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11. ACCIDENTS AND PERSONAL INJURY

b. Non-Fatal Accidents (Continued)

TABLE VIII-A

COMPARISON OF

COMPENSABLE ACCIDENTS, INCLUDING FATALITIES

BY MINES

Mine or Plant	Frequency 1945	Frequency 1946	Severity 1945	Severity 1946
Athens	19.04	18.248	0.596	1.186
Cliffs Shaft	16.27	21.386	1.526	1.452
Canisteo	7.11	7.069	0.387	0.244
C. P. & L. Co.	0.00	0.000	0.000	0.000
Sthse. & Shops	4.90	7.143	0.588	0.621
Hill Trumbull	7.58	10.395	0.071	4.029
Holman Cliffs	0.00	19.273	0.000	4.097
Lloyd	20.07	29.788	1.154	1.352
Maas	24.51	17.618	8.220	1.373
Miscellaneous	0.00	0.000	0.000	0.000
Negaunee	24.58	22.179	3.557	0.847
Princeton	19.61	10.919	0.891	1.637
Spies-Virgil	5.59	11.331	0.329	0.346
Tilden	29.20	0.000	0.394	0.000
Mather	10.39	26.856	0.670	1.228
Cambria-Jackson	20.99	25.503	1.455	1.677
General	0.00	0.000	0.000	0.000
All Properties	14.74	16.899	1.860	1.337

TABLE VIII-B

Mine or Plant	Tons of Ore Mined	Hours of Labor	COMPENSABLE ACCIDENTS: No. of Comp. Accidents	Number of Days Lost Comp. Accid.	Frequency Rate	Severity Rate
Athens	367361	602847	11	715	18.248	1.186
Cliffs Shaft	401939	748152½	16	1087	21.386	1.452
Lloyd	251682	335729½	10	454	29.788	1.352
Maas	476348	681128	12	935	17.618	1.373
Negaunee	418797	495953	11	420	22.179	0.847
Princeton	28438	91584¾	1	150	10.919	1.637
Spies-Virgil	59155	176486¾	2	61	11.331	0.346
Cambria-Jackson	299191	367341¾	9	616	25.503	1.677
Mather	339433	521338½	14	640	26.856	1.228
Tilden	101968	44750½	0	0	0.000	0.000
Canisteo	547398	282876	2	69	7.069	0.244
Hill Trumbull	590040	288590	3	1163	10.395	4.029
Holman Cliffs	534503	363215	7	1488	19.273	4.097
Atkins		44019	1	22	22.727	0.500
C. P. & L. Co.		115529½	0	0	0.000	0.000
Miscellaneous		97562½	0	0	0.000	0.000
Sthse. & Shops		280081¼	2	174	7.143	0.621
General Roll		439610 (est.)	0	0	0.000	0.000
TOTALS	4416253	5976795½	101	7994	16.899	1.337

TABLE VIII-BB

ACCIDENT STATISTICS FOR 1946

Mine or Plant	Tons of Ore Mined	Hours of Labor	Number of Compensable Accidents	No. of Non-Compensable 1 - 7 Days	Comp. Days Lost	Total Lost Time Accidents	Non-Compensable Days Lost	No. of Slight Accid. No Lost Time	Total Days Lost	Frequency	Severity
Princeton	28438	91584 3/4	1	6	150	7	13	10	163	76.545	1.779
C. Jackson	299191	367341 3/4	9	11	616	20	27	18	643	54.451	1.751
Cliffs Shaft	401939	748152 1/2	16	18	1087	34	44	43	1131	44.445	1.512
Maas	476348	681128	12	27	935	39	61	71	996	57.260	1.462
Lloyd	251682	335729 1/2	10	9	454	19	26	47	480	56.598	1.429
Mather	339433	521338 1/2	14	13	640	27	27	69	667	51.793	1.279
Athens	367361	602847	11	11	715	22	24	53	739	36.496	1.226
Negaunee	418797	495953	11	15	420	26	42	39	462	52.425	0.931
Spies-Virgil	59155	176486 3/4	2	3	61	5	7	23	68	28.328	0.385
Holman Cliffs	534503	363215	7	7	1488	14	16	35	1504	38.546	4.141
Hill Trumbull	590040	288590	3	4	1163	7	12	31	1175	24.255	4.072
Atkins	------	44019	1	0	22	1	0	13	22	22.727	0.500
Canisteo	547398	282876	2	0	69	2	0	30	69	7.069	0.244
Tilden	101968	44750 1/2	0	1	0	1	2	1	2	22.346	0.045
Gen. Sthse. & Shops		280081 1/4	2	0	174	2	0	17	174	7.140	0.621
Miscellaneous		97562 1/2	0	0	0	0	0	11	0	0.000	0.000
C. P. & L. Co.		115529 1/2	0	0	0	0	0	3	0	0.000	0.000
General Roll		439610 (Est.)	0	0	0	0	0	1	0	0.000	0.000
TOTALS	4416253	5976795 1/2	101	125	7994	226	301	515	8295	37.812	1.388

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11. ACCIDENTS AND PERSONAL INJURY

b. Non-Fatal Accidents (Continued)

TABLE VIII-C

Comparison of

FREQUENCY - SEVERITY RATINGS

Taken from Available Statistics, N.S.C.

	Frequency	Severity
1945 National Rating, all Mining	49.47	9.01
1945 " " , Underground Metal Mining	26.20	6.27
1945 " " , Open Cut Metal Mining	17.11	3.35
1945 Lake Superior District, all Mines	21.49	5.04
1946 Cleveland Cliffs Iron Co. Compensable Accidents	16.90	1.34
1946 " " " " All Accidents	37.81	1.388
1946 " " " " Open Cut Mining	24.43	2.708
1946 " " " " Top Slicing	50.10	1.265
1946 " " " " Stoping	45.27	1.340
1946 " " " " Sub-Level Caving	52.89	1.470
1946 " " " " General Shops	7.140	0.621
1946 " " " " General Roll	0.00	0.000
1946 " " " " Miscellaneous	0.00	0.000
1946 Cliffs Power & Light Company	0.00	0.000

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11. ACCIDENTS AND PERSONAL INJURY

b. Non-Fatal Accidents (Continued)

TABLE IX

SHOWING GROUP AGES OF INJURED WORKERS
(Compensable Accidents)

Age	Number Injured
16 to 25 years of age.....	9
26 to 30 years of age.....	11
31 to 35 years of age.....	13
36 to 40 years of age.....	17
41 to 45 years of age.....	9
46 to 50 years of age.....	7
51 to 55 years of age.....	15
56 to 60 years of age.....	10
61 to 65 years of age.....	10
Total.....	101

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11. ACCIDENTS AND PERSONAL INJURY

b. Non-Fatal Accidents (Continued)

TABLE X

SHOWING TIME PERIODS WHEN COMPENSABLE ACCIDENTS OCCURRED

Time	Number	Working Period
8:00 A.M. to 12:00 Noon	36	First half of day shift
12:00 Noon to 4:00 P.M.	23	Second half of day shift
4:00 P.M. to 8:00 P.M.	16	First half of afternoon shift
8:00 P.M. to 12:00 M.N.	12	Second half of afternoon shift
12:00 M.N. to 4:00 A.M.	4	First half of night shift
4:00 A.M. to 8:00 A.M.	5	Second half of night shift
No time stated	5	
	101	

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11. ACCIDENTS AND PERSONAL INJURY

b. Non-Fatal Accidents (Continued)

TABLE XI

SHOWING OCCUPATION OF INJURED WORKERS
(Compensable Accidents)

Underground		Surface	
Miners	41	Laborers	7
Trammers	9	Pipemen	1
Timbermen	3	Carpenters	3
Motormen	3	Truck Drivers	3
Scraper Operators	5	Policemen	1
Motor Brakemen	4	Oilers	3
Laborers	3	Operators	2
Electricians	1	Brakeman(Locomotive)	1
Chutemen	2	Welders	1
Pumpmen	1	Repairman(Mechanic)	2
Cage Riders	1	Timberman	1
Repairman	1		25
Shift Boss	2		
	76		

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Mr. Harry F. Rogers, Safety Inspector, and myself made the regular routine inspections of properties on the Marquette and Menominee Ranges. Mr. Thomas Hill, Ventilation Engineer, also made inspections but reported direct to me. I also inspected the Minnesota Mines in company with the safety inspector and superintendents.

All of our inspections have been made while in company of either the Superintendent, Captain, Foreman, or Boss. It has been the policy of the Company to allow any supervisor to correct any unsafe condition while in company of any member of the safety department without any report made by the inspector, but if he failed to see the unsafe condition, violation, etc., it was then written into a report. We have found that the majority of supervisors are on the alert at all times for unsafe conditions and correct them immediately. General conditions underground were better during 1946 than for several years past and this I believe was due to the fact that more men were available and could be spared for clean-up jobs and general housekeeping. There is no doubt in my mind that good housekeeping leads to better safety.

Supervisors at all properties gave us fine cooperation. The only times recommendations were not carried out were when there was a misinterpretation.

Our inspections have covered every nook and corner in each underground mine except complete inspections of shafts which are difficult to inspect because of hoisting. Where it has been possible we also have inspected parts of the shafts. All surface operations are also inspected, including diamond drills operated by the Company.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XII

Mine or Plant	Violations of Standards	Safety Suggestions	Recommend-ations	Fire Hazard	Total
Cliffs Shaft	10	15	9	2	36
Princeton	4	1			5
Spies-Virgil	0	4			4
Maas	18	12	5		35
Negaunee	1	5	3		9
Athens	23	13	1		37
Cambria-Jackson	22	2	7		31
Lloyd	3	3	2	1	9
Mather	10	9	4		23
Shops & Storehouse	2	2	4		8
Diamond Drills			1		1
Ishpeming Hospital		2	3	2	7
Totals	93	68	39	5	205

TABLE XIII

Mesaba Range

No. of Inspections	No. of Recommendations	No. of Suggestions
241	26	60

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Idle Properties

All idle properties were inspected during the spring and again during the fall of the year. Because of the mines being practically idle during April and May months, Mr. Rogers, Mr. Hill and myself inspected the properties and at the same time made repairs to fences. Mr. Julien Payen took care of the major repair jobs at the old Tilden Pit and the Lake Shaft. The major damage done to fences is at the Salisbury, Lake, Republic and Jackson Mines where people "short cut" through the properties.

Fire Patrol Inspection

This inspection is made, usually by shift bosses, underground at the beginning of any idle period and once every twenty-four hours thereafter to check for incipient fires, see that all power circuits are open and report any unusual condition. These inspections have already proven their value and will be continued. So there will be no laxity in these inspections, I have reminded all superintendents to check with the mine captains. During the labor strike, Mr. Rogers and myself accompanied some of the men who made the inspections. On surface the police department make a similar inspection during their rounds of the properties.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection

Blasting Procedure Inspections

To help prevent blasting accidents, shift bosses must inspect the blasting procedure used in each of his mining contracts at least once every two months or six times each year. This consists of watching the making of primers, charging the bore holes, and lighting the round. Any mistakes must be corrected and a written report is made of the entire procedure. This ruling is one of our most important accident prevention programs because it keeps all miners alert to the fact that explosives are dangerous if not handled properly. It gives the shift boss a chance to educate new miners to the hazards involved, and is a continuous reminder for everyone. Our rules covering the storage, handling, and use of explosives are among the best, if not the best in the district, and if followed faithfully should prevent explosives accidents which usually are very severe.

During the past year, as shown in table XIV, these inspections were not kept up as well as usual. Superintendents have been notified and we hope to get into the routine again. Comparisons of inspection reports have been sent to all mines covering the years of 1944, 1945, and 1946.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XIV

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

Mine	Number of Inspections	Number of Violations Reported
Athens	32	7
Cambria-Jackson	18	6
Cliffs Shaft	209	1
Lloyd	23	3
Maas	198	6
Mather	90	3
Negaunee	88	22
Princeton	0	0
Spies-Virgil	45	0
Totals	703	48

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Rules and Regulations

During the year the Safety Rule Books were revised to include many new rules and to modernize some of the old rules. The safety department personnel made the revision and the Central Safety Committee passed on the changes.

Our rule books now consist of "Underground Safety Rules" and "Surface Safety Rules" instead of separate rule books for foremen and employees. These rule books were distributed by the mine clerks and foremen to all employees who signed a receipt for them.

We have had many favorable comments on our new rules and many requests from other mining companies in the district. The Oliver Iron Mining Company is now using our rules for their guide for their new rule books.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XVII

RULE BOOKS DISTRIBUTED AT MICHIGAN MINES & PLANTS

Surface and Underground Rule Books 1942 Edition

Mine or Plant	Surface Employees	Underground Employees	Totals
Athens	3	40	43
Cambria-Jackson	8	16	24
Cliffs Shaft	8	41	49
C. P. & L. Co.	5	0	5
Lloyd	2	13	15
Mather	9	104	113
Maas	5	46	51
Negaunee	7	28	35
Princeton	0	7	7
Gen. Shops & Sthse.	5	0	5
Spies-Virgil	0	19	19
Tilden	1	0	1
Totals	53	314	367

DISTRIBUTION OF NEW SURFACE AND UNDERGROUND RULE BOOKS 1946 REVISED

Mine or Plant	Surface Employees	Underground Employees	Totals
Athens	73	271	344
Cambria-Jackson	57	166	223
Cliffs Shaft	93	237	330
C. P. & L. Co.	1		1
Lloyd	43	150	193
Mather	69	265	334
Maas	65	329	394
Negaunee	63	225	288
Princeton	16	6	22
General Shops	132	1	133
Spies-Virgil	29	75	104
Tilden	31		31
Laboratory	27		27
General Storehouse	18		18
General	5	29	34
Totals	722	1754	2476

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Inspection Reports by Plant & Mine Foremen

Certain inspections are made by plant and mine foremen and their reports are sent to the safety department for checking. All of these reports are valuable in that they are for the protection of men and equipment. It will be noted in the following reports on "Fire Doors" Underground that only a few reports have been turned in. This is because the Central Safety Committee has changed the ruling on these doors. The committee does not believe that closing fire doors in case of fire is the safest or the proper thing to do because it may endanger the lives of men in the mine. Decision to close or open doors in case of fire must be made by responsible persons. Air lock doors near the shafts in rock drifts have taken the place of fire doors in most mines.

c. Safety Inspection (Continued)

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

TABLE XV

Type of Inspection	Ath.	C.S.	Lloyd	Maas	Neg.	Spies	Princeton	Math.	Tild.	Camb. Jack.	Atkins	Can.	Hill Trumb.	Holman Cliffs	Total
Hoisting Ropes	186	209	216	254	220	159	14	211		208					1,677
Skip and Cage Roads	70	72	67	54	39	28	4	40		61					435
Ladder Roads	34	71	19	31	40	25	3	38		-					261
Safety Catches	8	19	10	8	8	9	1	8		6					77
Fire Doors(U.G.)	-	-	1	2	1	-	-	-		-					4
Slack Rope Device	10	10	3	3	9	9	-	11		5					60
Hoist Inspection	23	22	22	21	22	18	12	22		22					184
Fire Extinguishers	2	-	1	-	2	2	2	1	2	2	1	1	1	1	18
Fire Equipment	-	2	-	1	3	3	-	1	1	1	1	1	1	1	16
Fire Prevention	21	30	13	18	25	11	8	4	14	13	3	11	16	10	197
TOTALS	354	435	352	392	369	264	44	336	17	318	5	13	18	12	2,929

	Hibbing Dist. Office	Negaunee Dispensary	Storehouse and shops	Rented Bldgs.	Ishpeming Hospital	General Office	Totals
Fire Extinguishers			2	1	2	2	7
Fire Prevention	2	2			2	2	8
TOTALS	2	2	2	1	4	4	15

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XVI

NUMBER OF FIRE EXTINGUISHERS INSPECTED

Mine or Plant	2½ Gal. Soda Acid	2½ Gal. Non-Freezing	2½ Gal. Foam	1 Gal. 1-1½ quart Carbon-Tetra-Chloride	15-30 Dry Powder Type	150 Dry Powder Type	3 Gal. Car-Tet. Chloride	Total
Athens	5			16	4		2	27
Maas	7			24	5		5	41
Negaunee	6			18	6		3	33
Mather	4			28	18			50
Cliffs Shaft	10		3	33			2	48
Lloyd	2		1	19	2		4	28
Princeton	1			20	3		2	26
Cambria-Jackson	13			15	5			33
Spies-Virgil	3			17	9		4	33
Tilden	1			36	3		1	41
Holman-Cliffs				16	26			42
Hill Trumbull				12	37		1	50
Canisteo	6		1	14	18	1		40
Hibbing District	3						1	4
Ishpeming Hosp.	9			10				19
Ishpeming Resid.				16				16
Negaunee Dispens.	3			4				7
North Lake Resid.	3			7				10
Spies Location				18				18
Shops & Sthse.	11	9		26				46
Central Office	6		1	6				13
C. P. & L. Co.	4			13	1	1	2	21
Gwinn District				5				5
Atkins	2			1	3			6
TOTALS	99	9	6	374	140	2	27	657

All Carbon Tetrachloride Type fire extinguishers are tested and inspected twice annually.

Soda Acid Type, discharged and recharged once annually.

All other types inspected once annually.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

TABLE XVIII

CAUSES AND NUMBER OF DISCIPLINARY ACTION

Cause	Neg.	Cliffs Shaft	Mather	Lloyd	Athens	Maas	Cambria	Sthse.	Total
Losing time	5		3		1	1	3		13
Infraction of rules			1	2			2		5
Reporting to work in an intoxicated condition	1	1		3	2				7
Disregarding instructions			1						1
Insubordination					1	1			2
Violation of no smoking rule		2	1		1				4
Leaving job without authority			1			1		1	3
Totals	6	3	7	5	5	3	5	1	35

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Central Safety Committee

This committee met thirteen times during the year to classify accidents and discuss general safety subjects and suggestions. Following are listed, with a few comments the most important subjects taken up by the committee.

Safety goggles and eye glasses: Plastic frame safety eye glasses were approved. Men working on surface do not feel the cold so much with the plastic frame as with the metal frame. To encourage men to wear safety glasses at all times supervisors will wear glasses to set an example.

Revision of Safety Rules: Both surface and underground rule books were revised to care for changing conditions in operations.

Dust Prevention: Agreed to a standard of 10 million particles per cubic foot in ore and 5 million in rock as the maximum limits in all work places.

Developed a water misting curtain for allaying dust which will be standard for all mines. The misting nozzle is not only efficient but also economical, using 2 gallons of water per hour for each misting nozzle.

Insecticides: D. D. T. was first recommended as a roach killer but was abandoned when more information was available. A Hydro-Mist Vaporizer was purchased after being tried out at the Negaunee Mine. Vaposector used with this apparatus is harmless to humans and non-explosive.

South African Fuse Lighter: This fuse lighter was demonstrated to the committee and tried out in one of the mines. I was not impressed with it and it was not approved because it gave off too many sparks and was considered a fire hazard.

No Smoking Rules for Surface Shops: This rule was changed to allow men to smoke in certain shops. "No Smoking" signs to be posted in certain of the shops which are considered a fire hazard.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Central Safety Committee (Cont'd.)

Fire Fighting Equipment: All supervisors were asked to report on thread sizes of all fire hose and hydrants with the idea of standardizing. Fire maps to be brought up to date and posted at each mine. Not less than two inch water pipe lines to be installed on levels in each mine so that plenty of water and pressure will be available to fight fire.

Dual Controls on Steam Shovel: These controls to be installed for the craner so he will not be exposed to high banks and trestle legs when and if they fall.

Duplicate Signal Systems in Shafts: This had been checked by the safety department. Three shafts did not have duplicate signal systems and will install them.

Shaped Charges: Considerable discussion of the possible use of shaped charges to blast large chunks of ore and rock. It was decided to wait for more information on this type of blasting.

Classification of Accidents: The committee decided that the Mesaba Range Central Safety Committee should classify their own accidents as we did not have enough detailed information in reports to classify them intelligently.

Mechanically Operated Chute Doors: Because of the number of accidents occurring while loading chunky ore at the Cliffs Shaft Mine it was decided to install compressed air operated doors in all chutes where there is considerable loading of cars. Plans are now completed and installation will soon be made.

Shaft Safety Gates: It was decided to increase the strength of shaft station gates at all mines to prevent trucks, cars or haulage locomotives from accidently being pushed into the shaft.

Signalling During Shaft Repair Work: This came in for considerable discussion. Best methods used at present is use of an auto horn or locomotive bell to signal to men at shaft station.

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Central Safety Committee (Cont'd.)

Foremens' Safety Bonus: Discussed this subject with idea of making certain standards to be used at all mines. Will complete the standards in near future.

Underground Haulage Tail Lamps: Only two mines now use the coal mine Tail Lamp on haulage trains. Others use regular electric cap lamps which are placed in a steel box which has a red glass window and gives a satisfactory light.

Mine Rescue Training: This training was discussed and superintendents instructed to send only physically and mentally fit men to classes because this work is very trying. In actual fire fighting about 20% of the trained men are disqualified for various reasons.

Stage Poles: Because tamarack is next to impossible to buy, it was decided that Angle Iron be tried out in place of tamarack poles to support stages built by miners. Angle Iron has now been furnished to many mining contracts and is proving successful.

Doors at Bottom of Raises: To deflect falling material in raises it was agreed to install either a door or deflector of some kind to prevent material from striking persons on the level below.

"H" Beams for Stages in Raises: Because steel rails become brittle and often break when used to support stages in raises, "H" beams will be used in the future.

Underground Toilets: It was agreed that a chemical toilet which costs only about $75.00 should be used underground. Three superintendents were instructed to install these toilets.

Fire Patrol: Superintendents were instructed to check on the fire patrol which is done at the beginning of each idle period in the mines and once every 24 hours thereafter. It had been found that there had been some laxity of this rule after the war ended.

Aluminum Ladders: The Cliffs Shaft Mine reported the successful use of these ladders when barring in the high stopes. They are easily set up, taken down and moved with the saving of much time and effort.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

c. Safety Inspection (Continued)

Lake Superior Mining Section, National Safety Council

The annual meeting of the section was held again in 1946 after a lapse of one year due to the war. The meeting was held at Duluth, Minnesota on June 20 and 22 with 552 persons registered. An excellent program and exposition made the meeting a success and was well worth the time spent there.

Mr. Hugh Leach, Asst. Supt., Hill Trumbull Mine presented a paper on "Safe Truck Haulage-Operation".

Mr. F. J. Haller, Supt., Mather Mine presented a paper on"Safety in Sub-Level Stoping" and Mr. Thomas Tippett, Mining Captain, Lloyd Mine was a member of a panel discussion on "Fundamental Causes of Accidents".

The Cleveland Cliffs Iron Company was represented by 26 employees from Minnesota and Michigan Iron Ranges as follows.

D. Anderson, Mine Clerk, Taconite, Minnesota
R. Barkla, Shop Foreman, Taconite, Minnesota
Leonard Clifford, Wash Plant Foreman, Coleraine, Minnesota
M. J. Donovan, Chief Clerk, Hibbing, Minnesota
Fred Fink, Engineer, Coleraine, Minnesota
J. J. Foucault, Supt., Coleraine, Minnesota
M. E. Gaffney, Master Mechanic, Marble, Minnesota
Hugh Leach, Asst. Supt., Marble, Minnesota
A. J. Lemire, Mine Clerk, Coleraine, Minnesota
William Mattson, Asst. Chief Clerk, Hibbing, Minnesota
Joe Olson, Mortorized Equipment Foreman, Coleraine, Minnesota
W. A. Pakala, Supt., Coleraine, Minnesota
F. Wassberg, Chief Chemist, Coleraine, Minnesota
G. R. Whittington, Safety Inspector, Taconite, Minnesota
James Wivell, Wash Plant Foreman, Coleraine, Minnesota
J. K. Young, Dist. Electrician, Marble, Minnesota

Ruben Carlson, Mine Foreman, Negaunee, Michigan
John Dawe, Mine Foreman, Ishpeming, Michigan
William Goldsworthy, Mine Foreman, Negaunee, Michigan
F. J. Haller, Supt., Ishpeming, Michigan
C. C. Hawes, Chief Chemist, Ishpeming, Michigan
L. C. Moore, Chief Mech. Engr., Negaunee, Michigan
Harry Rogers, Safety Inspector, Negaunee, Michigan
A. J. Stromquist, Director of Safety, Negaunee, Michigan
Thomas Tippett, Mine Captain, Ishpeming, Michigan
John Trosvig, Mine Supt., Ishpeming, Michigan

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c. Safety Inspection (Continued)

Lake Superior Safety Conference (Cont'd.)

Mr. George Whittington, Safety Inspector, Mesaba Range Mines is a member of the Prize Awards Committee and the writer is a member of the Executive Committee and Chairman of the Exhibits Committee.

Sectional Meetings were held as follows.

January	10, 1946	Virginia, Minnesota
February	14, 1946	Duluth, Minnesota
March	22, 1946	Ironwood, Michigan
April	11, 1946	Ironton, Minnesota
May	9, 1946	Duluth, Minnesota
June	20-21, 1946	Duluth, Minnesota
September	19, 1946	Duluth, Minnesota
November	14, 1946	Duluth, Minnesota
December	12, 1946	Ishpeming, Michigan

I had charge of the Ishpeming Meeting and arranged the program and also was chairman. This meeting was attended by 72 men. These men came from the Marquette, Menominee, Mesabi and Copper Ranges and from Chicago and Duluth. Thirteen companies and the U. S. Bureau of Mines were represented. Mr. W. R. Atkins, Supt., Negaunee Mine, presented a paper on "Safety Education of Employees at The Negaunee Mine". Mr. James Westwater, Asst. Supt., Mather Mine, presented a paper on "Testing and Choosing Explosives". Mr. S. W. Sundeen, Supt., Cliffs Shaft Mine had a paper on "Mechanical Chute Stoppers". Mr. Robert Edwards, Inland Steel Company, had a paper also on "Mechanical Chute Stoppers". Jack Victor, Safety Engineer, Castile Mining Company, presented a paper on "Safety in sub-level Caving at The Eureka Mine". Mr. Al Wagner, Efficiency Engineer, Oliver Iron Mining Company, gave a talk on "Safety in Sub-Level Caving at the Geneva Davis Mine".

National Safety Council

The council met in Chicago, Illinois during the week of October 7th to 11th after a lapse of one year due to the war. Our company was represented by the following men: T. W. Hill, Ventilation Engineer, Wilfred Mallett, Mining Captain, Athens Mine, O. Marjama, Supt., Lloyd Mine, H. O. Moulton, Supt., Maas Mine, George Whittington, Safety Inspector, Mesabi Range Mines, H. C. Bolthouse, Supt., Mesabi Range Mines, and myself.

The mining section of the council had a well prepared program of

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c. Safety Inspection (Continued)

National Safety Council (Cont'd.)

a variety of subjects which were very well presented and in my judgment was the best meeting that I have ever attended.

Since the coal operators separated from the mining section our meetings have been much more interesting and valuable. Previously there was too much emphasis on coal mining and not enough on metal mining because the coal men were in majority. Each year the coal mining section and the metal mining section have one joint meeting to exchange ideas or discuss some subject which is of value to both sections.

News magazines and safety literature now received from the council is much improved over a few years back, and I feel that we now are receiving more for our money and do not have to feel like "orphans" as we did in the past. The new National Safety Council Staff Representative of the mining section seems to be very much interested in the Lake Superior District mining operations and has attended a number of Lake Superior Mining Sections Safety Meetings. Our poster service is improved but we are allowed only 12 posters per year which pretain entirely to Iron Mining. This is due to lack of funds for this service. We hope to improve this service and our district has contributed about 200 photographs and sketches for posters to be used in the future.

Safety Banner Flag Awards

These flags are awarded to the underground mine, open pit, and independent unit having the best severity record for the year and is a very much sought for prize.

The underground flag was won by the Spies-Virgil Mine with a severity rating of 0.385 which is almost the same rating this mine had during 1945 to win the flag that year. The Spies Mine had 5 lost-time injuries for a total of 68 days lost-time, the same number of days lost during 1945.

The Tilden Mine won the flag in open-pit competition with a severity rating of 0.045. It had 1 lost time injury causing 2 days lost time.

The Cliffs Power and Light Company won the competition for independent units with a clear slate. The power company has now operated 39 months without a compensable accident.

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c. Safety Inspection (Continued)

Miners' Safety Bulletin

The bulletin was issued only once during the year. The issue prepared for February was cancelled because of the C.I.O. labor trouble. After the men returned to their jobs the later part of May, there was considerable dissension among them and the bulletin was held up until December, and announced in the bulletin that it would be changed to include items of personal interest to both employees and their families.

Foreman's Safety Bonuses

$4,578.63 was paid out to foremen as a safety bonus during the past year. A total of 85 men participated in the bonus, receiving an average of $53.87 each. Penalties for violations of standards or unsafe practices amounted to $47.66, or less than half the penalties imposed during 1945.

There has been some difference of opinion among superintendents and heads of departments as to the amount to penalize a foreman for certain infractions of rules and unsafe practises. At times I am inclined to believe that before a penalty is made, not enough investigation has been made. This subject has been brought before the Central Safety Committee and a special meeting will be called soon to standardize on penalties and methods of investigation when more than one boss is involved. Following are tables showing amounts of bonuses at each mine and those participating in the bonus plan which we believe is very effective in accident prevention work.

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c. Safety Inspection (Continued)

TABLE XIX

SAFETY BONUSES PAID TO FOREMEN

Mine or Plant	Amount	Men Participating	Amount of Penalties Imposed
Athens	$ 727.16	15	$ 10.18
Cliffs Shaft	835.39	13	1.01
Lloyd	351.72	8	16.32
Maas	747.59	11	9.68
Mather	485.84	9	-----
Negaunee	595.28	9	4.39
Spies-Virgil	198.81	6	-----
Princeton	130.16	3	-----
Cambria-Jackson	442.40	9	6.08
C. P. & L. Co.	64.28	2	-----
Totals	$4,578.63	85	$47.66

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c. Safety Inspection (Continued)

TABLE XX

OCCUPATIONS OF MEN PARTICIPATING IN BONUS

Title	Athens	C.S.	Lloyd	Maas	Mather	Neg.	Spies Virgil	Princeton	Camb. Jack.	C.P.&L.Co.	Total
Shift Boss	12	9	6	8	4	6	2	2	4		53
Machinery Foreman	1	1	1	1	1	1	1	1	1		9
Surface Foremen	1	1	1	1	1	1	1		1		8
Timber Foremen	1	1		1		1			1		5
Scraper Foremen		1									1
Pipe Foremen					1						1
Ass't. Mech. Foreman					1						1
Sub Boss							2		2		4
Electrician Foreman					1						1
Line Foremen										2	2
Totals	15	13	8	11	9	9	6	3	9	2	85

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d. Ventilation

During the year we have kept a constant check on ventilation in all the mines, having made two complete surveys of each mine and have measured the changes in air splits each time a new airway has been opened. With but a few exceptions ventilation has been good in all mines. We have taken temperature and humidity readings in every working contract and also of intake and exhaust air. These readings show that average temperatures are lower than they were formerly, and relative humidity is down slightly. Reports of surveys have been submitted to superintendents with recommendations when or where necessary. The Jeffery type of main mine fan has given very satisfactory results because of its flexibility. The blades of these fans are adjustable and can be changed to seven different positions. This allows us to care for most any change which may occur in mine characteristics. Considerable work was done at the various mines to keep airways open and make new ones. Most of the supervisory force are now more ventilation conscious and realize the value of good ventilation in work places and also better control of air in case of fire.

A brief summary of the ventilation at each mine follows.

Athens Mine — This mine offers the most difficult problem of mine ventilation because intake and exhaust air must be taken thru the same shaft and because six levels are in operation. American Blower Fan delivered 85,000 C.F.M. at 5.8" water gage. 74,736 C.F.M. available for mine ventilation. 55,830 C.F.M. recirculated thru mine because of poor condition of air doors at shaft timber stations and short circuit of air between skip and cage compartments in skip pit. Distribution of air to mining contracts is fair.

Cambria Jackson Mine — Jeffery 8 H-42 fan delivers 38,000 C.F.M. at 1.8 inches W.G. Booster Fan - Buffalo Turbo Conoidal Size 5½ delivers 16,722 C.F.M. at 1 inch W.G. to two contracts at the west end of the 6th level. Considerable recirculation around Jeffery fan installation which will be taken care of. There is recirculation from main fan thru stopes of old Cambria mine amounting to over 4,000 C.F.M. and from Booster fan amounting to 16,722 C.F.M. A brattice will be built on the 7th level to prevent recirculation from main fan but recirculation from Booster fan cannot be stopped in 6 and 19 contracts until they have finished mining on first sub below the old stopes.

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d. Ventilation (Continued)

When this is complete ventilation of mine will be excellent.

Cliffs Shaft

Natural ventilation ranges from 48,200 C.F.M. during warm weather to 57,000 C.F.M. in cold weather. Distribution is very good but volume not quite enough to allow blasting anytime during shifts. Some "dead" spots with poor circulation of air.
A Jeffery fan of 100,000 C.F.M. capacity will be installed during 1947 which should allow blasting at any time of shift in development headings.

Lloyd Mine

B.F.Sturtevant #60 fan delivering 14,700 C.F.M. against .7 inch W.G.;air well distributed thru mining contracts. Only 2000 C.F.M. leakage from shaft thru air doors and brattices on 4th, 6th, and 7th levels. These doors and brattices to be rebuilt because rotting has taken place.

Maas Mine

55,542 C.F.M. furnished from Negaunee Mine fan. A part of this air can be considered fresh air as it comes direct from the Negaunee Mine fan to 1390 cross cut and to the Maas 400 drift. The volume is 15,300 C.F.M. Air volume which enters Maas Mine from Negaunee 14th level has passed thru many workings. Water-sprays help to keep this air in better condition by washing out some of the gas, smoke and dust.
Because of the poor connections between the two mines the volume of air is low and builds up pressure at the fan. The ground is very heavy in some places and at the present time there are only two good connections between the two mines. Recommendations have been made for a large air-way from Maas 6th level to Negaunee 14th level, 1470 drift where it can be completely in rock and would be permanent. Until such time when a greater volume of air enters the Maas Mine ventilation can be considered only poor to fair. In order to ventilate mining contracts properly, auxiliary fans must be used. About 20 are in operation at all times.

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d. Ventilation (Continued)

Mather Mine — An American Blower Fan #5½ furnishes 36,500 C.F.M. at .6 W.G. for the 3rd, 2nd and 5th levels and a #45 Sturdevant supplies 3500 C.F.M. for drift contract on the 6th level. Air has been very well distributed to mining contracts. The main fan is now too small for the increased size of the mine and will be replaced with a larger fan.

Negaunee Mine — A Jeffery Aerodyne #8H-72 fan delivers 91,500 C.F.M. against 4.4 W.G. with blades at #4 position. Most of the mine resistance is in the airway connections with the Maas Mine. Distribution of air in the Negaunee Mine has been very good with the supervisory force continually making improvements.

Princeton Mine — The Buffalo Forge - Turbo Conoidal mine fan delivered 24,000 C.F.M. Distribution of air was poor because of short circuits thru stope areas and poor air doors to #2 shaft. When Princeton Mine was closed this fan was transfered to the Negaunee Mine to be used as a booster fan.

Spies - Virgil — Jeffery Aerodyne 8H-42 in storage. To be placed at new air shaft when connection to mining area is completed. Temporary ventilation set-up is with a B. F. Sturtevant fan which furnishes 3500 C.F.M. Small auxiliary fans used when necessary. Ventilation fan in all work places. New ventilation system should be completed by the end of February, 1947.

Dust Elimination and Analysis

During the past year our dust analysis has showed a slight increase in average dust counts. This has been due entirely to failure to provide good ventilation and use known dust allaying methods. There have been times when a fan was not available for the ventilation of a new heading but in most cases it was failure to get the fan set-up before starting mining operations. I believe that during the coming year we will have better dust control than at any time in the past because we now have come to a better understanding with the supervisory force.

During the past year we have taken dust samples regularly at all rock headings because the greatest hazard is in rock work. Whenever possible

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d. Ventilation (Continued)

these samples have been taken during all the cycles of the operation. When time has permitted, samples have been taken in ore headings, blowing-out chutes, cars, pockets, crushers, intake and exhaust air and main airways after blasting.

We have experimented with various water sprays and now have standardized on a misting nozzle which gives off the very fine mist necessary to allay the fine dust which is harmful. This misting nozzle uses less than two gallons of water per hour so is also very economical and easy to clean. We have not yet standardized on a "water blast" but probably will do so soon, as we do have a few which are very efficient.

Our rules call for the wearing of dust respirators in all rock work and during the past year very few violations have been noted. The main reasons for this rule is to give the employees full protection at all times in case of failure of ventilation or water supply.

At no time have we picked ideal conditions when taking dust samples, but rather have followed up the most difficult conditions with the idea of correcting poor conditions as soon as possible and preventing dust from contaminating main air currents.

We have proven that thru the use of misting nozzles in vent-tubes or steel ventilation pipe that we are able to reduce dust counts from 200 million to less than 5 million particles per cubic foot. These experiments were made after blasting in a rock heading which gives off the greatest amount of dust. No water was used thru the "water blast" in order to know the worst conditions. The ventilation fan was drawing air from the heading with a small fan blowing into the heading. By use of a good "water blast" during blasting operations and for a period of 15 minutes after the blast and with the use of good ventilation, dust counts in rock headings are usually much below the recommended maximum dust counts. In raising where dust counts have been considerably higher than in other operations we are now experimenting with "water blasts" and the use of a high pressure auxiliary fan connected to eight inch steel pipe. Usually the common vent-tube cannot be protected enough to prevent damage to it when blasting in raises so the standard steel pipe or steel ventilation pipe must be used. We hope to standardize on either eight or ten inch pipe for this work.

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11. ACCIDENTS AND PERSONAL INJURY

d. Ventilation (Continued)

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

TABLE XXI

Dust Samples Collected in Rock and Ore Work

Mine or Plant	1946 In Ore	1946 In Rock	Total 1946	Total 1933 -- 1946
Athens	29	27	56	536
Cambria-Jackson	24	13	37	95
Cliffs Shaft	16	20	36	1434
Lloyd	27	5	32	507
Maas	27	6	33	523
Mather	8	70	78	369
Negaunee	20	15	35	708
*Princeton	--	--	--	85
Spies-Virgil	--	7	7	77
Tilden	3	--	3	36
Miscellaneous	--	--	--	111
Totals	154	163	317	4481

* Closed down.

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11. ACCIDENTS AND PERSONAL INJURY

d. Ventilation (Cont'd.)

TABLE XXII

VARIOUS OCCUPATIONS WHERE DUST SAMPLES WERE COLLECTED

Occupation	Athens	Cliffs Shaft	Camb. Jack.	Lloyd	Maas	Mather	Neg.	Princeton	Spies-Virgil	Tilden	Totals
Drilling	21	29	16	7	7	28	12	--	5	--	125
Scraping	16	--	12	14	11	7	15	--	--	--	75
Using Loader to Fill Cars	--	--	--	2	--	25	--	--	--	--	27
Blasting	1	--	1	--	1	8	2	--	--	--	13
Timbering	3	--	3	2	--	7	2	--	--	--	17
Hand Shoveling	--	--	1	--	--	1	--	--	--	--	2
Barring Back	1	--	--	--	--	--	--	--	--	--	1
Blowing Cars	6	--	--	3	7	--	--	--	--	--	16
Loading Cars at Chute	2	--	--	1	--	--	--	--	--	1	4
General Mine Air	1	1	1	--	1	--	1	--	2	--	7
Charging Holes	1	--	--	--	1	2	1	--	--	--	5
Rigging Machine	--	--	1	--	--	--	--	--	--	--	1
Crushing Ore	--	3	--	--	--	--	--	--	--	2	5
Breaking Chunks	--	--	1	2	--	--	--	--	--	--	3
Loading Skip	4	--	--	--	4	--	2	--	--	--	10
Driving Spiling Poles	-	--	--	1	1	--	--	--	--	--	2
Blowing Out Bore Holes	--	--	1	--	--	--	--	--	--	--	1
Crushing Ore Sample	-	1	--	--	--	--	--	--	--	--	1
Pulverizing Ore Sample	--	2	--	--	--	--	--	--	--	--	2
Totals	56	36	37	32	33	78	35	--	7	3	317

TABLE XXIII

AVERAGE LIGHT FIELD COUNT OF ALL SAMPLES TAKEN

Mine or Plant	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946
Athens		32.90	14.12	28.32	26.69	12.85	12.59	9.89	7.28	25.80	4.90	8.33	6.64	4.17
Cliffs Shaft	17.94	14.56	8.29	8.98	15.53	9.86	10.36	7.77	8.18	7.55	5.99	6.23	8.18	6.34
Cambria											12.10	6.21	17.05	11.99
Lloyd		9.90	12.42	39.25	20.25	10.84	13.47	11.73	8.05	6.95	5.01	14.45	6.49	9.38
Maas		7.46	27.55	35.75	150.98	11.24	36.90	8.71	17.29	8.46	12.48	8.78	8.17	9.29
Mather									2.42	5.58	6.64	7.57	8.39	7.72
Negaunee		53.80	17.77	33.25	59.06	56.26	25.49	10.79	14.02	17.02	4.65	11.81	11.92	6.67
Princeton											10.59	6.32	8.48	--
Spies-Virgil					70.61	26.99	1.80	8.40	6.97			5.59	14.22	3.59
Tilden				67.52	285.27	74.60	60.40		49.60				24.18	66.92
Gardner Mackinaw		27.77	-----	8.61	48.53									
Miscellaneous			8.66	3.00	6.80	14.73				3.00				

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d. Ventilation (Continued)

TABLE XXIV

COMPARISON OF DUST COUNTS

IN RAISING TO DRIFTING

Mine	Average in Raising	Average in Drifting	General Average
Athens	2.72	5.70	4.17
Cliffs Shaft	7.79	3.85	6.34
Cambria-Jackson	22.62	12.75	11.99
Lloyd	----	11.32	9.38
Maas	25.18	----	9.29
Mather	9.22	5.69	7.72
Negaunee	11.83	11.64	6.67
Princeton	----	----	----
Spies-Virgil	----	5.67	3.59

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d. Ventilation (Continued)

TABLE XXV

AVERAGES IN ORE COMPARED TO AVERAGES IN ROCK

Mine	Average in Ore	Average in Rock	General Average
Athens	10.49	5.86	4.17
Cliffs Shaft	7.72	5.32	6.34
Cambria-Jackson	13.42	9.00	11.99
Lloyd	8.92	12.34	9.38
Maas	8.20	25.18	9.29
Mather	8.94	6.78	7.72
Negaunee	6.49	7.10	6.67
Princeton	----	----	----
Spies-Virgil	2.03	4.22	3.59

TABLE XXV-A

COMPARISON OF AVERAGE DUST COUNTS IN VARIOUS OPERATIONS

Mine or Plant	Raising in Rock	Raising in Ore	Drifting in Rock	Drifting in Ore	Slicing in Ore	Stoping in Ore	Breaking Chunks	Blowing Out Cars	Loading From Chutes	Loading Skip
Athens	----	2.72	5.80	3.86	4.79	----	----	21.57	21.74	20.26
Cliffs Shaft	7.78	7.81	3.14	5.12	----	4.99	----	----	----	----
Camb.-Jackson	22.62	----	7.64	20.74	6.28	23.93	7.25	----	----	----
Lloyd	----	----	12.35	7.20	8.40	11.97	13.84	3.15	6.30	----
Maas	25.18	----	----	----	6.41	15.15	----	9.12	----	11.13
Mather	18.44	----	5.70	4.74	18.27	6.92	----	----	----	----
Negaunee	9.09	----	3.12	13.31	5.64	----	----	-----	----	3.46
Princeton	----	----	----	----	----	----	----	----	----	----
Spies-Virgil	----	----	5.67	----	----	----	----	----	----	----

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e. Mine Rescue Training

This training was conducted during the later part of October and the first half of November. The training was scheduled to continue to December 5th, but because of the deer hunting season it had to be dropped.

Mr. Hill, Ventilation Engineer, Mr. Rogers, Safety Inspector, and myself started the Initial Mine Rescue Training. I had two classes during the first week. These men were examined and passed by Mr. M. L. Williams, Mining Engineer, U.S. Bureau of Mines, and received Bureau of Mines certificates. The following week Mr. Williams worked with Mr. Rogers, training two more classes. During the third week, Mr. Stott, Engineer, U.S. Bureau of Mines, replaced Mr. Williams and worked with Mr. Hill. Mr. Stott was a new man with the Bureau of Mines with very little experience, if any, in Mine Rescue Work, and caused considerable discomfort for the men during classes. Only a few of the men passed his tests. He was very critical of our men and equipment, due no doubt, to his lack of experience, and he was partly responsible for our delaying additional training for our experienced crews. We hope to continue with more mine rescue training during the spring of 1947, at which time they will also receive instructions in the use of the new Chemox Self-Contained Oxygen Breathing Apparatus.

Following is a list of men trained during November, 1946:

MEN TRAINED IN MINE RESCUE
DURING NOVEMBER, 1946

	Initial Training	Additional Training
Athens	4	4
Cambria	3	2
Cliffs Shaft	4	2
Engineering Dept.	1	4
Maas	2	1
Lloyd	5	0
Mather	5	0
Negaunee	6	1
TOTALS	30	14

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e. Mine Rescue Training (Cont'd.)

The following table shows the number of mine rescue men available at each mine.

TABLE XXVI

MEN TRAINED BY THE SAFETY DEPARTMENT AND EXAMINED BY U.S. BUREAU OF MINES

	Additional Mine Rescue	Initial Mine Rescue
Athens	12	3
Cambria	11	3
Cliffs Shaft	11	4
Lloyd	7	6
Maas	10	2
Mather	21	3
Negaunee	11	6
Spies-Virgil	5	0
Engr. Dept.	6	1
TOTALS	94	28

TOTAL 122

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

TABLE XXVII

FIRST AID SUPPLIES DISTRIBUTED

Material	Number Distributed
Merthiolate Pads	24,936
Ounces of Merthiolate	177
1" Roller Bandage	257
2" " "	275
3" " "	201
Rolls of Adhesive Tape	36
Picric Gauze	158
Plain Gauze	296
Leather Finger Cots	120
Merthiolate Applicators	1,233
Ozs. Aromatic Spirits of Ammonia	12
Tubes of Unguentine ($\frac{1}{2}$ oz.)	34
Ozs. Absorbent Cotton	16
Triangular Bandages	6
Pairs of Scissors	1
Totals	27,757

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11. ACCIDENTS AND PERSONAL INJURY

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

Reports on Accident Statistics

We have followed the usual routine by sending our accident statistics to the following:

Marquette County Mine Inspector, Ishpeming, Michigan
Iron County Mine Inspector, Iron River, Michigan
Itasca County Mine Inspector, Kiwatin, Minnesota
U. S. Bureau of Mines, Statistical Division, College Park, Maryland
National Safety Council, Statistical Division, Chicago, Illinois
Lake Superior Mining Section, National Safety Council, Duluth, Minnesota

Mine Rescue Station

Equipment kept at the station is inspected, and necessary repairs made at least once a month. All oxygen bottles for the McCaa Self-Contained Oxygen Breathing Apparatus have been cleaned and the inside of the bottles scaled. Five new bottles have been received to replace leaking bottles, and the old ones will be sent to the Mine Safety Appliances Company for hydrostatic tests.

Two new Chemox Oxygen Breathing Apparatus have been added to the equipment and four others are on order. The new apparatus weighs only 13½ pounds and will give us one hour of service for each canister of chemical. This will be a great improvement over the 37 pound McCaa apparatus when working in raises and tight places, and will allow us to use experienced mine rescue men who have poor teeth and cannot wear the McCaa apparatus because the mouth piece must be held between the teeth, whereas the Chemox has a face piece.

The station was painted during the mine strike last April, and is in first-class condition.

Safety Department

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f. Miscellaneous

Max Petersen, Mining Engineer, U.S. Bureau of Mines, took photographs of various safety devices and practices, and these pictures are now being used in safety promotion.

The caves thru which the Cambria-Jackson Mine takes its air for mine ventilation were inspected and found to be filling in with rock; report of same was submitted to the superintendent.

During the driving of the surface timber tunnel at the Mather Mine, gasoline-powered trucks were used for hauling. Safety department personnel took air samples and C.O. Indicator tests each week to check the air to prevent carbon monoxide poisoning of the men working in the tunnel. At no time was the concentration of C.O. found to be dangerous. A total of 5,000 C.F.M. of fresh air was delivered to the face of the heading at all times. The driving of the tunnel was discontinued on October 15, because of cold weather and will not be resumed again until next spring.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

f. Miscellaneous (Cont'd.)

Incipient Fires

The following incipient fires were reported to this office during the year.

February 27, 1946 - Princeton Mine

Chimney fire extinguished by policeman. Slight damage.

June 1, 1946 - Maas Mine

Change house-Fire in clothes locker extinguished by policeman. Slight damage.

July 22, 1946 - Cliffs Shaft Mine

Grass fire extinguished by Ishpeming Fire Department. No damage.

July 25, 1946 - Cliffs Shaft Mine

Peat fire. No damage; extinguished by Ishpeming Fire Department.

November 9, 1946 - Maas Mine

No. 49 Contract. Mine rescue men called but did not have to use O_2 Apparatus. Blasted piece of ore had broken insulation on a coiled cable and caused a short circuit when water dripped on the cable. The fire was reported at 1:00 a.m. Miners and supervisors had failed to open electric switch to 49 Contract at the end of shift. Fire was out when crew reached contract. Only the insulation on the cable was burned. Timber was scorched but did not catch on fire.

Safety Department

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11. ACCIDENTS AND PERSONAL INJURY

f. Miscellaneous (Cont'd.)

Supervisors Meetings

These meetings have taken the place of the regular Foremans' Meetings held in the past. More can be gained by having meetings with small groups than with large ones.

Mr. Rogers and myself have attended many of these meetings which cover safety, and operations. At the Negaunee Mine during the past year, Mr. W. R. Atkins, Superintendent, and Wilfred Tippett, Mining Captain, have done a very fine job of training men in safety. Groups of motor crews, timbermen, miners, etc., were instructed as to their duties and the hazards connected with their jobs. I assisted with an outline for the instruction course and helped the supervisors during the first few meetings, and then turned the instruction work over to them. I am firmly convinced that these classes have already paid dividends. The Negaunee Mine has one of the best safety records during 1946.

ANNUAL REPORT OF THE MINING ENGINEERING DEPARTMENT FOR THE YEAR ENDING DECEMBER 31ST, 1946

The books of photographic maps and sections showing the work done during 1946 accompany this report. The maps show, in red, the areas that were mined and the development during the year. The sections of the Minnesota open pit mines show, in color, the material left in place as of the end of the operating season. Books have been prepared for various companies that are interested in the different mines. The following list shows what books have been prepared and the mines included therein:

Company	Mines
The Cleveland-Cliffs Iron Company	Athens, Atkins, Cambria-Jackson, Canisteo, Cliffs-Shaft, Hill-Trumbull, Holman-Cliffs, Lloyd, Maas, Mather, Morris, Negaunee, Princeton, Spies-Virgil and Tilden.
Bethlehem Steel Company	Mather and Negaunee.
Pickands Mather & Company	Athens.
Hanna Iron Ore Company	Hill-Trumbull and Holman-Cliffs.
Inland Steel Company	Hill-Trumbull and Holman-Cliffs.
Jones & Laughlin Steel Corporation	Hill-Trumbull and Holman-Cliffs.
Pittsburg Steel Company	Hill-Trumbull and Holman-Cliffs.
Republic Steel Corporation	Hill-Trumbull and Holman-Cliffs.
Wheeling Steel Corporation	Hill-Trumbull and Holman-Cliffs.

Two bound volumes were made for The Cleveland-Cliffs Iron Company, one for the Cleveland office and one for the Engineering Department at Ishpeming. One loose-leaf book was prepared for each of the partners of the Mesaba-Cliffs Mining Company and an extra copy for the Republic Steel Corporation. Loose-leaf books were also prepared for the Bethlehem Steel Company and Pickands Mather Company.

Similar loose-leaf books were made for fee-owners and superintendents as follows:

Person or Company	Mines
Arthur Iron Mining Company	Atkins, Hill-Trumbull, and North-Star-Bingham Lease of Holman-Cliffs.
Inland Steel Company	Atkins.
Teal Lake Iron Mining Company	Cambria.
Walter A. Sterling, Asst. Manager,	Atkins, Canisteo, Hill-Trumbull and Holman-Cliffs.
W. R. Atkins, Superintendent	Negaunee
H. C. Bolthouse, Superintendent	Hill-Trumbull and Holman-Cliffs.
F. J. Haller, Superintendent	Mather.
O. Marjama, Superintendent	Lloyd and Spies-Virgil.
H. O. Moulton, Superintendent	Maas.
W. A. Pakkala, Superintendent	Canisteo.
C. R. Sundeen, Superintendent	Athens.
S. W. Sundeen, Superintendent	Cliffs-Shaft.
J. Trosvig, Superintendent	Cambria-Jackson.

B. MAP REPORTS

At the end of each month, two sets of the working maps of Michigan Mines were prepared, showing, in red, the work done underground during that month. One set was for the Assistant Manager and the other for the Mine Superintendent. The maps of the Cliffs-Shaft Mine were posted only twice during the year, but monthly small prints were made for the Superintendent showing the development work. No sets of maps were made for February, March, April and May, because of the strike.

Other map reports for fee-owners and others were made during the year as follows, with the exceptions of the months as noted above:

ATHENS MINE

Two sets of monthly blueprints of the Athens Mine, showing in red the work done during that month were sent to the Pickands Mather & Company. There was no work done on the Corbit Lease during the year, so no maps were sent to the Trustees of the Maria Corbit estate.

CLIFFS-SHAFT MINE

Two sets of whiteprints of the geological maps of the Bancroft and Section 10 Leases, scale 1" = 50', were prepared for the Oliver Iron Mining Company after the two surveys, one for the Ishpeming office and one for their Duluth office. These maps show, in color, the work done since the previous survey, except that the maps at the end of the year show the work done for the entire year as well as the areas used in making the estimate of ore reserves for the Michigan State Tax Commission. Two copies of the estimate of ore reserves in the Bancroft and Section 10 Leases as of December 31, 1946, as prepared for the Michigan State Tax Commission, accompanied the maps for the end of the year.

MAAS MINE

A monthly set of blueprints, scale 1" = 50', of the Maas Mine underground maps, were sent to Mr. R. C. Miller, Negaunee, showing in red the work done during the month. Whenever work was done on the Roman Catholic Cemetery Lease, maps of this lease were sent to Mr. R. S. Archibald, Negaunee, showing the work done during that month.

NEGAUNEE MINE

Each month a set of whiteprints of the working maps of the Negaunee Mine were sent to Mr. R. C. Miller of Negaunee, showing in red the mining during the month. At the end of the year, a set of whiteprints of the North-South cross-sections affected by mining during 1946 were sent to Dr. Donald M. Fraser, Chief Geologist of the Bethlehem Steel Company, Bethlehem, Pennsylvania.

MICHIGAN STATE TAX COMMISSION

Estimates of ore reserves in the Athens, Cambria-Jackson, Cliffs-Shaft, Lloyd, Maas, Mather, Negaunee and Spies-Virgil Mines as of December 31, 1946, were prepared for the Michigan State Tax Commission. Accompanying these estimates were Annual Report maps for each of the mines, showing the areas used in making each of these estimates and the general geological structure of each sub-level. All estimates were made on plan maps rather than sections. Two sets of these estimates and maps were prepared, one for the Tax Commission and one for the Engineering Department at Ishpeming.

C. REMARKS ON MISCELLANEOUS DOCUMENTS AND ABSTRACTS

All documents affecting lands and rights held by the Company and its subsidiaries passed through the Engineering Department for recording and approval, with the exception of documents relative to timber cutting, etc. which are handled by the Land Department. These documents were placed on the Department records and initialed by Mr. Brewer and, in certain cases, by Mr. Derby where the mineral rights were affected.

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

Classification	Number Received	Last File Number
Mining Leases	2	78
Miscellaneous Documents	23	1596
Easements	4	427
Rights of Way	0	224
Surface Leases	136	5996
Applications for Sale	0	180
Sales	199	3617
Tax Histories	0	704

The following comments cover the various documents as shown above:

MINING LEASES

Lease No. 14-A

In December, 1946, the necessary papers were sent notifying the fee-owners of the Roman Catholic Cemetery Lease, Maas Mine, cancelling this lease as of January 31st, 1947.

Lease No. 29

During December, 1946, notices were sent to the Chicago & North Western Railway Company cancelling the lease on the NE¼ of NE¼ of Section 19, 45-25, as of January 1st, 1947. The Princeton Mine was permanently closed down during 1946.

Lease No. 65

The Canisteo Mining Company assigned all its interests in the Holman-Brown property to the Mesaba-Cliffs Mining Company as of March 31, 1946, and all its interest in the Canisteo Mine to The Cleveland-Cliffs Iron Company as of the same date. This assignment followed the purchase of the stock of the Canisteo Mining Company in 1945.

Lease No. 77

This number was given to the proposed lease of Section 11, 47-27.

Lease No. 78

This number was given to the lease of the Atkins Mine, formerly the North Wade property, in Section 12, 48-19, Minnesota. The Cleveland-Cliffs Iron Company has a half interest with the Inland Steel Company in the fee of the SE¼ of NW¼ of Section 12, 48-19 and a joint lease-hold interest from the North Star Iron Company on the N½ of S½ of the same Section. The Cleveland-Cliffs Iron Co. is to be the operator and the agreements were signed in 1946, but no copies of the documents have been received in the Engineering Department.

MISCELLANEOUS DOCUMENTS

All documents affecting any rights of operating mines or mineral lands are included in this classification. There were 13 documents affecting the Minnesota properties, six copies of documents desired for office purposes and the rest were miscellaneous documents affecting mineral lands.

EASEMENTS

The four easements received cover transmission line rights for the Cliffs Power & Light Company on some of their service lines.

RIGHTS OF WAY

This classification covers railroad rights of way.

SURFACE LEASES

All surface leases originate in the Land Department and cover the use of Company lands for roads, farms, gardens, camps, etc.

APPLICATIONS FOR SALE

These also originate in the Land Department and are preliminary reports covering lands to be sold for farms in areas not valuable for their minerals.

SALES

This classification covers transfer of property of all kinds, including Bills of Sale for houses sold under contract on leased lands, sale of lands off the mineral formation, platted lots in Gwinn, Munising, etc.

TAX HISTORIES

No tax histories were received during the year.

ABSTRACTS

There was no work done on abstracts during the year.

D. THE FORCE

There have been quite a few changes in the Department during the year. Mr. Donald W. Carlson returned to the Department at the beginning of the year after being discharged from the Armed Services, and is the Stenographer for both the Engineering and Geological Departments. On January 14th, both Messrs. F. Alfred Koski and P. Daniel Isaacson came back to the Department after their discharge from the Armed Services, the former as a Surveyor and the latter as a Helper. Mr. John J. Dobson, Helper, left the Department on January 22nd to return to underground mining. Mr. Hugo H. Korpinen, Engineer, left the Department on May 21st to take charge of introducing the sub-level caving system of mining at the different mines. Mr. Harry C. Swanson, Surveyor, left the Department on September 21st, to assist in preparing plans for the development of Section 1, 47-27. Messrs. Alfred B. Nault and Raymond E. Oja entered the Department as Helpers on September 10th and October 1st, respectively.

The following table shows the personnel of the Department during the year, their positions, and period of employment:

Name	Position	Entered	Left	1946 Employment
Carl Brewer	Recorder			12 Months
Robert M. DeGabriele	Engineer			12 "
John M. Haivala	"			12 "
Grant T. Hollett	"			12 "
T. Adolph Kauppila	"			12 "
Hugo H. Korpinen	"		May 21st	5 "
Maxwell H. Madsen	"			12 "
W. Harlow Stannard	Draftsman			12 "
Lawrence K. Viall	"			12 "
Edgar G. Curtis	Surveyor			12 "
C. Arthur Koski	"			12 "
F. Alfred Koski	"	Jan. 14th		11½ "
Ernest A. Oja	"			12 "
Harry C. Swanson	"		Sept. 21st	9 "
Clifford H. Amel	Helper			12 "
John J. Dobson	"		Jan. 22nd	½ "
P. Daniel Isaacson	"	Jan. 14th		11½ "
Louis R. Miller	"			12 "
Alfred B. Nault	"	Sept. 10th		3½ "
Raymond E. Oja	"	Oct. 1st		3 "
Donald W. Carlson	Stenographer	Jan. 2nd		12 "

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

Name	Date Entered	Length of Service
Carl Brewer	August, 1906	28 years, 3 months.
Robert M. DeGabriele	December, 1945	1 " 1 "
John M. Haivala	March, 1943	3 " 10 "
Grant T. Hollett	August, 1940	6 " 4½ "
T. Adolph Kauppila	March, 1944	2 " 10 "
Maxwell H. Madsen	September, 1943	3 " 4 "
W. Harlow Stannard	November, 1940	6 " 2 "
Lawrence K. Viall	April, 1945	1 " 8 "
Edgar G. Curtis	February, 1944	2 " 11 "
C. Arthur Koski	June, 1941	2 " 1 "
F. Alfred Koski	January, 1936	6 " 9 "
Ernest A. Oja	March, 1943	3 " 10 "
Clifford H. Amel	May, 1944	2 " 7½ "
P. Daniel Isaacson	November, 1940	1 " 4½ "
Louis R. Miller	August, 1945	1 " 4½ "
Alfred B. Nault	September, 1946	3½ "
Raymond E. Oja	October, 1946	3 "
Donald W. Carlson	August, 1936	7 " 1 "

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 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, sick or absent during the year of all those who were in the Department:

Name	Days Worked	Days Sick	Days Absent
Carl Brewer	237½	1	38
Robert M. DeGabriele	271	1½	4
John M. Haivala	262½	2½	13
Grant T. Hollett	270½	1	6
T. Adolph Kauppila	270	½	8½
Hugo H. Korpinen	109½	2	1½
Maxwell H. Madsen	267½	1	10½
W. Harlow Stannard	258½	1½	16½
Lawrence K. Viall	260	4½	12
Edgar G. Curtis	259	3	15½
C. Arthur Koski	269½	-	8
F. Alfred Koski	261½	-	7
Ernest A. Oja	264½	5	7
Harry C. Swanson	204	-	6
Clifford H. Amel	266½	1	9
John J. Dobson	16½	-	-
P. Daniel Isaacson	264	--	4½
Louis R. Miller	259	1	17½
Alfred B. Nault	82½	-	3½
Raymond E. Oja	68½	-	-
Donald W. Carlson	259½	6	11

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

Name	Underground	Field	Office	Total
Carl Brewer	-	32	205½	237½
Robert M. DeGabriele	107	27	137	271
John M. Haivala	110	17½	135	262½
Grant T. Hollett	83	40	147½	270½
T. Adolph Kauppila	113	35	122	270
Hugo H. Korpinen	30	13	66½	109½
Maxwell H. Madsen	63	15	189½	267½
W. Harlow Stannard	-	14½	244	258½
Lawrence K. Viall	-	9	251	260
Edgar G. Curtis	124	23	112	259
C. Arthur Koski	119	53	97½	269½
F. Alfred Koski	97½	72	92	261½
Ernest A. Oja	34	89	141½	264½
Harry C. Swanson	82	34	88	204
Clifford H. Amel	55	90	121½	266½
John J. Dobson	9	-	7½	16½
Louis R. Miller	109	26	124	259
P. Daniel Isaacson	111	68	85	264
Alfred B. Nault	30	16½	36	82½
Raymond E. Oja	37	10	21½	68½
Donald W. Carlson	-	-	259½	259½
TOTAL	1,313½	684½	2,684	4,682
%	28.1	14.6	57.3	100.0

The practice, started in 1945, of having survey crews consisting of a Surveyor and two helpers to do all the surveying to relieve the mining engineer of this detail, has been so successful that it has been decided to expand this part of the Department to take care of the demands of the Mine Superintendents and Mining Captains. The sub-level caving system of mining requires that each sub-level drift be accurately located according to previously prepared plans. This requires more sub-level surveying than was called for by the top-slicing mining method. Now each sub-level caving drift is driven on lines given by the survey crew. As a consequence, it has been necessary to increase the number of surveyors and helpers. Furthermore, it is necessary that a surveyor should spend as much time in the office calculating and plotting his work as is required underground running the surveys. Office work has suffered owing to the demand for underground surveys. The increased development of the Mather Mine alone calls for the continuous employment of two surveyors and two helpers, so that the proper attention can be paid to the mapping and plotting of the mine workings. An additional crew is necessary for the Cliffs-Shaft Mine and two other crews to take care of the other mines.

During the latter part of the year, Mr. F. Alfred Koski and C. Arthur Koski, with P. D. Isaacson and R. E. Oja, helpers, were the survey crews for the Ishpeming, North Lake and Iron River Districts, and Messrs. E. G. Curtis, Surveyor, with L. R. Miller as Helper, for the Negaunee District. It will be necessary to have an additional surveyor and helpers for the Negaunee District. Ernest Oja, Surveyor, assisted Mr. Madsen in the Cliffs-Shaft Mine until his illness which prevented him from going underground.

The following is a resume of the work done by the members of the Department during the year:

CARL BREWER, Recorder, supervised the general work of the Department and laid out the general plans for surface and underground surveys, triangulation work, etc. He initialed the documents passing through the Department and made spcial reports regarding them as was necessary. He compiled the Annual Report books, Tax Commission reports, stockpile estimates, etc. He spent considerable time planning the proposed Cliffs 7th Addition to the City of Ishpeming and was in the field supervising the street surveys and installation of block corners, etc. He prepared the tax list for the Mining Department and the Cliffs Power & Light Company lands.

The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
General Engineering	-	32	205½	237½	100.0
%	-	13.5	86.5		100.0

GRANT T. HOLLETT, Engineer, was in charge of the engineering work at the Mather Mine for the entire year, and at the Cambria-Jackson Mine during January.

The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Mather Mine	81	31	127	239	88.3
Cambria-Jackson Mine	2	-	4	6	2.2
General Engineering	-	7	14½	21½	8.0
Section 1, 47-27	-	2	2	4	1.5
TOTAL	83	40	147½	270½	
%	30.7	14.8	54.5		100.0

ROBERT M. DEGABRIELE, Engineer, did the engineering work at the Cambria-Jackson Mine after February 1st and at the Athens Mine after May 1st. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	48½	9	48	105½	38.9
Cambria-Jackson Mine	52	17	78½	147½	54.3
Maas Mine	2	-	-	2	.8
Mather Mine	2	-	9	11	4.1
Negaunee Mine	1	1	½	2½	.9
Princeton Mine	½	-	-	½	.2
Spies Mine	1	-	-	1	.4
Tilden Mine	-	-	1	1	.4
TOTAL	107	27	137	271	
%	39.5	10.0	50.5		100.0

JOHN M. HAIVALA, Engineer, was in charge of the engineering work at the Athens Mine from January 1st to May 1st, at the Negaunee Mine for the entire year, and at the Lloyd and Spies-Virgil Mines from May 1st to the end of the year. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	9	-	20	29	11.0
Cambria-Jackson Mine	2	3	1½	6½	2.5
Lloyd Mine	23	2	24½	49½	18.9
Mather Mine	11	1½	8	20½	7.8
Negaunee Mine	32½	5	42	79½	30.3
Spies-Virgil Mine	32½	4	35½	72	27.4
General Engineering	-	2	3½	5½	2.1
TOTAL	110	17½	135	262½	
%	41.9	6.7	51.4		100.0

T. ADOLPH KAUPPILA, Engineer, was in charge of the engineering work at the Maas Mine for the entire year, at the Princeton Mine until it closed down in May and at the Tilden Mine from May 1st until the end of the year. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Cambria-Jackson Mine	5	½	½	6	2.2
Maas Mine	83	6	85½	174½	64.8
Mather Mine	12	2½	-	14½	5.4
Princeton Mine	10½	6	17	33½	12.2
Tilden Mine	-	17½	15	32½	12.1
General Engineering	2½	2½	4	9	3.3
TOTAL	113	35	122	270	
%	41.8	13.0	45.2		100.0

HUGO H. KORPINEN, Engineer, did the engineering work at the Lloyd and Spies-Virgil Mines until May 21st when he left the Department to supervise the adoption of the sub-level caving system of mining. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Lloyd Mine	10½	2	22	34½	31.5
Mather Mine	8½	3½	11½	23½	21.5
Spies-Virgil Mine	10	1	24	35	32.0
General Engineering	1	6½	9	16½	15.0
TOTAL	30	13	66½	109½	
%	27.4	11.9	60.7		100.0

MAXWELL H. MADSEN, Engineer, did the engineering work at the Cliffs-Shaft Mine for the entire year and at the Tilden Mine until May 1st. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Cambria-Jackson Mine	4			4	1.5
Cliffs-Shaft Mine	52	6½	145	203½	76.0
Mather Mine	4½	½	3½	8½	3.2
Tilden Mine		3½	12½	16	6.0
General Engineering	2½	4½	24½	31½	11.8
Sec. 1, 47-27			4	4	1.5
TOTAL	63	15	189½	267½	
%	23.6	5.6	70.8		100.0

W. HARLOW STANNARD, Draftsman, posted most of the annual report maps, did the cross-hatching and put the geology on the tracings of all the mines. He made many miscellaneous drawings for the Department and posted some of the diamond drill records for the Geological Department. He assisted in the field work of the stockpile surveys and in laying out the Cliffs 7th Addition. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine			18½	18½	7.2
Cambria-Jackson Mine		2	10	12	4.6
Cliffs-Shaft Mine		½	4	4½	1.7
Lloyd Mine			3	3	1.2
Maas Mine		1	30	31	12.0
Mather Mine			18½	18½	7.2
Negaunee Mine			19	19	7.4
Princeton Mine		1		1	.4
General Engineering			64½	64½	24.9
Republic Mine		4		4	1.5
Geological Department			42	42	16.2
Cliffs 7th Addition		6	5	11	4.3
Section 1, 47-27			15	15	5.8
Section 11, 47-27			9	9	3.5
Morris Mine			5½	5½	2.1
TOTAL		14½	244	258½	
%		5.6	94.4		100.0

LAWRENCE K. VIALL, Draftsman, spent most of the year making new tracings and mounted maps for the various mines. He also posted some of the drill records for the Geological Department. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine		1	27	28	10.8
Cambria-Jackson Mine			31	31	11.9
Cliffs-Shaft Mine			1	1	.4
Lloyd Mine			1½	1½	.6
Maas Mine			59½	59½	22.9
Mather Mine		1	39½	40½	15.6
Negaunee Mine		1½	18½	20	7.7
Spies Mine			20	20	7/7
Tilden Mine			4	4	1.5
General Engineering			31½	31½	12.1
Geological Department		5½	13	18½	7.1
Section 1, 47-27			3	3	1.1
Morris Mine			1½	1½	.6
TOTAL		9	251	260	100.0
%		3.5	96.5		100.0

EDGAR G. CURTIS, Surveyor, has done the surveying at the Athens, Cambria-Jackson, Maas and Negaunee Mines for the entire year. He has, of course, had considerable assistance from other surveyors as these properties are too much for one man to handle.

The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	29	7½	35½	72	27.8
Cambria-Jackson Mine	40½	9	34	83½	32.2
Maas Mine	27	1	23	51	19.7
Mather Mine	13	1	3½	17½	6.8
Negaunee Mine	8½	2½	13	24	9.3
Princeton Mine	6		2½	8½	3.3
General Engineering		2	½	2½	.9
TOTAL	124	23	112	259	
%	47.9	8.9	43.2		100.0

C. ARTHUR KOSKI, Surveyor, was a helper until October when he was made Surveyor and assisted Mr. Madsen in the Cliffs-Shaft Mine. He has also done some surveying in the Negaunee District. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	5½			5½	2.0
Cambria-Jackson Mine	14½	4½	1	20	7.4
Cliffs-Shaft Mine	18½	2	18	38½	14.3
Lloyd Mine	9	1	4	14	5.2
Maas Mine	14½	3½	3	21	7.8
Mather Mine	41	4½	10	55½	20.6
Negaunee Mine	5½	3		8½	3.2
Princeton Mine	2	3	2½	7½	2.8
Spies Mine	8½	1½		10	3.7
General Engineering		22½	58	80½	29.9
Geological Department		2½		2½	.9
Section 1, 47-27		5	1	6	2.2
TOTAL	119	53	97½	269½	
%	44.1	19.7	36.2		100.0

F. ALFRED KOSKI, Surveyor, entered the Department on January 14th and for the rest of the month assisted the other surveyors. He did the surveying at the Lloyd Mine after February 1st; at the Maas and Negaunee Mines between February 1st and July 1st and at the Mather and Spies-Virgil Mines after September 21st. He also made the triangulation surveys and assisted in the shaft plumbings and surface surveys in Sections 1 and 11, 47-27. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine			2	2	.8
Cambria-Jackson Mine	2	7		9	3.4
Cliffs-Shaft Mine	16	2	15½	33½	12.8
Lloyd Mine	15	2	12	29	11.1
Maas Mine	8	1½	11½	21	8.0
Mather Mine	39½	10	19	68½	26.2
Negaunee Mine	7	4½	12	23½	8.9
Princeton Mine		3½	3	6½	2.5

Property	Underground	Field	Office	Total	%
Spies-Virgil Mine	10	-	4½	14½	5.6
Tilden Mine		2	½	2½	1.0
General Engineering		33½	8	41½	15.9
Section 1, 47-27		5	2	7	2.7
Section 11, 47-27		1	2	3	1.1
TOTAL	97½	72	92	261½	
%	37.3	27.5	35.2		100.0

ERNEST A. OJA, Surveyor, assisted Mr. Madsen in the Cliffs-Shaft surveying until June when he was taken sick and has been unable to go underground since. He has, however, done considerable work on surveys in Section 11, 47-27 and was in charge of the field work and the laying out of the Cliffs 7th Addition to the City of Ishpeming. He also ran surveys in Section 9, tying in Section corners, etc. He made the stockpile surveys and did cross-sectioning at the Republic Mine. He assisted in calculations and other office work during the latter part of the year. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	1½		5½	7	2.6
Cambria-Jackson Mine	-	7	6½	13½	5.1
Cliffs-Shaft Mine	7	1½	13	21½	8.1
Lloyd Mine			5½	5½	2.1
Maas Mine	3	2½	11½	17	6.4
Mather Mine	16½	4½	10½	31½	11.9
Negaunee Mine	-	2	6	8	3.0
Princeton Mine	2	-	1½	3½	1.3
Spies-Virgil Mine	4	7	8½	19½	7.5
Tilden Mine		3	4	7	2.6
General Engineering		8½	51	59½	22.5
Cliffs 7th Addition		37	9	46	17.4
Section 1, 47-27		5	3	8	3.0
Section 11, 47-27		4½	2	6½	2.5
Republic Mine		6½	4	10½	4.0
TOTAL	34	89	141½	264½	
%	12.9	33.6	53.5		100.0

HARRY C. SWANSON, Surveyor, did the surveying at the Mather and Spies-Virgil Mines until September 21st and at the Lloyd Mine during January. On September 21st he left the Department to do special work at the Mather Mine in connection with Section 1, 47-27 development. He was on the shaft plumbing work at the Mather and Cambria-Jackson Mines and the ventilation shaft at the Spies. He assisted in the triangulation calculations and ran a special survey in Section 1, 47-27. The following tables shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine			½	½	.2
Cambria-Jackson Mine	5	2½	2	9½	4.7
Lloyd Mine	4½	2	1½	8	3.9
Maas Mine	1	3	1	5	2.4
Mather Mine	46½	9	41½	97	47.5
Negaunee Mine	1	1	½	2½	1.2
Spies-Virgil Mine	24	3½	18½	46	22.5
General Engineering		5½	17½	23	11.3
Section 1, 47-27		5½		5½	2.8
Section 11, 47-27		2	5	7	3.5
TOTAL	82	34	88	204	
%	40.2	16.7	43.1		100.0

CLIFFORD H. AMEL, Helper, did all the blueprinting for the Annual Report as well as much of the other printing during the year. He assisted in most of the surface surveys, including the Cliffs 7th Addition, and in some surveys underground on main levels. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	6½	2	5½	14	5.3
Cambria-Jackson Mine	4½	3½	1	9	3.4
Cliffs-Shaft Mine	½			½	.2
Cliffs 7th Addition		18½		18½	6.9
Lloyd Mine	2	1		3	1.1
Maas Mine	5	4	3	12	4.5
Mather Mine	25½	9	6½	41	15.4
Negaunee Mine	5	2		7	2.6
Princeton Mine		3½		3½	1.3
Spies-Virgil Mine	6	2½	2	10½	3.9
Tilden Mine		9		9	3.4
General Engineering		19	102	121	45.4
Section 1, 47-27		11	1½	12½	4.7
Republic Mine		5		5	1.9
TOTAL	55	90	121½	266½	
%	20.6	33.8	45.6		100.0

JOHN J. DOBSON, Helper, assisted in the underground surveys until he left the Department on January 22nd to take a job underground at the Cliffs-Shaft Mine. The following table shows the distribution of his time while in the Engineering Department:

Property	Underground	Field	Office	Total	%
Athens Mine	1			1	6.1
Cambria-Jackson Mine	1			1	6.1
Cliffs-Shaft Mine	2		2	4	24.2
Mather Mine	4			4	24.2
Spies-Virgil Mine	1			1	6.1
General Engineering			5½	5½	33.3
TOTAL	9	-	7½	16½	
%	54.5		45.5		100.0

P. DANIEL ISAACSON, Helper, entered the Department on January 14th and for the balance of the year assisted in the various surface and underground surveys, especially at the Cliffs-Shaft, Mather, Lloyd and Spies Mines. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	3	1	7	11	4.2
Cambria-Jackson Mine	2	8	3½	13½	5.1
Cliffs-Shaft Mine	28	2	9½	39½	15.0
Lloyd Mine	6½	½	4½	11½	4.4
Maas Mine	4	1½	10½	16	6.1
Mather Mine	48	11	22	81	30.7
Negaunee Mine	3½	2	2½	8	3.0
Spies Mine	16		1½	17½	6.6
Tilden Mine		1½	½	2	.8
General Engineering		28	21	49	18.4
Cliffs 7th Addition		3½		3½	1.3
Section 1, 47-27		5		5	1.9
Section 11, 47-27		4	2½	6½	2.5
TOTAL	111	68	85	264	
%	42.0	25.8	32.2		100.0

LOUIS R. MILLER, Helper, assisted in the surface and underground surveys in the Negaunee District during the year. He also assisted in the shaft plumbings and other special surveys during the strike. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	25½	6½	13	45	17.4
Cambria-Jackson Mine	31	12	23½	66½	25.6
Cliffs-Shaft Mine			9	9	3.5
Maas Mine	27	1½	23	51½	19.9
Mather Mine	14	1	4½	19½	7.5
Negaunee Mine	7½	1½	6	15	5.8
Princeton Mine	4		3½	7½	2.9
General Engineering		3½	41½	45	17.4
TOTAL	109	26	124	259	
%	42.1	10.0	47.9		100.0

ALFRED B. NAULT, Helper, entered the Department on September 10th. He assisted principally in the Cliffs-Shaft Mine surveys with occasional work at other properties, and in the blueprinting, etc. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Cambria-Jackson Mine	1			1	1.2
Cliffs-Shaft Mine	19	1	11	31	37.6
Lloyd Mine		1		1	1.2
Maas Mine	4			4	4.9
Mather Mine	4½	½	2	7	8.5
Negaunee Mine	½	1½		2	2.4
Princeton Mine		3½		3½	4.3
Spies Mine	1			1	1.2
General Engineering		3½	23	26½	32.1
Cliffs-7th Addition		2½		2½	3.0
Geological Department		3		3	3.6
TOTAL	30	16½	36	82½	
%	36.4	20.0	43.6		100.0

RAYMOND E. OJA, Helper, started on October 1st and has assisted in the underground surveys at the Mather, Lloyd and Spies-Virgil Mines. The following table shows the distribution of his time for the year:

Property	Underground	Field	Office	Total	%
Athens Mine	2½			2½	3.6
Cambria-Jackson Mine	1	2½		3½	5.1
Maas Mine	6	3		9	13.1
Mather Mine	19		1	20	29.2
Negaunee Mine	3½			3½	5.1
Spies Mine	5			5	7.3
Tilden Mine		1½		1½	2.3
General Engineering			20½	20½	29.9
Cliffs 7th Addition		2		2	2.9
Section 11, 47-27		1		1	1.5
TOTAL	37	10	21½	68½	
%	54.0	14.6	31.4		100.0

DONALD W. CARLSON, Stenographer, re-entered the Department on January 2nd and did the stenographic work for both the Engineering and Geological Departments.

E. DISTRIBUTION OF TIME

The landscaping at the Cambria-Jackson Mine required more attention during the year than at any of the other mines. There has been very little surface work at the other properties. The Mather Mine required a large amount of attention during the year and during the idle period most of the Engineering Department staff was engaged in shaft plumbing to check the underground surveys.

The development of the 1330' Sub-Level drainage drift at the Spies-Virgil Mine also required a considerable amount of attention. Triangulation surveys and work in the Cliffs-7th Addition and in Sections 1 and 11, 47-27 constituted most of the surface surveying during the year.

The following table shows the distribution of time for the year, divided between underground, field and office, for the different properties, and the percentage of time spent on each property:

Property	Underground	Field	Office	Total	%
Athens Mine	132	27	182½	341½	7.3
Cambria-Jackson Mine	167½	78½	197	443	9.5
Cliffs-Shaft Mine	143	15½	228	386½	8.3
Lloyd Mine	70½	11½	78½	160½	3.4
Maas Mine	184½	28½	261½	474½	10.1
Mather Mine	390½	90½	337½	818½	17.5
Negaunee Mine	75½	27½	120	223	4.8
Princeton Mine	25	20½	30	75½	1.6
Spies-Virgil Mine	119	19½	114½	253	5.4
Tilden Mine	-	38	37½	75½	1.6
General Engineering	6	180½	705½	892	19.1
Geological Department		11	55	66	1.4
Republic Mine		15½	4	19½	.5
Section 1, 47-27		38½	31½	70	1.4
Section 11, 47-27		12½	20½	33	.7
Cliffs 7th Addition		69½	14	83½	1.8
Stenography			259½	259½	5.5
Morris Mine			7	7	.1
TOTAL	1,313½	684½	2,684	4,682	
%	28.1	14.6	57.3		100.0

F. COSTS

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

	1944	1945	1946
Salaries	$ 30,138.74	$ 30,073.34	$ 40,802.33
Auto Expense	2,174.41	2,506.99	2,373.78
Furniture and Fixtures	47.30	27.65	261.51
Heat, Light and Power	563.04	617.29	789.69
Insurance	12.55	86.00	124.32
Postage	37.67	28.99	33.70
Repairs	68.62	67.77	112.88
Stationery and Printing	251.15	126.23	153.65
Supplies	3,532.24	3,695.97	3,450.24
Taxes	46.79	46.72	46.69
Traveling and Entertainment	155.78	210.15	159.64
Telephone and Telegraph	199.44	122.24	96.08
Papers and Periodicals	10.07	12.24	21.43
Unemployment Insurance Tax	378.55	390.15	529.87
General - Unclassified	502.92	228.33	491.79
Old Age Benefit Tax	291.20	300.15	407.63
Depreciation	104.07	104.07	104.07
Equipment	15.09	995.15	788.58
TOTALS	$ 38,449.63	$ 39,639.43	$ 50,748.18

H. AUTOMOBILES

The Four Wheels, Inc. replaced the Ford Sedan on August 17th. The Company-owned Ford and Chevrolet station-wagons were operated throughout the year.

The following table shows the mileage covered in 1946, the total mileage to the end of the year, and the date the cars were received in the Engineering Department:

Car	Miles		Date Received
	1946	Total	
Ford Sedan	5,123	45,696	Jan. 30, 1941
Ford Sedan	5,637	6,345	Aug. 17, 1946
Ford Station-Wagon	6,356	40,429	Jan. 24, 1941
Chevrolet Station-Wagon	9,600	39,241	July 29, 1943

I. MINES

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

GENERAL

The general strike in the Lake Superior District closed the mines between February 8th and May 22nd. As long as the Engineering Department was permitted to go underground, several plumbings of the Mather shaft were made and also plumbings at the Cambria-Jackson Mine, in order to check our previous plumbings of these properties. This idle period gave us a very good chance to do this work and we were fortunate in being able to have plenty of time, without interfering with mining operations. As weather permitted, the triangulation system was extended and the surveys were calculated and brought up to date. When the mines are in operation, it is quite difficult to work on the surface surveys and we utilized the idle period to the best advantage for this purpose. As noted above, the surveys crews were kept very busy throughout the operating portion of the year. The use of these crews permits the engineers to spend more time with the Superintendent and Captain in planning the underground work and makes it possible to do more planning of development than was previously possible.

ATHENS MINE

Ground subsidence over the Athens ore deposit has disturbed our principal survey stations at this property and a new survey was run around the East end up to the shaft and engine house, so as to preserve the original surveys. The original survey plugs on the main levels were in pretty bad

condition due to rotting, and in many places only one or two permanent survey stations remained. During the idle period of the strike, new survey plugs were installed on all main levels and check surveys run to them, tying in with what old survey points remained. Also, surveys were run up raises to check between levels so that by the time the mine reopened, all the main levels had been resurveyed and double-checked. Plans were drawn for the block caving of certain areas and lines and grades were given as required for this development. Lines and grades were also given for sub-level caving throughout the mine.

CAMBRIA-JACKSON MINE

The landscaping around the shaft and mine buildings required frequent grades and lines for sidewalks, curbs, roads, etc. The new fence around the possible caving area required an extensive survey. Grades and lines were given for the new shop building. When the mine was idle, check shaft plumbings were made from surface to the 5th Level, 5th to 7th Levels, and 6th to 7th Levels. Also, two check surveys were run on the 7th Level from the shaft to the breast, advancing toward the Mather Mine. This drift was about 100' distant from the Mather property at the end of the year. Lines were given for raises, sub-level caving drifts, etc. as required.

CLIFFS-SHAFT MINE

During the year, Mr. Madsen completed an estimate of ore remaining in pillars. This estimate was made for purposes of record and irrespective of whether or not the ore in the pillars could be recovered. Two quarterly surveys of the property were made during the last half of the year. Special development raises and drifts were mapped monthly for the Superintendent. Diamond drill holes were located and several special studies were made for the Superintendent.

LLOYD MINE

After the strike the proposed plan for a winze to the 9th Level was abandoned. During the rest of the year lines were given for raises and stopes as required.

MAAS MINE

Early in the year a ventilation drift on the 170' Sub-Level made a connection between the 4th Level, Maas, and 13th Level, Negaunee Mine. This connection gave us the first opportunity in many years to check the surveys between old survey stations near the Maas and Negaunee shafts to a common point near the boundary. These surveys show a check of .77 in Northing and Southing and 1.47' in Easting and Westing, and 1'40" in course. This was a very satisfactory check, considering the fact that there has been no proper tie-in between the two properties since the 3rd Level, Maas, holed into the 12th Level, Negaunee, many years ago. Lines were given for the sub-level caving development above the 4th and 6th Levels. Surveys were also run to other sub-levels as required.

MATHER MINE

Check surveys were run to the East timber tunnel before work was resumed in the spring. Plans were prepared for stockpile ground grades and this work was checked as the work was conducted from time to time. The bases for the new stockpile trestle piers were staked out.

During February the shaft was plumbed from the 3rd Level down, taking off at the 5th and 6th Levels to check previous surveys. These surveys did not check very well as there was considerable vibration due to air currents. Furthermore, it was noticed that magnetic fields were set up by the electric cables which affected the position of the plumbing wires. It was therefore decided that the entire shaft be re-plumbed by two separate crews. It was further decided that the plumbings should be at shorter intervals rather than all the way down and taking off at the various levels. Two independent plumbing crews, "A" and "B", were organized. Crew "A" would plumb one day, putting their wires on the East side of the shaft and Crew "B" would plumb the same distance the following day, placing their wires on the West side of the cage road of the shaft. The following table shows the engineers, surveyors and helpers that were engaged in these plumbings and the dates and intervals of these plumbings:

March 5th - - - Surface to 960' Level

Korpinen	Haivala	
F.A.Koski	Swanson	(Crew "A")
Isaacson	Amel	

March 6th - - - Surface to 960' Level

Hollett	Kauppila	
E. Oja	Curtis	(Crew "B")
C.A.Koski	Miller	

March 7th - - - 960' Level to 3rd Level
Crew "A"

March 8th - - - 960' Level to 3rd Level
Crew "B"

March 9th - - - 3rd Level to 6th Level
Crew "A"

March 10th- - - 3rd Level to 6th Level
Crew "B"

March 18th- - - Surface to 960' Level
Crew "A"

March 19th- - - Surface to 960' Level
Crew "B"

The results of this work were satisfactory and checked very closely the original plumbings. We now feel satisfied that the underground surveys are correct. The development of the 5th and 6th Levels were checked very closely and also the mining above the 2nd and 5th Levels. Lines were given as required for this development work.

NEGAUNEE MINE

Very little new development was conducted at this property during the year, but lines and grades were given as required for sub-level caving drifts and stopes.

PRINCETON MINE

This mine was not reopened after it was closed by the strike on February 8th. Underground equipment and pumps were removed and the mine abandoned as an operating property. Concrete slabs were placed at the collars of the shafts.

SPIES-VIRGIL MINE

The stripping of the bore hole to the 1330' elevation was completed early in the year. The location of the sollars in the enlarged shaft were carefully planned so as to permit the passage of the hoisting cable without interference with ladder roads, pipes, etc. The drainage drift toward the East Deposit was planned and surveyed. Owing to the fact that the shaft was not straight, a special plumbing device was needed to carry our lines down to the underground drift in the East Deposit. The surveys were run to the stopes and drainage drift on the 1330' Sub-Level and lines given for drifting toward the ventilation shaft. Also, the drainage drill holes were located and surveyed as required. The conditions for underground surveying in the East deposit are extremely difficult owing to the large amount of water encountered in the raises and the short steep survey sights. Plans were prepared for the utilization of the ventilation shaft for pumping and elevations were run for a surface discharge line. The North-South section 4800 E. was run for the Geological Department.

TILDEN MINE

Estimates of stripping were made and surveys run for outlining these areas. The location of drill holes were surveyed and the blasts calculated and supervised by the engineer in charge.

J. MISCELLANEOUS

SHAFT GAUGING

The following table shows the dates when the cage and skip runners in the shafts of the operating mines were gauged:

Mine	Shaft	Date
Athens	-	April 1st
Cambria-Jackson	Hartford #2	March 29th
Cliffs-Shaft	"A"	April 2nd
Cliffs-Shaft	"B"	April 2nd
Lloyd	No. 2	March 27th
Maas	-	March 28th
Mather	-	April 3rd
Negaunee	No. 3	April 4th
Princeton	No. 2	April 5th
Princeton	No. 3	April 5th
Spies-Virgil	Spies	April 8th.

STOCKPILES

The ore in stock at the various Michigan mines was estimated and reported as of November 1st. The following table shows the comparison of ore in stock as of November 1st, 1945 and November 1st, 1946:

Mine	Nov. 1, 1945	Nov. 1, 1946	Difference
Athens	4,049	26,975	22,926
Cambria-Jackson	18,626	73,515	54,889
Cliffs-Shaft	876	45,526	44,650
Lloyd	217,590	248,343	30,753
Maas	80,395	98,680	18,285
Mather	0	702	702
Negaunee	20,449	71,114	50,665
Princeton	160,167	143,479	-16,688
Spies-Virgil	10,670	51	-10,619
TOTAL	512,822	708,385	195,563

TAXES

Mr. Brewer prepared the tax list for the Mining Department lands in Michigan, Wisconsin and Minnesota and also for the lands of the Cliffs Power & Light Company. He checked over the delinquent tax lists of some of the Michigan counties to make sure that no Company mineral lands were listed, and made such recommendations for purchase as seemed advisable.

EXPLORATIONS

The following diamond drill holes were located and surveyed for the Geological Department during the year:

Hole No.	Location
144	Section 1, 47-27
32, 33, 34	Section 4, 47-27
9	Section 11, 47-27
78, 79	Section 24, 43-35

TRIANGULATION

During the strike period some of the members of the Engineering Department, including Messrs. Madsen, Kauppila and Swanson, worked up forms for adjusting triangulation quadrilaterals by the method of Least Squares. This method of adjusting is used by the U. S. Government and has been used by us in adjusting all of our triangulation quadrilaterals. Two quadrilaterals in the City of Negaunee were surveyed, extending our triangulation system Easterly to the Maas and Athens Mines. The Interstate Iron Company is desirous of tying into our triangulation system and putting their maps on our coordinate system. It seemed desireable, therefore, to textend our surveys in this direction so that our boundaries along the Athens, Bunker Hill and Lucy Mines can be tied in to our triangulation system. One of the quadrilaterals in Section 6, 47-26 used two survey stations that had been included in a

traverse survey by Mr. Trosvig in 1939 in determining the mineral boundaries of the Pioneer & Arctic Lands in Section 6. The distance between these two survey points, namely Station 456 and Station 200, was 2918.32' by Mr. Trosvig's survey and 2918.47' by triangulation. This difference of .15' in this distance showed an excellent check between the traverse survey and triangulation.

Another quadrilateral was surveyed to extend the surveys to the North side of Teal Lake. Weather conditions, however, prevented getting good results and the resumption of mining operations made it necessary to discontinue observations on this quadrilateral. The triangulation system was, however, extended to the Southern part of Section 11, 47-27 and tied in to existing triangulation stations to the West.

SURFACE TRAVERSE SURVEYS

A survey was run in the triangulation system across the South side of Section 1, 47-27 in order to locate certain boundary corners on the South line of Section 1. This information was needed to calculate the mineral boundaries of Section 1. A search was made in Section 11, 47-27 to find out how many of the old concreted survey stations were still serviceable. Most of these iron pins were found and the old surveys recalculated on the triangulation system.

A survey was run in Section 9, 47-27 to tie in various quarter and 16th corners in the N½ of this section. This was in connection with the work of staking out the Cliffs 7th Addition.

CLIFFS 7TH ADDITION TO THE CITY OF ISHPEMING

In 1945 a report was prepared by Mr. Brewer recommending the platting of part of the N½ of Section 9, 47-27 for building lots for the City of Ishpeming. At that time the drawback was the flooding of the area by the Carp River. Estimates and new plans for a new Carp River channel were prepared and submitted. Early in the year, the City of Ishpeming dug a new channel for the Carp River in order to facilitate the building project of the Robbins Flooring Mill on part of the area proposed to be platted. This deepening of the Carp River removed the obstacle to platting part of this area.

Approval for platting the Cliffs 7th Addition in the N½ of Section 9 was received in July. In August, surveys were started to determine the exact size and area to be platted. Four tentative lay-outs of the proposed plat were prepared and submitted to the Manager and to the City Council for approval, one of which was accepted. By the time it was necessary to stop field work because of winter weather, all the streets had been staked out and most of the block and plat corners had been placed. By the end of theyear, the City had graded and rock-filled part of the proposed streets. The new map of the plat was underway. This will be completed early in the spring and it is hoped to have the plat accepted and approved before building can be started in the spring.

GROUND WATER IEVELS

The elevation of the ground water levels was taken monthly in the test holes at the Athens, Maas and Negaunee Mines. The following table shows the elevation at the beginning and end of the year, with the net difference and the total difference from the original elevation encountered in the hole:

RELATIVE ELEVATION OF GROUND WATER LEVELS

MAAS MINE

Test Hole No.	Elevation of Water Jan. 1, 1946	Elevation of Water Jan. 1, 1947	Difference 1946	Original Elevation	Total Difference
1W	1248.7	1249.6	+0.9	1317.0	-67.4
2W	1243.9	1240.8	-3.1	1318.8	-78.0
5W	1246.5	1247.1	+0.6	1366.6	-119.5
9W	1268.7	1269.9	+1.2	1281.8	-11.9
13W	1304.9	1303.6	-1.3	1340.0	-36.4
14W	1292.7	1288.2	-4.5	1323.8	-35.6
15W	1309.8	1310.4	+0.6	1326.3	-15.9
16W	1281.8	1280.6	-1.2	1324.8	-44.2
18W	1253.3	1255.0	+1.7	1319.4	-64.4
20W	1259.6	1259.8	+0.2	1319.0	-59.2
21W	1236.9	1236.8	-0.1	1229.1	+7.7
		NEGAUNEE MINE			
6A	1180.5	1178.1	-2.4	1197.0	-18.9
7	1183.0	1182.3	-0.7	1195.1	-12.8
		ATHENS MINE			
104W	1300.8	1295.6	-5.2	1299.5	-3.9
105W	1298.8	1299.8	+1.0	1301.5	-2.7
106W	1295.9	1297.0	+1.1	1302.4	-5.4

AERIAL SURVEY MAPS

Early in the year we received the contour maps prepared by the Aero Service Corporation which they made from aerial photography. We received copies of the maps that were made for the Jones & Laughlin Co. and the Interstate Iron Company as well as those made for us.

HOLIDAYS

The following holidays were granted during the year:

January 1st - - - - - - - - - - New Years Day.
May 30th - - - - - - - - - - - Memorial Day.
July 4th - - - - - - - - - - - Independence Day.
August 14th - - - - - - - - - - V-J Day.
September 2nd - - - - - - - - - Labor Day.
November 28th - - - - - - - - - Thanksgiving Day.
December 24th, (½) - - - - - - - Christmas Eve.
December 25th and 26th - - - Christmas.

Carl Brewer

Recorder

CB:DWC -
3-4-47
-3-

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ATHENS MINE:

In the engine house a new regulator and high pressure cylinder head were installed on the Ingersoll-Rand compressor and valves cleaned on both cylinders during February. In May the intercooler was replaced with a repaired unit which reduced the temperature by 20 degrees. The old unit was repaired and held as a spare. A new Worthington pump, capacity 250 GPM, head 50 feet, was installed to provide better cooling. Hoist and motor-generator sets gave no trouble during the year.

In the headframe new plates in the skip dump pocket and a new butterfly complete with shaft and bearings were installed. New steel liners were inserted on both skip head sheaves.

On surface the cooling water tank was cleaned. The new Brownell stoker was received in April, but due to the strike was not installed until August. A temporary boiler moved from Cliffs Shaft Mine was used during this installation period. All fire extinguishers were tested and filled during January and June.

Underground the large ventilating fan on the 10th level was cleaned and painted and new V-belts installed. A new pump was installed at the Breitung shaft to replace the old one whose motor had burned out. During an electrical storm in August this new motor burned out and was replaced by the old one, which had been repaired. A new plunger was installed on the #1 Prescott pump on the 10th level. The Marlo packing installed by a factory expert on this pump proved unsatisfactory and was removed after 48 days service. A by-pass valve was replaced on this pump. In July a locomotive was lowered from the 4th to the 6th level.

Tests on the first skip equipped with extended guides proved satisfactory and the other skips were similarly rebuilt. On January 13th a new hoisting rope was installed on the cage hoist. During June the skip ropes were oiled and a new counterweight rope installed. In August a new galvanized rope was installed on the north skip and in December changed end for end.

In the shaft twenty-two feet of 6" airline was replaced.

ATKINS MINE:

During June month a 2000 GPM 200 foot head pump was mounted on a scow in the pit and dewatering started July 2nd. In July five new Euclid 15-ton trucks without engines were received and a few days later new Buda 150 HP engines arrived and were installed in the trucks. A 54-B diesel 2½ yard shovel was shipped over from the Holman-Cliffs Mine and stripping started August 26th, continuing the rest of the year. A 500 GPM pump replaced the 2000 GPM unit when dewatering was completed in September.

In December an 85-B electric 2½ yard shovel was received from the Canisteo Mine and erected as a spare for the 54-B. It will also be used to clean up along the belt conveyor location.

On October 7th the 60 foot square wooden garage burned down with a loss of $25,000 worth of equipment, including one new truck. Within ten days a 40 foot square garage was started of concrete blocks and erected in six weeks. This is large enough for all repairing and overhauling.

A new 54-B 2½ yard shovel has been ordered for this mine.

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CAMBRIA-JACKSON MINE:

Painting of the engine house and all machinery, wires, pipes, etc. in safety code colors was completed in April. The Laidlow compressor purchased from the Holmes Mine of the Oliver Iron Mining Company was in operation on the 15th of January. During September, due to excess carbon, the air temperature rose above normal and tripped the motor. Intervals between cleaning of the valves were shortened, but again in November this machine shut down due to excess heat. The ario compressor oil was changed to D.T.E. heavy medium made by the Socony-Vacuum Company. Up until the present time this machine has operated satisfactorily. A new coupling with brake flange was installed on the hoist. The new emergency brake and engine were installed during June and all piping completed in July and they are operating perfectly.

On surface a new stack was installed on the change house boiler to replace the old stack which broke in two. It was decided to replace the old shop with new ones of concrete block construction. Contract was given to McDonald and Kaake and by the end of the year the foundations were in and walls half way up. The new building is located just back of the office to the south west.

Underground the 7th level sump was cleaned in November of 85 skips of mud. The new Gould pump on the 7th level was installed and in operation during July. After 15 days of operation the valves and seats became pitted and were replaced with valves and seats of our own design. No further trouble has been experienced. Credit of $125.00 was received from the company for this replacement work. A test run on pump pole lubrication using present pole grease on one pole and a drip cup containing rock drill oil on the second proved the life of packing much longer at this mine using rock drill oil. All pole lubricators have been changed to the drip type. Building of foundations in the 7th level pump house for the Prescott pump purchased from the Holmes Mine was begun in August. The motor driving the Ingersoll-Rand pump on the 325 foot level supplying water to the air compressors burned out and was replaced.

During January and again in December all wearing shoes on skips and cages were replaced with new shoes. During June the west skip and cage were changed. In September a new double deck cage was installed in the east compartment replacing the old single deck cage. The east skip rope was changed in January and the west rope in December.

Some work was done on the 6 inch discharge line in the shaft.

CANISTEO MINE:

Due to strike at the mine from February 8th to May 22nd ore operations did not start until June 24th, the washing plant working two 8 hour shifts per day and 5 days per week. The season closed November 8th, producing a total of 547,398 tons of concentrates. The west wing of the washing plant was used until October 1st for flotation testing by the Minerals Separation North American Corporation.

Two 2½ yard and one 4 yard electric shovels operated in the pit on stripping and crude ore until November, when one 2½ yard was repaired and shipped to the Atkins Mine to replace the 2½ yard Diesel unit which will be returned to the Holman pit. In December a 4½ yard Harnischfeger electric shovel was received and erected on the north bank near the washing plant. This will be ready to start stripping in January, giving the pit two 4 yard shovels and one 2½ yard. It is planned to ship the 2½ yard electric moved to the Atkins to Ishpeming for stock pile loading when the Atkins Mine receives its new 54-B Diesel shovel.

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CANISTEO MINE: (Continued)

Two new Walters four-wheel drive 20-ton trucks equipped with Buda diesel engines were received and placed on comparative test with two Euclid 20-ton trucks equipped with Cummins Diesel engines. During the first month both front and rear transmissions had to be changed in the Walters truck. A new oil was tried and seems to have corrected this trouble. A years operation should develop some interesting information on these.

CLIFFS SHAFT MINE:

A repaired triplex pump was installed in the basement of the engine house to supply cooling water for the compressors. Water pipe lines to all compressors were changed to copper, and the compressors were thoroughly cleaned. A small Westinghouse Air Brake Company compressor with 5 H.P. motor was installed to supply air to the new emergency hoist brakes when the large compressors are idle.

The new emergency brakes for "A" and "B" shaft hoist were installed and in operation by July. They are operating satisfactorily, though minor adjustments must still be made before they can be classed as perfect.

In the crusher house a rebuilt pan conveyor was installed during July and a new D. O. James speed reducer was placed in operation during December. A new mantle, eccentric, gear, bottom and spout wearing plates were needed on the No. 8 crusher. A new chute was put in between the crusher and screen.

A new Granby type car was placed in service on the "A" shaft upper tram. A new 8'-0" sheave was installed for the "B" shaft counterweight rope. New idler pulley supports of welded pipe construction were installed for both "A" and "B" shaft ropes, replacing the old decayed wood supports.

A temporary boiler was set up at the change house and during January the old boiler was dismantled and removed. In July the new boiler was installed and the temporary boiler taken to the Athens Mine. A larger stack was added to the heating boiler at the laboratory.

Work was begun in July installing the new 1000 GPM 1000 foot head Worthington pump in the new 5th level pump house. During a test run in August the crosshead guide on the motor side was scored. This scoring was caused by poor work at the factory. It was found necessary to practically dismantle the pump, rebore the guide and install an oversize crosshead, before the pump operated satisfactorily. Repairs were immediately begun on the old Prescott pumps as soon as the new one could carry the load.

A new skip box replaced the old one at "A" shaft.

The 80-B electric shovel was received from the Tilden Mine during December. It was erected and stored for stockpile loading next shipping season.

HILL-TRUMBULL MINE:

Due to many changes necessary in washing and retreat plant the ore production did not start until July 1st, with only the washing plant in operation. With non-delivery of screens from Allis-Chalmers Co. due to strikes the retreat plant started September 12th at half capacity and continued at this rate for the season. Both plants closed down October 31st, producing 590,040 tons of concentrates.

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HILL-TRUMBULL MINE: (Continued)

At the washing plant the four Selective Media Concentrators were set up on table jig floor and 24" conveyor belts installed to move their product to the shipping bins. The strike at Allis-Chalmers has eased off sufficiently to ship our screens in the fall and the work on retreat plant this winter will complete it for full production next May. A ball mill is being added on the table floor to reduce size on some types of jig ore. Tests were made on new Pettibone Mulliken tailings pump installed for a try out and its performance warranted ordering a size larger unit to carry the load. The tailings basin is full and next year the pump will have to carry a higher head than formerly.

In the pit no change was made in shovel equipment for the year, but it was necessary to replace some of the worn-out Euclid trucks with new ones of better design. Improvement consists in adding more metal at the weak points and locating the engine to give the repair men a better chance to service it.

HOLMAN-CLIFFS MINE:

The washing plant started June 24th and shut down Novembef 8th, producing 529,070 tons of concentrates. This, with 5,433 tons direct shipping ore, totaled 534,503 tons. While the mine was closed down from February to May, details were completed covering belt conveyor system in pit and the moving of washing plant. Orders were placed in February with most of deliveries ranging from 8 to 12 months. During the summer foundations were built not only in pit for conveyor system but on the south bank ready for moving the washing plant. Piling was driven for loading pocket piers and grading completed for water reservoir. Dismantling of washing plant started in November and was about completed by the end of the year.

In the pit No. 35 shovel replaced No. 57 on stripping in January, while No. 55 and 32 were overhauled at the shop. At the end of the season No. 57 was moved to the shop to be converted into a dragline for stripping work. In October No. 32 was put out of commission by a fall of dirt from the high bank but no one was hurt. In July the No. 55 shovel was repaired and shipped to the Atkins Mine to start stripping there.

The old Layne and Bowler pump sold to this mine from the worked out Stevenson Mine was rented to Pickands Mather Co. for $4,000 per year to drain half of Rabbit Lake on the Cuyuna Range. It is still operating there.

At the shops a second-hand lathe 22" swing by 72" centers was set up to replace a worn-out machine that had been there since 1912. Some trouble was experienced from Cummins engine bearings failing in the trucks. Comparative tests between these and the Buda engine show longer service from the Buda make.

LLOYD MINE:

In the engine house the Sullivan compressor developed sufficient heat in the discharge line to operate the thermal relay trip in spite of frequent cleanings. D.T.E. heavy medium oil in place of the ario compressor was tried and proved satisfactory. Examination and cleaning of the valves have shown much less carbon deposit.

The two second hand hoists moved to the mine for shaft sinking were stored on surface until needed elsewhere. New cup leathers were installed in the skip hoist brake engine to stop a bad air leak.

MECHANICAL DEPARTMENT
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LLOYD MINE: (Continued)

Minor repairs were made on the crusher in the headframe, the skip dump was repaired and a new sheave was installed on the pulley stand.

On surface the stoker in the dry was repaired in January. In May the stoker used at Princeton #2 was installed at the shaft house boiler replacing the old one which was in poor condition. Changes were made in the Morris Mine water supply lines and water supply pump.

Underground repairs were made to the Eimco loader and to the drilling jumbo.

During August both cage and skip ropes were replaced with new ropes.

MAAS MINE:

In the engine house repairs were made on the air compressor during July. A new all steel welded anchor base was installed on the skip hoist power brake, replacing the old cast iron base which was cracked. Repairs were also made on the cage hoist brake.

During June the crusher was repaired.

Underground the installation of the new Aldrich 800 GPM 1200 foot head pump on the 3rd level was completed and in operation during September. Repairs were begun on the #1 Aldrich on this level. The Prescott pump on the 3rd level was repaired several times. Two new valve pots were ordered for this pump, the old pots being in such poor condition, further repairs were inadvisable. These pots are promised for delivery in February. Repairs were also made to the pots and valves on the 5th level Prescott. A small triplex pump from the Princeton Mine now being overhauled in the General Shops will be installed on the 6th level. A leak in the discharge column was repaired by welding.

The stock pile shovels worked into December with the shipping season closing later than usual.

MATHER MINE:

In the engine house new Fisher & Porter flow meters and copper cooling water piping were installed on the air compressors. Compressors were thoroughly cleaned and the cylinders and other hot areas were given a trial coat of heat resisting paint.

Foundations were poured for the columns supporting the extension to the top tram trestles. The hydraulic system on the Larry cars was repaired to prevent oil leakage and the bodies raised one half inch to give more clearance when crossing switches. The cars were equipped with hold downs to prevent tipping while unloading on stockpile. A repair shed for top tram cars was built on the east rock pile.

In the headframe air lines for braking railroad cars were installed for loading ore from pockets. Openings were made in the ore chutes above landing to permit easier cleaning of sticky ore. A new railroad pocket was built on the south side incorporating the roller door which has proved successful underground. The north pocket is now being rebuilt.

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MATHER MINE: (Continued)

On surface the mouth of the east timber tunnel was concreted. The heating boiler was cleaned and repaired. The lines running from the heating coils in the boiler are becoming badly corroded and will need replacing soon. More clothes racks were installed in the dry, additional showers installed in the captain's office and some changes made in the miners toilets.

Underground ore cars are being enlarged from 90 to 100 cubic foot capacity. Car dumping cylinders were installed on the 6th level.

The two 500 GPM pumps on the 1000 foot level were made to operate automatically. A 250 GPM 400 foot head centrifugal pump from the Cambria was installed on the 2200 foot level. Two 500 GPM 2400 foot head Worthington horizontal duplex pumps driven by 350 HP motors were received and will be installed on the 2200 foot level when excavation of pump rooms is completed.

A steel wall and door were built for the ignitron room on the 1900 foot level.

The 1750 and 2200 foot level trenches were equipped with safety screens and rope stands. Grizzly bars were installed on the 6th level pocket.

During July the north skip was replaced by the spare and the south skip replaced by the repaired north skip. In December the spare skip was equipped with pneumatic tired wheels to save wear on the shoes and was installed on December 29th. By covering the steel rail skip guides with pump pole grease each week end the skip shoes life was increased from 3 to 60 days during the summer. In the winter the grease flaked off due to cold and the shoes did not last so long.

NEGAUNEE MINE:

In the engine house the various machines and equipment were painted in National Safety Code colors. A small air compressor from the Princeton Mine was installed in the engine house. A main bearing on the Ingersoll-Rand compressor burned out and was replaced by a spare from the Maas Mine.

Both skip dumps in the headframe were repaired. Both north and south skips were changed and overhauled.

On surface the heating plant for underground air at #2 ventilating shaft was shut down March 8th. During the summer the boiler and stoker were overhauled. The stoker will last this winter, but a new and larger unit will be necessary for the following winter. At the dry heating plant a new stack was added to the boiler and a pump and tank installed in boiler room. Three-hundred feet of 3 inch pipe was installed for fire protection at the sawmill and timber yard.

Underground all pumps operated without trouble during the year. A 4" air line is being installed on the 11th level connecting with the Athens Mine as an emergency measure in case of compressor trouble at either mine. A Buffalo blower fan, size 5½, bought from the Princeton Mine was assembled, equipped with a new base and will be used underground.

The 120-B electric shovel was used for stockpile loading during the shipping season and is now being dismantled and moved to the Mather Mine.

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PRINCETON MINE:

The Princeton Mine ceased operations permanently during July month. The main items of equipment moved so far are as follows:

Description	Shipped To
U.G. Centrifugal pump No. 2 Shaft 500 GPM 500' Head	Maas Mine
Plunger pump, Aldrich, 500 GPM 500' Head	Left in mine
Motor for above pump, 150 HP, 580 RPM	Princeton Shop
Mine cars	Cambria
Motor-generator set	Spies-Virgil
Locomotives, 6-ton	1 - Cliffs Shaft
	2 - Mather
	3 - In Dry
Air Hammer	Mather Mine
Small compressor, 20 HP motor	Negaunee Mine

SPIES-VIRGIL MINE:

The most severe trouble encountered during the year was in pumping, many repairs being made to the pumps and discharge column. The principal cause was very dirty water, the sumps not being cleaned as often and thoroughly as necessary. Ore production was finally discontinued for a period of 6 weeks during September and October, new settling basins were cut out and all sumps cleaned.

The Aldrich quintuplex pump on the 6th level underwent the following repairs. The motor pulley became ragged and worn and caused much damage to the belts and a new pulley was ordered and installed in November. With the new pulley, new leather belt, plungers, valves and seats and packing this pump is now in good condition. The two Prescott pumps on the eighth level were equipped with new herringbone pinions and shafts. Repairs were also made to the 3rd level Deane and the 4th level Aldrich pumps. All pumps now are in good operating condition.

Work on the discharge column consisted of removing practically all flanges and butt welding the joints, replacing several hundred feet of old pipe with new, repairing many leaks and anchoring the column much more solidly to the shaft steel. A diamond drill hole on the 4th level was plugged.

The discharge column was installed in the air shaft and 1600 feet of 6 inch line laid on surface connecting the discharge column to the main Spies discharge creek.

The old concrete cooling pond was repaired and new piping installed replacing the old wood tank which was decayed and leaking badly.

The No. 15 and 30 shovels were repaired during the winter and were used for stockpile loading during the shipping season.

The north skip rope was changed end for end in May and a new cage rope installed in September.

TILDEN MINE:

In the crusher house 8 diaphragm liners, 3 rib liners and a lower mantle were installed on the 42 inch crusher. The motor bearings were sent to the General Shops for rebabbiting and boring.

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TILDEN MINE: (Continued)

On the east 10 inch crusher a lower mantle was installed, concaves changed and bearings changed in the motors before the operating season. During September two new wearing plates and new concaves were installed.

On the west 10 inch crusher new gears in the oil pump, new eccentric and new concaves were installed. Later in the season the rebabbited eccentric was installed.

After the season closed the main pocket was cleaned out and repaired with new timbers and plank lining. Twelve new grizzly bars were installed.

A new jack shaft, complete with clutches and V-belt pulley, was installed on the No. 7-29-T churn drill. No. 7 and 8-29-T churn drills, complete with motors and transformers, were shipped to the Steep Rock Mine, Antikokan, Ontario, Canada.

The conveyor motor armature and bearing will be repaired at the General Shops during the winter.

A new pinion on the swing motor, a shipper shaft on the boom machinery and a new latch plate on the dipper was installed on the No. 46 shovel and the lighting system repaired.

The No. 29 shovel was dismantled and shipped to the Cliffs Shaft Mine during October, where it will be used for stockpile loading. The No. 31 shovel was dismantled and shipped to the Athens Mine during December, where it will be used for stockpile loading.

The old railroad dump cars were sold for scrap as all ore hauling is done by 15-ton Euclid trucks.

GENERAL:

Ernest Keast retired May 1st. due to age and poor health. His work was divided between Folke Johnson and Wilfred Tousignant.

At the end of the year six men in the shops that were over 65 were retired. Some of them had been kept on due to war conditions, the age of the oldest being 72.

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COMPARATIVE TABLES

CLIFFS SHAFT MINE: YEAR	TONS ORE AND ROCK HOISTED	CU. FT. AIR USED	CUBIC FT. AIR PER TON HOISTED	GALLONS OF WATER PUMPED	G.P.M.
1937	579,759	1,102,635,000	1,901	370,765,799	705
1938	352 983	735 452 000	2 083	362 700 824	689
1939	415 682	790 875 000	1 902	363 540 036	693
1940	573 487	1 053 990 000	1 837	362 590 686	686
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
ATHENS MINE:					
1937	455 512	884 565 000	1 941	134 521 343	257
1938	276 800	643 005 000	2 322	165 316 266	313
1939	416 225	819 405 000	1 968	173 774 003	331
1940	526 456	1 196 505 000	2 272	185 418 833	351
1941	638 178	1 305 945 000	2 116	185 835 174	354
1942	699 590	1 351 440 000	1 931	204 553 558	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	1 980	168 139 933	317
MAAS MINE:					
1937	784 328	1 251 710 000	1 595	686 467 622	1,307
1938	438 359	742 635 000	1 694	752 268 448	1 429
1939	528 389	1 005 165 000	1 902	726 916 014	1 386
1940	709 755	1 288 665 000	1 815	710 849 782	1 346
1941	849 963	1 646 145 000	1 936	595 239 587	1 135
1942	894 045	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
NEGAUNEE MINE:					
1937	839 283	1 096 200 000	1 306	562 290 718	976
1938	439 588	771 210 000	1 754	534 118 975	1 015
1939	577 510	1 026 945 000	1 778	532 642 228	1 015
1940	890 598	1 296 675 000	1 455	377 169 929	714
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

MECHANICAL DEPARTMENT
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COMPARATIVE TABLES

YEAR	TONS ORE AND ROCK HOISTED	CU. FT. AIR USED	CUBIC FT. AIR PER TON HOISTED	GALLONS OF WATER PUMPED	G.P.M.
CAMBRIA-JACKSON MINE:					
*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
LLOYD MINE:					
1937	545 274	559 512 000	999		
1938	286 864	293 247 000	1 022		
1939	323 639	273 042 000	843		
1940	487 287	398 308 500	839		
1941	572 778	534 456 000	933	40,031,200 (10 mos)	91
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
MATHER MINE:					
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
TILDEN MINE:					
1937	305 418				
1938	85 889				
1939	170 276				
1940	205 612				
1941	302 943				
1942	235 207				
1943	139 991				
1944	214 824				
1945	197 476				
1946	101 968				
PRINCETON MINE:					
1942	83 918				
1943	248 845	490 680 000	1 971	109 444 342	250 (10 mos)
1944	236 310	434 091 000	1 836	104 716 106	198
1945	280 491	362 925 000	1 293	119 237 162	227
1946	28 438	(Mine abandoned; no ore hoisted after Feb. 8th.)			

(*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.)

THE CLIFFS POWER AND LIGHT CO.
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Due to the strike in the iron ore mines which existed from February 8th until May 22nd, 1946 total output and sales of energy were reduced below the previous year. The total generated and purchased for the year 1946 amounted to 96,432,920 Kwh, which was 4.5% less than was generated and purchased in 1945. Kilowatt-hours sold were correspondingly reduced by 3.5% and revenues were reduced by 8.5% to a total of $1,166,494.53. The revenue decrease is greater than the decrease in Kwh figures mainly because of the fact that we liquidated, during the mine strike, 1,169,000 Kwh which we owed to the Munising Paper Company under a previous agreement and 1,148,000 Kwh which we delivered to the Paper Mill during our flood water period, which enabled us to obtain from them at a later date 574,000 Kwh in return.

We entered the year 1946 with an estimated 20,502,000 Kwh in storage, which constituted 46.1% of our storage capacity. Precipitation during the year was the lowest that has been experienced in the past 16 years and run-off was considerably less than had been experienced in the past years, with the result that our plants were able to produce only 75,914,200 Kwh and it was necessary for us to purchase 20,518,720 Kwh to supply our customers. In spite of these heavy purchases, which were begun in July, we entered the year 1947 with only 10,526,000 Kwh in storage, which represents 24.1% of our storage capacity. The energy generated by our own plants during the year of maximum production, namely 1943, was 32% more than that generated during 1946 and the 1945 generation was 24% greater.

On January 11th the National Labor Relations Board held an election of the company's employees to determine whether or not these employees would accept the United Steelworkers-CIO as their sole bargaining agent. This election was carried by the union 25 votes for and 16 votes against the bargaining unit. All employees eligible to vote at the election cast ballots. Due to the union being very busy with the strike we heard nothing from the union officials in regard to the drafting of a labor contract until June. However, immediately after the granting of the 10¢ per hour increase by the mining companies in March we had a conference with Messrs. Grenfell, Zhulkie and Krieg, who represented the local union of the United Steelworkers, at which time we offered and they accepted a 10¢ per hour increase for hourly employees and its equivalent to monthly employees effective at the same time that the iron company had made its wage changes. This offer was accepted and that change was made in conformity with the conference. In June negotiations were opened for a labor contract by the national representatives of the union and this contract was finally signed by both parties on July 30th, to be effective August 1st. This agreement carried an additional wage increase to the equivalent of 8½¢ per hour, or a total of 18½¢ per hour, retroactive to May 22nd, at which time the mining company wage controversy was settled.

In the early part of January, due to an acute power shortage in the city of Marquette, a study was made by a firm of consulting engineers who recommended that the city purchase a 2000 KW unit to be installed as soon as practical. After discussion our company decided that we were in no position to furnish this power and that no bid should be made for the sale of it to the city of Marquette. The city has gone forward with the construction of the new plant, but delivery of materials and construction difficulties have delayed the installation considerably with the result that several times during the year the city has been forced to call on our company to keep them from suffering acute power shortages. A vegbal agreement was made with the city in which we agreed to supply such emergency power at a rate of 1.25¢ per Kwh, and we have been able to avoid any serious power shortage in the city by that agreement. This arrangement, of course, will be terminated as soon as the city can get its machine installed.

During the strike and while the demands on our power system were comparatively low we took the opportunity to repair some of our eledtric units which could be spared from service at that time. The foundation of the Republic Plant was reconstructed where serious deterioration in concrete had taken place by spalling. The #1 unit at that plant was completely overhauled and both gate valves at the McClure Plant were rebuilt. These and several other minor repairs placed our power generating facilities in good condition to give practically continuous operation during the remainder of the year whenever water was available for them.

During March Mr. Keeton of the Alger County Taxpayers Acccciation called our attention to the fact that the power situation in the township owned power plant at Grand Marais was serious and that either some transmission line facilities must be brought into the town or a heavy expenditure must be made for the purpose of acquiring additional power facilities. After much discussion within our own organization and with other power companies, it was decided that this extension could not be profitably made by any private organization and accordingly, the Alger-Delta Co-operative Association, an REA organization, was called in by Mr. Keeton to consider the project. This Co-operative met with the supervisors of Burt Township several times and made them a definite proposition for the construction of the line from Seney. At the close of the year, however, no agreement had been made by that organization and our company for the purchase of power nor had any definite promise been made as to when the proposed line into Grand Marais would be constructed. During the month of August this same Co-operative discussed with us the construction of an extension from our present Forest Lake-AuTrain line north and west to serve the villages of Rock River, Onota and Deerton. This line has been discussed several times with the Co-operative also, but no actual contract arrangements had been made with them up until the end of 1946.

The work welding the steel pipe line at the Carp Plant started the first week in July and was carried forward until the first day of November. During that time a total of 2,891 feet of the pipe was welded. This, added to the work done in 1945, which consisted of 1,427 feet, gives 4,318 feet of pipe line welded and leaves approximately 4,200 feet still to be completed. This means it will necessitate work during the year of 1947 and a portion of the summer of 1948 to complete the work.

During September we received notice that the Penn Iron Mining Company was anticipating sale of their Sturgeon Falls Plant on the Menominee River. Investigation of this plant and study of our own system indicated that we could not profitably purchase the plant and connect it to our transmission system, and at the same time we discovered that the Penn Company had previously given an option on the plant to the city of Norway. An election was held during November to determine whether the city of Norway would exercise this option on the plant and the election was carried in favor of the purchase of the plant by a substantial majority.

In the latter part of September a study was made with various concrete repair firms of the numerous methods which could be utilized in repairing the up-stream face of power dams where they have deteriorated excessively due to spalling. It was decided that extensive repairs to the Hoist Dam should be attempted during this year while the water level in the reservoir was low and in the early part of November preparation for the work was started. Little was accomplished during November other than construction of the necessary housing for equipment, scaffolds and other facilities. Actual patching of the up-stream face of the dam was begun during the month of December. This work proved to be very tedious and expensive, but it is felt necessary for the preservation of the structures and will be carried forward on this dam until all of the present portions which have been destroyed by spalling have been replaced.

THE CLIFFS POWER & LIGHT COMPANY

STATISTICAL DATA - 1946

	KILOWATT HOURS GENERATED & PURCHASED								STATION USE	DELIVERED TO LINES	KWH SOLD	TRANSMISSION LOSSES	
	McCLURE	CARP	HOIST	AuTRAIN	REPUBLIC	ESCANABA	PURCHASED	TOTAL				KWH	&
Jan.	3,853,000	1,376,000	1,358,000	353,400	150,000	366,000	109,000	7,565,400	20,020	7,545,380	6,958,429	586,951	7.77
Feb.	3 502 000	1 200 000	1 282 000	494 600	152 600	329 000	411 000	7 371 200	20 050	7 351 150	6 612 798	738 352	10.04
Mar.	2 525 000	1 607 000	807 000	607 400	162 200	438 000	0	6 146 600	17 230	6 129 370	5 595 462	533 908	8.71
Apr.	2 254 000	1 089 000	767 000	614 400	306 500	1,006 000	0	6 036 900	16 890	6 030 010	5 463 076	556 934	9.25
May	2 646 000	714 000	904 000	615 300	252 300	484 000	0	5 615 600	14 210	5 601 390	5 164 508	436 882	7.79
June	3 686 000	1 087 000	1,333,000	600 300	310 400	616 000	88 000	7 720 700	17 470	7 703 230	7 162 931	540 299	7.01
July	4 420 000	1 022 000	1 542 000	517 000	247 200	397 000	625 000	8 770 200	18 440	8 751 760	8 009 905	741 855	8.47
Aug.	3 563 000	1 235 000	1 239 000	224 200	109 700	266 000	2,684 000	9 320 900	18 760	9 302 140	8 351 204	950 936	10.22
Sept.	3 252 000	1 004 000	1 171 000	196 000	64 400	254 000	3 505 600	9 447 000	17 260	9 429 740	8 747 837	681 903	7.23
Oct.	3 176 000	1 049 000	1 124 000	197 600	57 900	232 000	3 756 640	9 593 140	17 150	9 575 990	8 773 452	802 538	8.38
Nov.	2 139 000	1 156 000	730 000	178 300	82 000	457 000	4 672 600	9 414 900	17 030	9 397 870	8 502 841	895 029	9.52
Dec.	2 454 000	822 000	835 000	225 200	91 300	336 000	4 666 880	9 430 380	16 420	9 413 960	8 738 611	675 349	7.1
	37,470,000	13,361,000	13,092 000	4,823,700	1,986 500	5,181,000	20,518,720	96,432,920	210,930	96,221,990	88,081,054	8,140,936	8.45

THE CLIFFS POWER & LIGHT COMPANY
ANNUAL REPORT
YEAR 1946

STATISTICAL DATA - 1946

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Precipitation -	1.76	0.92	1.26	0.98	2.80	3.07	1.32	5.46	2.29	2.52	2.30	1.44

Total Precipitation at Ishpeming during 1946 - 26.12" (2.176 ft.)
Average " " Marquette - 32.80" (46 year record)

CARP RIVER PLANT:

Drainage area above Intake Dam	66.66 sq. miles
Cubic feet precipitation in 1946	4,043,822,000
Kilowatt hours generated in 1946	13,361,000
Cubic feet water utilized (90 cu. ft. - 1 Kwh)	1,226,790,000
" " " in Carp Storage Basin Dec. 21, 1945	288,543,000
" " " " " " " Dec. 23, 1946	185,986,000
" " " taken from storage in 1946	102,557,000
" " " wasted over Intake Dam	58,176,000
Total run-off for year 1946 (cubic feet)	1,182,409,000
Run-off per sq. mile of drainage area (cubic feet)	17,737,908
Second-feet of run-off	0.5624

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
Total precip.	30.11	26.53	38.40	36.83	25.46	31.05	29.50	27.40	30.38	33.67	21.90	22.95	20.71
Sec.ft. run-off	1.03	0.67	0.93	1.29	0.70	0.79	0.83	0.73	0.68	1.06	0.59	0.50	0.25

	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Total Precip.	35.69	29.86	36.06	32.28	23.14	36.70	31.20	32.72	32.87	27.10	30.23	30.10	35.32
Sec. ft. run-off	0.85	0.98	1.11	0.67	1.10	0.83	1.13	1.14	1.00	0.79	0.89	0.86	1.33

	1939	1940	1941	1942	1943	1944	1945	1946
Total precip.	33.58	30.34	32.20	34.26	32.04	32.77	30.81	26.12
Sec. ft. run-off	1.47	1.05	0.83	0.84	1.17	0.70	0.81	0.56

McCLURE PLANT:

Drainage area above Intake Dam	140.52 sq. miles
Cubic feet precipitation in 1946 (Hoist Plant-31.91"-2.659')	10,420,477,000
Kilowatt hours generated at McClure Plant in 1946	37,470,000
Cubic feet water utilized (125 cu. ft. - 1 Kwh)	4,683,750,000
" " " wasted over Intake Dam	0
" " " in Hoist Storage Basin Dec. 21, 1945	1,587,952,000
" " " " " " " Dec. 23, 1946	818,921,000
" " " taken from Hoist Storage Basin in 1946	769,031,000
" " " in Silver Lake Dec. 21, 1945	91,408,000
" " " " " " Dec. 23, 1946	0
" " " taken from Silver Lake in 1946	91,408,000
Total run-off for year 1946 (cubic feet)	3,823,311,000
Run-off per sq. mile of drainage area (cubic feet)	27,208,304
Second-feet of run-off	0.862

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933
Total Precip.	35.10	42.03	26.60	30.49	24.06	43.95	35.51	43.80	38.75	30.81	37.02	32.54	35.07
Sec. ft. run-off	1.02	1.54	0.85	0.92	0.52	1.52	1.80	2.22	1.36	1.45	1.10	1.23	1.30

	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946
Total Precip.	35.02	29.96	32.16	38.18	40.93	41.22	36.59	38.15	40.20	35.64	37.62	37.94	31.91
Sec. ft. run-off	1.16	0.90	1.05	1.19	1.75	1.69	1.47	1.28	1.15	1.43	1.17	1.36	0.86

THE CLIFFS POWER & LIGHT COMPANY
ANNUAL REPORT
YEAR 1946

SUBSTATION TRANSFORMERS:

Substation transformers installed as of December 31, 1946.

	Phase	No.	K.V.A.	Total K.V.A.	
66,000/2300 Volts					
Munising Substation	1	3	667	2,001	
Seney "	1	1	25	25	
Inland #1 "	1	3	500	1 500	
Inland #2 "	1	3	500	1 500	5,026 KVA
2300/66,000 Volts					
AuTrain Substation	1	3	333-1/3	1 000	
Gwinn "	1	3	590	1 770	2 770
33,000/66,000 Volts					
Gwinn Substation	1	3	1,250	3,750	3 760
33,000/12,000 Volts					
Clarksburg Substation	1	2	150	300	
Princeton "	1	1	37½	37½	337½
33,000/2300 Volts					
Gwinn Substation	3	1	1,250	1,250	
" "	1	3	75	225	
Cliffs Shaft Substation	1	3	500	1 500	
" " " (MG&ECo.Service)	1	3	150	450	
Morris-Lloyd "	1	3	590	1 770	
Cambria-Jackson "	1	3	400	1 200	
Maas "	1	6	590	3 540	
Brownstone "	1	3	625	1 875	
Palmer "	1	2	625	1 250	
Greenwood "	1	2	400	800	
Princeton "	1	1	25	25	
Tilden "	1	1	400	400	
Palmer Rural "	1	4	15	60	
Negaunee-Athens "	1	3	1 000	3 000	
Mather "	1	3	2 000	6 000	23 345
2300/33,000 Volts					
Republic "	1	3	250	750	
Hoist Plant "	3	1	2 500	2 500	
Escanaba " "	1	3	500	1 500	
McClure Plant "	3	2	5 000	10 000	
Carp " "	1	3	1 900	5 700	
Hoist " "	1	3	667	2 000	
" " "	1	3	200	600	23 050
12,000/440-220 Volts					
Piqua-Marquette Substation	1	3	100	300	
12,000/2300 to 2300/440-220	(1	3	185	555	
Piqua-Marquette Substation	(1	3	100	300	1 155
12,000/220-110 Volts					
D.S.S.&A.Ry. at Clarksburg	1	1	2½	2½	2½
12,000/2300 Volts					
McClure Plant (Furnace Lines)	3	2	1 250	2 500	
AuTrain Substation	1	3	185	555	
Chatham "	1	3	25	75	
Eben "	1	1	25	25	
Rumely "	1	2	15	30	
Inland #1 (Wis.Mich. Line)	1	3	50	150	
Rumely Substation	1	1	25	25	3 360

THE CLIFFS POWER & LIGHT COMPANY
ANNUAL REPORT
YEAR 1946

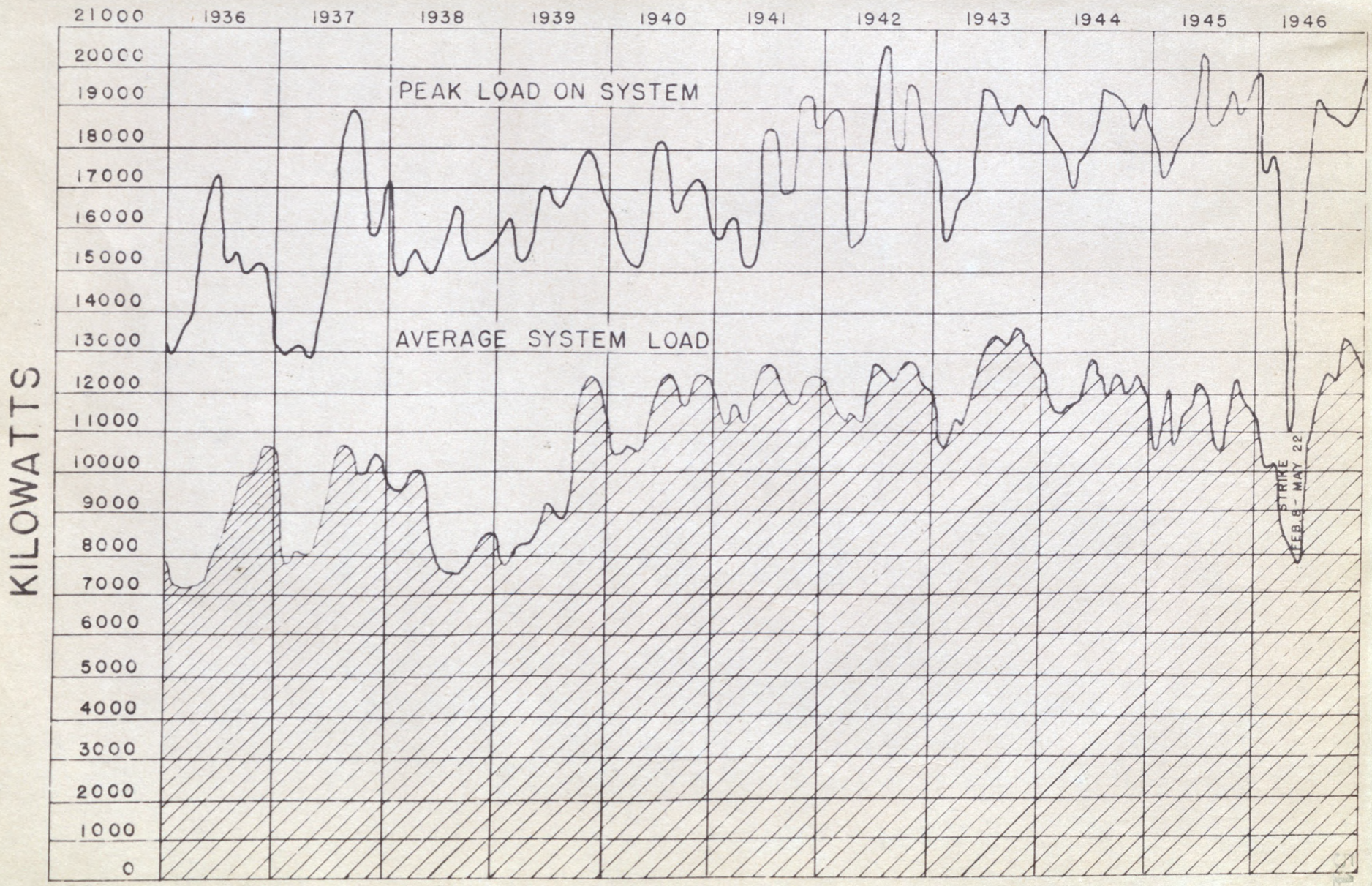
SUBSTATION TRANSFORMERS: (Continued)

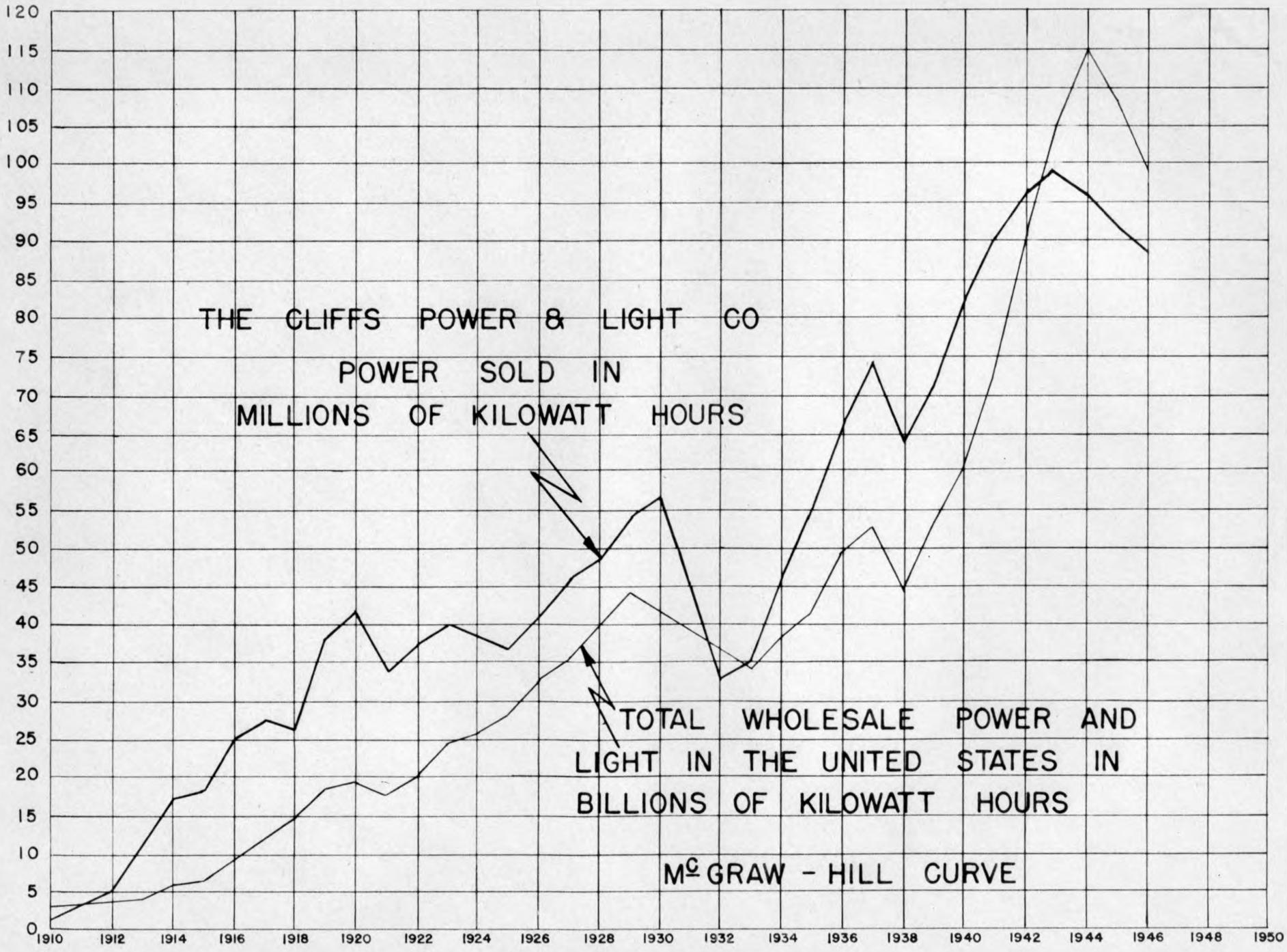
	Phase	No.	K.V.A.	Brought Fwd. Total KVA	62,796
6600/2300 Volts					
Inland #1 Substation	1	3	25	75	
Blaney Park "	1	2	25	50	
" " "	1	1	15	15	
AuTrain Lake "	1	1	25	25	
Gwinn "	1	1	50	50	
Princeton "	1	1	50	50	265
6600/115-230 Volts					
Furnace Substation Lighting	1	1	1½	1½	1½

Grand Total.....63,062½

DISTRIBUTION TRANSFORMERS:

	Number	Capacity
Total at first of year	396	2,476 KVA
" purchased during year	52	205
" installed " "	51	226½
" sold " "	13	73
" at close of year	435	2 608
In stock at close of year	20	76½ Kva
" service at " " "	377	2,152½
C.P.&L.Co. Plants & Auxiliaries	38	379
	435	2,608 KVA


KILOWATTS
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
PEAK LOAD ON SYSTEM
AVERAGE SYSTEM LOAD
STRIKE
FEB. 8 - MAY 22


THE CLIFFS POWER & LIGHT CO
POWER SOLD IN
MILLIONS OF KILOWATT HOURS
TOTAL WHOLESALE POWER AND
LIGHT IN THE UNITED STATES IN
BILLIONS OF KILOWATT HOURS
McGRAW - HILL CURVE
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
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1910
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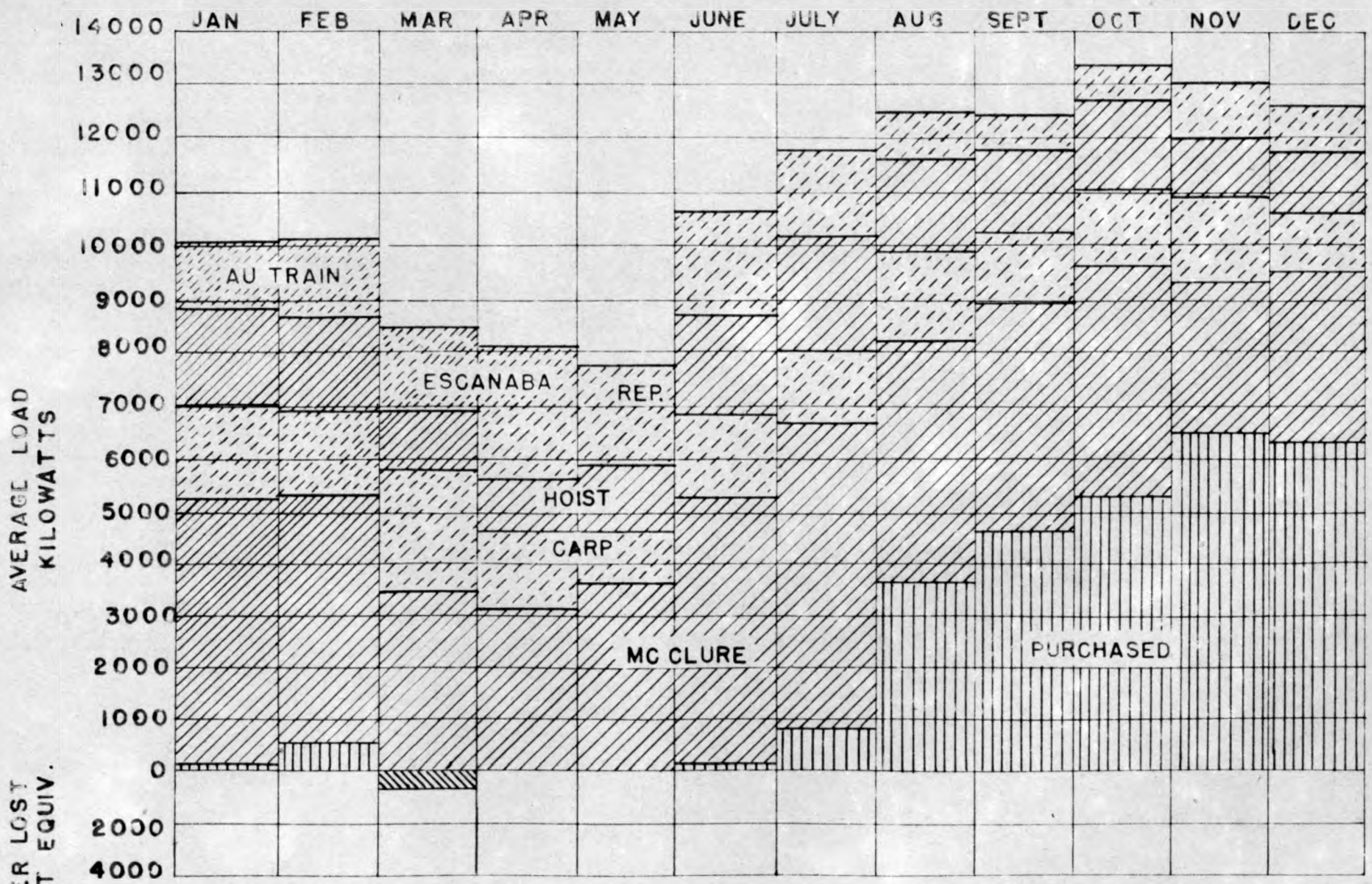
1946



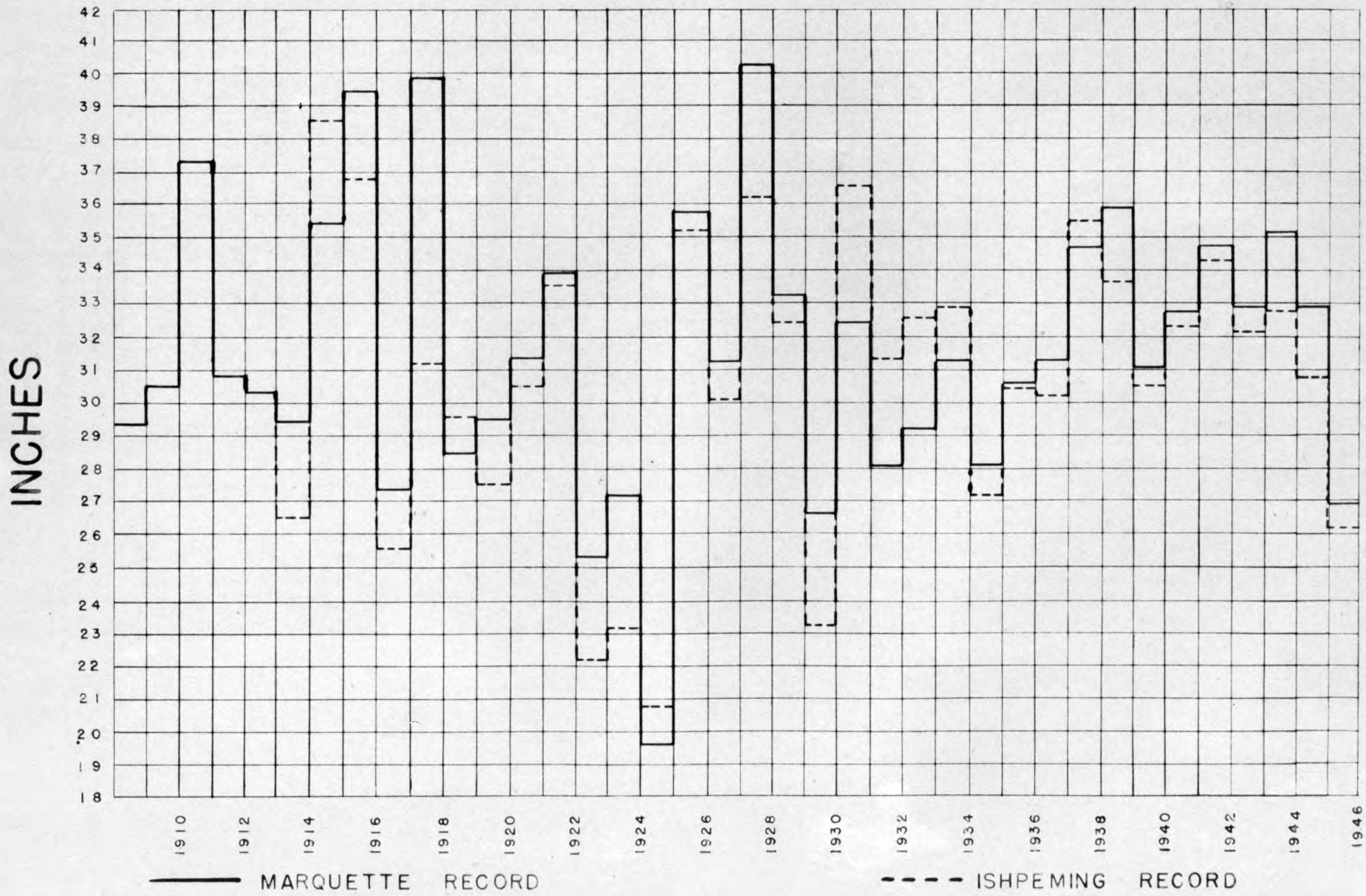
CURRENT GENERATED BY WATER POWER

POWER PURCHASED

KILOWATT EQUIVALENT
WATER LOST AT CARP
" " " MC CLURE

MC CLURE	38.86%
CARP	13.85
HOIST	13.58
AU TRAIN	5.00
ESCANABA	5.37
REPUBLIC	2.06
PURCHASED	21.28

PRECIPITATION BY YEARS



WELFARE DEPT. ANNUAL REPORT YEAR 1946

The normal functions of the Welfare Department, including the matters which deal with welfare, relief, insurance, compensation, public relations and personnel problems, as well as all other matters which are peculiar to a welfare department, were carried on in the usual manner during the year 1946. During the year we had an experience which this company has had only once before and that a half century ago, namely, a labor dispute. This presented some new problems to this department, some of them creating rather difficult situations. It is believed, however, that we went through the labor dispute period and returned to normal operations without too great a change in the usual policies which were carried on by this department.

The Company's Welfare Department has supervision of all matters pertaining to the general welfare and health of the Company's employees. The department is charged with various activities, such as the following: The study of general welfare and social problems, workmen's compensation, group insurance, retirement problems, social security, the Company's pension system, donations to employees with long and faithful service records, matters dealing with civic affairs, public health, safety and public relations, personnel direction, and the administration of the Ishpeming Hospital.

For the purpose of having in the record a definite statement regarding the Welfare Department, it is here recorded that this department was formerly known as the Pension Department and for many years Mr. W. H. Moulton, who retired on July 1, 1938, headed the department with the title of Secretary. (Mr. Moulton passed away in January, 1944). In July of 1938 the name of the department was changed from the Pension Department to the Welfare Department and Walter F. Gries became the head of the department with the title of Superintendent. We wish to record here that throughout the years of our association with Mr. Moulton he was always helpful, cooperative and eager to assist in any way. His great contribution to the development of this department over his more than thirty years of service has left a challenge to those of us who are privileged to follow in his footsteps. We wish also to record at this time the excellent cooperation of the Safety Department under Mr. A. J. Stromquist, Director, and Captain H. F. Rogers, Assistant Director. This cooperation and coordination with this department has, in our estimation, reacted splendidly to the Company's benefit and we believe the association which we have had has been helpful in every respect.

We are grateful for the continued cooperation of Mr. Walter E. Johnson who has been in charge of our Compensation Department for many years.

We wish also to record again that the cooperation and guidance of Mr. C. J. Stakel, Manager, and Mr. C. W. Allen, Assistant Manager, are highly appreciated.

The Police Department, during the year, was called upon to exercise good judgment and to carry on its work under some difficulties because of the labor dispute. It is felt that we have a well organized and well operating police department. We have reduced the department somewhat during the year due to the

fact that it was found that we could maintain a proper supervision of plants and properties with a smaller force. Our Police Department has had few changes, although during the year we had one death and one retirement. I wish to express my appreciation to Mr. Veale for his loyalty and for the cooperation he has always given.

The personnel of the Welfare Department is made up of the following people:

Walter F. Gries, Superintendent
Walter E. Johnson, Compensation Agent
Miss Mary Ryan, Receptionist and File Clerk
Miss Emily Nicholas, Secretary to the Superintendent
Lowell C. Holmgren, Secretary in the Compensation and Group Insurance Division
Robert J. Veale, Chief of Police

11.

a. WORKMEN'S COMPENSATION

The direct work of the Compensation Department has been taken care of by Mr. Walter E. Johnson as has been the plan since 1926.

Following are the cases of those men who required some special attention during the year.

RUSSELL B. MILDON - Negaunee Mine

On June 5, 1945 Mr. Mildon collapsed in the basement of his home in Marquette, Michigan, his attending physician making a diagnosis of a possible brain tumor. He was later treated by Dr. Camp at the University Hospital at Ann Arbor. Group insurance benefits were paid for the maximum period of thirteen weeks, and while Mildon made some recovery he did not again return to our employ. Early in 1946 Mr. Mildon filed a claim for compensation stating in said claim that he had suffered an injury at the Negaunee Mine on April 12, 1945 and that his present condition was the result of this injury. Our records showed that he had slipped while loading cars and had fallen against an ore car injuring his left side and causing two days' disability at the time. The matter came up for hearing before Mr. James W. Nolan, deputy commissioner, on March 1, 1946, and he subsequently ruled that there was no connection between Mildon's present condition and his injury of April 12, 1945, that he failed to give notice of any head injury, and also that he failed to make seasonable claim for compensation as provided by the act. Mildon did not appeal from this decision.

LOUIS JELICICH - Hill-Trumbull Mine - Acc. Rept. No. 118

On February 13, 1946 Jelicich informed the Company that he had injured his right arm on October 25, 1945. He was employed as a locomotive brakeman at the time and was assisting in getting a derailed locomotive back on the tracks. His claim was that while lifting a camelback on the locomotive he injured his right arm. He continued to work from the date of the injury to January 27, 1946 when he saw Dr. Plowman in Marble. The doctor found a rupture of the biceps muscle of the right arm. He subsequently was operated on by Dr. V. M. Baich of Bovey, Minnesota. We filed a denial of liability, and the matter was heard before a Referee on December 17, 1946 at which time the question of his having sustained an injury while in our employ was raised and also the fact that the operation performed by his own physician was largely responsible for any disability he might have. The Referee awarded him compensation on the basis of twenty-five per cent loss of use of the right arm, a total of fifty weeks, which was five per cent in excess of our own doctor's estimate. Mr. Gannon, our attorney, felt that an appeal would be sustained by the Industrial Commission, and as the difference in estimates was only five per cent, it was decided to pay the claim.

LEROY SCOVEL - Holman-Cliffs Mine - Acc. Rept. No. 40B

Mr. Scovel received a traumatic injury to the right testicle while working as a rock picker at the Holman-Cliffs Mine on July 27, 1944. He was standing on the edge of a rock chute using a bar to clean the chute when the bar slipped and he fell on the corner of the chute.

11.

a. WORKMEN'S COMPENSATION (Continued)

He lost about one week following the injury and then returned to work and continued until June 1945. From that date until his death on June 16, 1946 he was under the care of physicians both locally and at the University of Minnesota hospital, and it was found that death was due to an adenocarcinoma of the testicle. He had filed a petition for compensation and several hearings were held culminating in an award by the Industrial Commission on May 29, 1946 for compensation at $20.00 per week. Scovel died before payments could be started, and his widow then petitioned for compensation. This was largely a matter of form, as we knew the claim would have to be paid but wanted the authority of the Industrial Commission. Under the law she was entitled to $7,500.00 as a death payment payable at the rate of $16.96 per week. A stipulation was entered into and approved by the Commission whereby Mrs. Scovel would receive the back compensation awarded to the date of her husband's death and limiting her claim to $6,500.00 with the understanding that payments would cease upon her death or if she remarried the statutory amount of two years of compensation would be paid.

CRESCENZO SAURO - Cliffs-Shaft Mine - Acc. Rept. No. 1136

Mr. Sauro was fatally injured on July 21, 1943. In the investigation following the accident it was brought out that he had a wife living in Italy. As she was a non-resident alien she was entitled to compensation at the rate of $12.00 per week for three hundred weeks providing that we received proper proof of marriage and also proof that she was still alive. As an enemy alien the matter had to be handled through the office of the Alien Property Custodian. During 1946 they furnished photostatic copies of her birth and marriage certificates and also affidavits to the effect that she was still living and that she was the wife of Crescenzo Sauro. Following the submission of this proof we were ordered to pay the compensation to the office of the Alien Property Custodian for her benefit, and as the case is quite involved we have requested that the matter be settled on a reduced basis by the payment of a lump sum for the balance. We have reason to believe that this procedure will be acceptable to the Alien Property Custodian.

VITO VALLELA - Lloyd Mine

On February 1, 1938 Vallela was struck on the back by a falling timber, subsequent x-rays showing a fracture of the transverse processes of the 1st, 2nd, and 3rd lumbar vertebrae. He returned to light work after a week and continued on light work for two months and then returned to work at his regular occupation as a miner. In 1940 he began to show signs of epilepsy, and as a precaution he was given work on surface remaining there until 1945. During the five-year period preceding his lay-off in November 1945 he had a number of epileptic spells and toward the end their frequency increased. He had been under a doctor's care and treatment prescribed but Vallela refused to take the medication regularly even though the doctor

11.

a. WORKMEN'S COMPENSATION (Continued)

had told him he would have to continue with it whether or not he had a spell. During the last few months he worked he had frequent spells and finally in November of 1945 it was decided to separate him from the payroll as he was a distinct hazard. He later filed a claim for compensation on the grounds that the epilepsy was a result of the injury sustained on February 1, 1938 and submitted a report from a Chicago specialist which indicated a connection. He also claimed that he had never had these spells prior to the injury, and our own physical examination records showed no history of spells prior to 1940. While it was the opinion of our doctors that there was no connection between the injury and the following epilepsy the matter would, of course, be determined by the testimony introduced by both sides, and as his doctors felt that there was a connection it was a possibility that he might get an award of compensation. With this fact in mind a settlement was arranged with Vallela through his attorney, and the case was definitely closed upon the payment of $1,250.00

11.

a. WORKMEN'S COMPENSATION (Continued)

LUMP SUM SETTLEMENTS

During the year settlements were arranged in five cases. All were settled on a partial basis, and all were settled by redemption of liability so that there will be no further possibility of the cases being reopened. The settlements were arranged through the attorneys for the various individuals and, of course, all had to be approved by the Compensation Commission. Following is a list of the individuals with whom the settlements were made:

Paul Jarvi	Lloyd Mine	Fractured pelvis.	$3,000.00
Theodore Shepeard	"	Fractured vertebra.	2,300.00
Joseph M. Roberto	Princeton Mine	Back injury.	1,700.00
Edward Johnson	Negaunee Mine	Leg injury.	2,692.00
Nestor Ahlstrom	Maas Mine	Knee injury.	1,740.00