transmission lines. This crew worked continuously throughout the year doing this right of way clearing work and we feel that the services which it rendered were materially advantageous to us in maintaining continuity of service and lessening the time of interruption and damage to the transmission system. This work was conducted by Mr. Carlson on a straight time basis and was accomplished at a material savings to the company when compared with the cost of the same work conducted by our own crews.

In February, the United Steelworkers of America CIO began negotiations with our company in regard to obtaining for its members in our company an insurance and pension program similar to that which was at that time being negotiated with The Cleveland-Cliffs Iron Company. These negotiations were terminated on March 24 by the signing of a supplemental contract which granted to the employees of our company the same insurance and pension program which had been previously agreed upon between the Union and The Cleveland-Cliffs Iron Company and affiliated properties. This new program was made effective on March 1, 1950.

On October 9, the Union presented to the company a program which had been previously presented to The Cleveland-Cliffs Iron Company and which requested wage increases and various other benefits that the Union hoped to obtain for the employees in the bargaining unit. No negotiations on this matter were made directly with the Union but an agreement was reached between The Cleveland-Cliffs Iron Company and the Union, providing for a $12\frac{1}{2}\%$ per hour increase to all employees in the bargaining unit, the increase to be effective on December 1, 1950, and it was agreed that the company would make a study of job classifications with the idea of determining whether or not any changes in rates of pay should be granted as a result of that study.

On June 22, the thrust bearing of the #2 unit at the Hoist Plant failed, resulting in shutdown of this unit and necessitating complete dismantlement of it and a general overhaul. The bearing failure was caused by the machine being out of line and a machinist from the Allis-Chalmers Manufacturing Company was called in to re-align the unit and replace the bearing. This proved to be a very difficult job and the unit was out of service from the latter part of June until the first part of August. In the meantime, lightning came into the Carp Power Plant and burned out the #2 generator in that plant. This machine was dismantled and completely rewound. The repairs were completed on September 6.

In March, 1949, Pickands Mather & Company suggested that we consider the purchase of an undeveloped hydro site on the Menominee River in Norway Township known as the Sand Portage Power Site. This offer has been renewed from time to time by Pickands Mather & Company and as a result, we retained Mr. G. E. Ackerman of Holland, Ackerman and Holland to make an investigation of the economics of this development. This study was started in January, 1950, and since it was not practical to investigate the site during the winter, the report on it was not received from Mr. Ackerman until the latter part of May. Subsequent to that time, meetings had been held with Pickands Mather & Company in regard to the value of this site but there is such a wide divergence of opinion as to the value of the property that no conclusions have been reached regarding its purchase. The matter was still open at the end of the year and it is presumed that other discussions will take place some time in the future.

In the latter part of July, Mr. Beaglehole, Assistant Comptroller of the company, came to Ishpeming and began working with accountants in Ishpeming on the revision of the property values of the company and arranging them so that the values shown on the company's books would reflect the values which were established by the Michigan Public Service Commission as a result of the rate hearing which had been recently concluded. This work was carried to completion before the end of the year and the company's property account books were reconciled to the changes which were made in the rate base by the Public Service Commission. There had been a discussion of the possibility of revising our plant depreciation procedure at this time, but at the beginning of the year, no work had been done on this phase of the problem.

During the month of September, A. Lindberg & Sons were given the contract to raise the level of the east sand levee of the AuTrain Plant by approximately five feet. This involved hauling the necessary fill to increase the height of the levee and at the same time, stone was hauled in and riprap installed on both earth levees. We feel that this materially increases the strength of this levee and decreases the possibility of a dam failure due to washout and water over-running the levee.

In the fall, approval of an E. & A. to extend the outdoor substation at the Steam Plant to provide for additional circuit breakers and circuits into that station was approved and the necessary circuit breakers and steel structure ordered. Excavation of rock was started and the rock removal was completed during December. Work on this project will be held up until the coming of spring for the building of foundations and the delivery of the materials necessary to complete the work.

Plans for the new office building for The Cliffs Power and Light Company have been drawn and the architect was drawing up specifications preparatory to sending out for bids for the construction at the end of the year. It is hoped that satisfactory bids will be received and that work can be started in the spring as soon as the weather permits the commencement of construction activity.

THE CLIFFS POWER & LIGHT CO.

STATISTICAL DATA - 1950

	<u>McCLURE</u>	<u>CARP</u>	<u>HOIST</u>	<u>AuTRAIN</u>	<u>REPUBLIC</u>	<u>ESCANABA</u>	<u>TOTAL HYDRO</u>	<u>DIESEL</u>	<u>STEAM</u>	<u>TOTAL GENERATED</u>
Jan.	4,569,000	1,778,000	1,671,000	361,000	173,700	307,000	8,859,700	632,000		9,491,700
Feb.	4 965 000	1 582 000	1 765 000	499 100	124 400	257 000	9 192 500	608 300	175,000	9 975 800
Mar.	4 515 000	1 774 000	1 481 000	596 000	97 500	241 000	8 704 500	412 900	1 017 000	10 134 400
Apr.	3 820 000	1 607 000	1 159 000	712 500	169 500	524 000	7 992 000	135 700	2 256 000	10 383 700
May	4 251 000	2 450 000	1 084 000	764 300	261 000	1 000 000	9 810 300	195 100	1 737 000	11 742 400
June	4 838 000	1 398 000	1 481 000	594 600	286 200	855 000	9 452 800	13 300	1 898 000	11 364 100
July	4 602 000	1 682 000	1 693 000	676 300	211 700	409 000	9 274 000	7 000	1 874 000	11 155 000
Aug.	4 425 000	1 606 000	1 581 000	546 600	185 500	428 000	8 772 100	27 300	2 098 000	10 897 400
Sept.	4 849 000	1 463 000	1 659 000	278 900	88 000	233 000	8 570 900	15 800	3 467 000	12 053 700
Oct.	4 236 000	1 814 000	1 438 000	198 600	62 200	201 000	7 949 800	1 400	4 539 000	12 490 200
Nov.	4 068 000	1 759 000	1 381 000	92 100	56 100	302 000	7 658 200	102 400	4 797 000	12 557 600
Dec.	<u>4 032 000</u>	<u>1 456 000</u>	<u>1 391 000</u>	<u>100 400</u>	<u>174 200</u>	<u>350 000</u>	<u>7 503 600</u>	<u>47 600</u>	<u>4 827 000</u>	<u>12 378 200</u>
	53,170,000	20,369,000	17,784,000	5,420,400	1,890,000	5,107,000	103,740,400	2,198,800	28,685,000	134,624,200

THE CLIFFS POWER & LIGHT CO.

STATISTICAL DATA - 1950

	<u>TOTAL GENERATED</u>	<u>PURCHASED</u>	<u>TOTAL GEN. AND PURCH.</u>	<u>STATION USE</u>	<u>DELIVERED TO LINES</u>	<u>KWH SOLD</u>	<u>TRANSMISSION LOSSES</u>	
							<u>KWH</u>	<u>%</u>
Jan.	9,491,700	0	9,491,700	30,010	9,461,690	8,733,351	728,339	7.69
Feb.	9 975 800	0	9 975 800	55 460	9 920 340	8 942 111	978 229	9.86
Mar.	10 134 400	0	10 134 400	144 530	9 989 870	9 168 400	821 470	8.21
Apr.	10 383 700	2,000	10 385 700	250 460	10 135 240	9 511 784	623 456	6.15
May	11 742 400	0	11 742 400	223 280	11 519 120	10 637 584	881 536	7.65
June	11 364 100	0	11 364 100	231 755	11 132 345	10 356 101	776 244	6.97
July	11 155 000	0	11 155 000	220 052	10 934 948	9 859 907	1 075 041	9.83
Aug.	10 897 400	0	10 897 400	262 489	10 634 911	9 968 162	666 749	6.26
Sept.	12 053 700	0	12 053 700	311 414	11 742 286	10 868 309	873 977	7.44
Oct.	12 490 200	54 000	12 544 200	350 380	12 193 820	11 246 922	946 898	7.76
Nov.	12 557 600	132 000	12 689 600	353 550	12 336 050	11 328 357	1 007 693	8.16
Dec.	<u>12 378 200</u>	<u>0</u>	<u>12 378 200</u>	<u>356 095</u>	<u>12 022 105</u>	<u>10 902 223</u>	<u>1 119 882</u>	<u>9.31</u>
	134,624,200	188,000	134,812,200	2,789,475	132,022,725	121,523,211	10,499,514	7.94