11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.) TABLE IV

CLASSIFICATION OF COMPENSABLE ACCIDENTS

CLASSIFICATION	BUNKER HILL	CAMBRIA JACKSON	CANISTEO	CLIFFS SHAFT	DIAMOND DRILLS	ELEC. POWER DIV.	HAWKINS	HILL TRUMBULL	HOLMAN CLIFFS	HUMBOLDT	MISCELLANEOUS	MATHER MINE "A" SHAFT	MATHER MINE "B" SHAFT	ORE IMPROV. PLANT	OHIO	PELLET PLANT	REPUBLIC	STRHSE & SHOPS	TILDEN	WANLESS	TOTAL
I. Trade Risk, Incidental and Non-Preventable				4								2	6			1	1				14
II. Negligence of Company:																					
1. Failure to Use Safety Devices Provided																					0
2. Failure to Use Proper Tools Provided																					0
3. Violation of Rules																					0
4. Improper Act or Selection of Method of Doing Work (by Foreman)																					0
5. Failure to Instruct Men as to Hazards, Methods etc.																					0
6. Failure to Provide Safety Devices																					0
7. Failure to Provide Tools Appliances at Place of Work																					0
III. Negligence of Workman																					
A Injured Workman																					
1. Failure to Use Safety Devices Provided												1									1
2. Failure to Use Proper Tools, etc. Provided																					0
3. Violation of Rules				2								1	1			1					5
4 Improper Act or Method of Doing Work	4		1	5			1		1			11	12			1	1				37
B Other Workman																					
1. Failure to Use Safety Devices Provided																					0
2. Failure to use Proper Tools, etc. Provided																					0
3. Violation of Rules																					0
4. Improper Act or Method of Doing Work																					0

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.) TABLE IV (Cont.)

CLASSIFICATION OF COMPENSABLE ACCIDENTS

(COMBINED) CLASSIFICATION	BUNKER HILL	CAMBRIA JACKSON	CANISTEO	CLIFFS SHAFT	DIAMOND DRILLS	ELEC. POWER DIV.	HAWKINS	HILL TRUMBULL	HOLMAN CLIFFS	HUMBOLDT	MISCELLANEOUS	MATHER MINE "A" SHAFT	MATHER MINE "B" SHAFT	ORE IMPROV. PLANT	OHIO	PELLET PLANT	REPUBLIC	STRHSE & SHOPS	TILDEN	WANLESS	TOTAL
III-A-4 & III-B-4	2			1			1						3				1	1			9
III-A-4 & II-7				1														1			2
III-A-4 & II-5												1									1
III-A-3 & III-A-4							1														1
III-A-3 & III-B-3												1									1
III-B-2 & II-5												1									1
III-A-4,III-B-4 & II-5													1								1
TOTALS *	6	0	1	13	0	0	3	0	1	0	0	18	23	0	0	3	3	2	0	0	73

*Totals are for this page and preceding page.

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE V

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

YEAR	NUMBER OF FATALITIES	NUMBER OF MAN-DAYS WORKED PER FATALITY	NUMBER OF TONS OF ORE MINED PER FATALITY
1939	1	564,433	3,713,389
1940	5	142,878	1,156,387
1941	5	182,340	1,456,528
1942	2	512,356	3,808,258
1943	4	269,351	1,624,315
1944	3	331,090	1,995,787
1945	1	915,666	5,970,577
1946	0	747,079*	4,416,253**
1947	7	153,031	1,130,679
1948	3	386,965	2,869,090
1949	1	1,013,442	7,162,324
1950	5	233,060	1,647,066
1951	2	679,740	4,507,045
1952	5	239,483	1,493,841
1953	2	617,377	4,482,063
1954	0	884,848*	6,280,483**
1955	4	223,940	2,147,324
1956	0	911,240*	8,908,456**
1957	2	463,167	4,367,207
1958	3	175,078	1,748,612
TOTALS	55	19,294,573	142,391,515
20 Year Average	2.75	350,810	2,588,937

* Man-Days Worked During Year without Fatality

** Amount of Ore Mined During Year without Fatality

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE VI

Mine or Plant	Less Than 7 Days	7 Days or More	Fatalities	Total
Bunker Hill	1	6		7
Cambria Jackson	0	0		0
Canisteo	0	1		1
Cliffs Shaft	2	12	1	15
Diamond Drills	0	0		0
Electric Power Div.	0	0		0
Hawkins	3	3		6
Holman Cliffs	1	1		2
Hill Trumbull	0	0		0
Humboldt	0	0		0
Mather Mine "A" Shaft	3	17	1	21
Mather Mine "B" Shaft	5	22	1	28
Miscellaneous-Michigan	1	0		1
Miscellaneous-Minnesota	0	0		0
Ohio	0	0		0
Ore Improvement Plant	0	0		0
Pelletizing Plant	3	3		6
Republic	1	3		4
Research Laboratory	0	0		0
Strhse & Shops	0	2		2
Tilden	0	0		0
Wanless	0	0		0
TOTALS	20	70	3	93

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE VII

CAUSES OF COMPENSABLE INJURIES - UNDERGROUND

CAUSE	BUNKER HILL GROUP	CAMBRIA JACKSON	CLIFFS SHAFT	MATHER MINE "A" SHAFT	MATHER MINE "B" SHAFT	TOTAL
Fall of Ground	2		1	1	5	9
Falling Chunks,etc. (Shafts,Chutes,Raises)			1	4	3	8
Persons Falling (Slipping, and Stumbling)			1	1	2	4
Haulage	2			3	1	6
Flying Objects	1		1	1		3
Drilling Equipment			1		1	2
Lifting or Pulling				1	1	2
Handling Material					3	3
Falling Material			1	3	2	6
Caught by Chain Conveyor	1					1
Air Tugger Rope			1		1	2
Electricity			1			1
Falling From Bench			1			1
Loading Equipment			1	1		2
Bumping Against Objects			1			1
Falling Down Raise				2	1	3
Rolling Material				1	1	2
Caught by Scraper					1	1
Strain from Stage in Raise					1	1
TOTAL	6	0	11	18	23	58

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries

TABLE VII (Cont.)

CAUSES OF COMPENSABLE INJURIES - OPEN PITS

CAUSE	CANISTEO	HAWKINS	HILL TRUMBULL	HOLMAN CLIFFS	HUMBOLDT	OHIO	REPUBLIC	TILDEN	WANLESS	TOTAL
Falling from truck cab	1	1								2
Falling from ladder		1								1
Falling from railroad car		1					1			2
Falling from steel beam				1						1
Jumping from one RR car to another							1			1
Falling material							1			1
TOTAL	1	3	0	1	0	0	3	0	0	8

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE VII (Cont.)

CAUSES OF COMPENSABLE INJURIES - SURFACE (Underground Mines)

CAUSE	BUNKER HILL GROUP	CAMBRIA JACKSON	CLIFFS SHAFT	MATHER MINE "A" SHAFT	MATHER MINE "B" SHAFT	TOTAL
Slipping & Stumbling			1			1
Handling Material			1			1
TOTAL	0	0	2	0	0	2

	OTHER OPERATIONS							
Cause	Elec. Power Div.	Diamond Drill Dept.	Ore Imp. Plant	Pellet Plant	Strhs Shops Garage	Misc. Mich.	Misc. Minn.	Total
Falling from stage					1			1
Flying Objects				1	1			2
Caught in V-belt Drive				1				1
Caught by conveyor				1				1
TOTAL	0	0	0	3	2	0	0	5

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.) TABLE VIII

FREQUENCY RATES, ALL COMPENSABLE INJURIES

Year	TOTAL MAN DAYS WORKED	NUMBER OF COMPENSABLE INJURIES NON-FATAL	FATAL	FREQUENCY* RATE
1941	918,300	79	5	11.43
1942	1,024,713	75	2	9.39
1943	1,077,402¼	171	4	20.30
1944	993,272½	121	3	15.61
1945	915,665-3/4	107	1	14.74
1946	747,079	101	0	16.89
1947	1,071,219	149	7	18.20
1948	1,160,896¼	145	3	15.94
1949	1,013,442	126	1	15.66
1950	1,165,301½	145	5	16.09
1951	1,359,479-3/4	136	2	12.69
1952	1,197,416½	152	5	15.87
1953	1,234,755¼	152	2	15.39
1954	884,848	99	0	13.99
1955	895,762	121	4	17.44
1956	911,240¼	139	0	19.07
1957	926,334	140	2	19.16
1958	525,236	70	3	17.37

* Vased on One Million Man-Hours of Labor.

TABLE VIII-A

SEVERITY RATES, ALL COMPENSABLE INJURIES

Year	NON-FATAL DAYS LOST	RATE	FATAL DAYS LOST	DAYS LOST ALL INJURIES	SEVERITY* RATE
1941	5,403	.735	30,000	35,403	4.819
1942	5,851	.500	12,000	17,851	2.177
1943	10,355	1.201	24,000	34,355	3.986
1944	7,759	.976	18,000	25,759	3.242
1945	7,624	1.041	6,000	13,624	1.860
1946	7,994	1.337	0	7,994	1.337
1947	9,946	1.161	42,000	51,946	6.062
1948	14,526	1.564	18,000	32,526	3.502
1949	5,833	.719	6,000	11,833	1.390
1950	7,063	.757	30,000	37,063	3.976
1951	10,657	.979	12,000	22,657	2.083
1952	17,716	1.849	30,000	47,716	4.981
1953	8,587	.869	12,000	20,587	2.084
1954	6,502	.919	0	6,502	.919
1955	7,392	1.832	24,000	31,392	4.381
1956	5,560	.763	0	5,560	763
1957	6,302	.850	12,000	18,302	2.470
1958	3,337	.794	18,000	21,337	5.078

* Based on Days Lost by Injuries per 1,000 Man-Hours of Labor except for Years 1955, 1956, 1957 and 1958 which are based on new rate - 1,000,000 Man-Hours of Labor.

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE IX

COMPARISON OF COMPENSABLE ACCIDENTS, INCLUDING FATALITIES BY MINES

Mine or Plant	FREQUENCY 1957	FREQUENCY 1958	SEVERITY 1957	SEVERITY 1958
Bunker Hill	29.48	18.87	9,791	1,116
Cambria Jackson	4.13	0.00	136	0
Canisteo	10.80	4.84	443	39
Cliffs Shaft	28.37	32.10	1,220	15,715
Diamond Drill Dept.	29.52	0.00	876	0
Elec.Power Div.	.00	0.00	0	0
General Roll	.00	0.00	0	0
Hawkins	7.22	16.67	437	745
Hill Trumbull	17.05	0.00	634	0
Holman Cliffs	3.99	4.11	60	398
Humboldt	.00	0.00	0	0
Mather Mine "A" Shaft	21.13	25.42	817	9,627
Mather Mine "A" Shaft	23.37	30.78	5,529	9,501
Miscellaneous - Mich.	.00	0.00	0	0
Ohio	12.89	0.00	5,157	0
Ore Improvement Plant	79.96	0.00	4,971	0
Pelletizing Plant	5.67	13.68	91	994
Republic	22.74	16.22	625	378
Strhse & Shops	7.51	15.72	207	1,360
Tilden	.00	0.00	0	0
Wanless	.00	0.00	0	0
All Properties	19.16	17.37	2,470	5,078

Note: Severity rating based on 1,000,000 Man-Hours of Labor.

TABLE X

COMPENSABLE INJURIES INCLUDING FATALITIES

MINE OR PLANT	TONS OF ORE PRODUCED	HOURS OF LABOR	NO. OF FATALITIES	NO. OF COMP. INJ.	DAYS LOST FATALITIES	COMPENSABLE DAYS LOST	TOTAL DAYS LOST FATALITIES & COMPENS.	FREQUENCY	SEVERITY
Bunker Hill Group	323,287	317,996		6		355	355	18.87	1,116
Cambria Jackson	89,130	126,519						0.00	0
Cliffs Shaft	448,112	404,974	1	12	6,000	364	6,364	32.10	15,715
Mather Mine "A" Shaft	823,860	708,236	1	17	6,000	818	6,818	25.42	9,627
Mather Mine "B" Shaft	851,382	747,280	1	22	6,000	1,100	7,100	30.78	9,501
TOTALS	2,535,771	2,305,005	3	57	18,000	2,637	20,637	26.03	8,953
Canisteo	864,716	206,764		1		8	8	4.84	39
Hawkins	412,984	179,932		3		134	134	16.67	745
Hill Trumbull	-	18,726						0.00	0
Holman Cliffs	817,019	243,487		1		97	97	4.11	398
Humboldt	50,348	29,083						0.00	0
Ohio	-	-						0.00	0
Republic	462,435	184,971		3		70	70	16.22	378
Tilden	102,562	6,684						0.00	0
Wanless	-	-						0.00	0
TOTALS	2,710,064	869,647		8		309	309	9.20	355
Electric Power Div.		53,430						0.00	0
General Roll		542,028						0.00	0
Miscellaneous		28,851						0.00	0
Gen.Strhse & Shops		127,226		2		173	173	15.72	1,360
Diamond Drill Div.		17,452						0.00	0
Pelletizing Plant		219,336		3		218	218	13.68	994
Ore Improvement Plant		38,912						0.00	0
TOTALS		1,027,235		5		391	391	4.87	381
GRAND TOTALS	5,245,835	4,201,887	3	70	18,000	3,337	21,337	17.37	5,078

THE CLEVELAND CLIFFS IRON COMPANY
SAFETY DEPARTMENT, ACCIDENT STATISTICS - YEAR - 1958

MINE OR PLANT	Position Rating	Hrs.Labor	No. of Fatals	Compens. Injur.	Non-Comp. 1-7 Days	Compen. Days Lost	Days Lost Non-Comp. 1-7 Days	Lost Time Injur.Incl Fatals	Days Lost All Injur. & Fatals	Frequency	Severity	Avg. Days Lost per Injury	Type of Operation
Cambria Jackson	1	126,519								0.00	0	0	Underground
Bunker Hill Group	2	317,996		6	1	355	4	7	359	22.01	1,129	51	
Mather Mine "B" Shaft	3	747,280	1	22	5	7,100	20	28	7,120	37.47	9,528	254	
Mather Mine "A" Shaft	4	708,236	1	17	3	6,818	7	21	6,825	29.65	9,637	325	
Cliffs Shaft	5	404,974	1	12	2	6,364	5	15	6,369	37.04	15,727	425	
TOTALS		2,305,005	3	57	11	20,637	36	71	20,673	30.80	8,969	291	
Humboldt	1	29,083								0.00	0	0	Open Pits
Hill Trumbull	2	18,726								0.00	0	0	
Tilden	3	6,684								0.00	0	0	
Canisteo	4	206,764		1		8		1	8	4.84	39	8	
Republic	5	184,971		3	1	70	2	4	72	21.62	389	18	
Holman Cliffs	6	243,487		1	1	97	3	2	100	8.21	411	50	
Hawkins	7	179,932		3	3	134	10	6	144	33.35	800	24	
Wanless	8	-											
Ohio	9	-											
TOTALS		869,647		8	5	309	15	13	324	14.95	373	25	
General Roll	1	542,028								0.00	0	0	Independent Unit
Electric Power Div.	2	53,430								0.00	0	0	
Ore Improvement Plant	3	38,912								0.00	0	0	
Diamond Drills	4	17,452								0.00	0	0	
Miscellaneous	5	28,851			1		2	1	2	34.66	69	2	
Pelletizing Plant	6	219,336		3	3	218	10	6	228	27.36	1,040	38	
Strhse & Shops	7	127,226		2		173		2	173	15.72	1,360	86	
TOTALS		1,027,235		5	4	391	12	9	403	8.76	392	45	
GRAND TOTALS		4,201,887	3	70	20	21,337	63	93	21,400	22.13	5,093	230	

TABLE XI (1)

THE CLEVELAND CLIFFS IRON COMPANY

SAFETY DEPARTMENT, ACCIDENT STATISTICS - YEAR - 1958

MINE OR PLANT-MINNESOTA	Position Rating	Hours Labor	No. of Fatals	Compens. Injuries	Non-Compen. 1 - 7 Days	Compen. Days Lost	Days Lost Non-Comp. 1 - 7 Days	Lost Time Inj. Incl. Fatals	Days Lost All Injur. & Fatals	Frequency	Severity	Avg. Days Lost per Injury
General Roll	1	107,885								0.00	0	0
Hill Trumbull	2	18,726								0.00	0	0
Canisteo	3	206,764		1		8		1	8	4.84	39	8
Holman Cliffs	4	243,487		1	1	97	3	2	100	8.21	411	50
Hawkins	5	179,932		3	3	134	10	6	144	33.35	800	24
Wanless		-										
TOTAL		756,794		5	4	239	13	9	252	11.89	333	28
MINNESOTA MINES		756,794		5	4	239	13	9	252	11.89	333	28
MICHIGAN MINES		3,445,093	3	65	16	21,098	50	84	21,148	24.38	6,139	252
GRAND TOTAL		4,201,887	3	70	20	21,337	63	93	21,400	22.13	5,093	230

Frequency - Lost Time Acc. x 1,000,000 Man Hours Worked
Severity - Days Lost x 1,000,000 Man Hours Worked

TABLE XI (2A)

THE CLEVELAND CLIFFS IRON COMPANY
SAFETY DEPARTMENT, ACCIDENT STATISTICS - YEAR - 1958

MINE OR PLANT - MICHIGAN	Position Rating	Hours Labor	No. of Fatals	Compens. Injuries	Non-Comp. 1 - 7 Days	Compens. Days Lost	Days Lost Non-Comp. 1 - 7 Days	Lost Time Injur. Incl. Fatals	Days Lost All Injur. & Fatals	Frequency	Severity	Avg. Days Lost per Injury
General Roll	1	434,143								0.00	0	0
Cambria Jackson	2	126,519								0.00	0	0
Elec. Power Div.	3	53,430								0.00	0	0
Ore Improvement Plant	4	38,912								0.00	0	0
Humboldt	5	29,083								0.00	0	0
Diamond Drills	6	17,452								0.00	0	0
Tilden	7	6,684								0.00	0	0
Miscellaneous	8	28,851			1		2	1	2	34.66	69	2
Republic	9	184,971		3	1	70	2	4	72	21.62	389	18
Pelletizing Plant	10	219,336		3	3	218	10	6	228	27.36	1,040	38
Bunker Hill Group	11	317,996		6	1	355	4	7	359	22.01	1,129	51
Strhse & Shops	12	127,226		2		173		2	173	15.72	1,360	86
Mather Mine "B" Shaft	13	747,280	1	22	5	7,100	20	28	7,120	37.47	9,528	254
Mather Mine "A" Shaft	14	708,236	1	17	3	6,818	7	21	6,825	29.65	9,637	325
Cliffs Shaft	15	404,974	1	12	2	6,364	5	15	6,369	37.04	15,727	425
TOTAL		3,445,093	3	65	16	21,098	50	84	21,148	24.38	6,139	252
MICHIGAN MINES		3,445,093	3	65	16	21,098	50	84	21,148	24.38	6,139	252
MINNESOTA MINES		756,794		5	4	239	13	9	252	11.89	333	28
GRAND TOTAL		4,201,887	3	70	20	21,337	63	93	21,400	22.13	5,093	230

Frequency - Lost Time Acc. x 1,000,000 Man Hours Worked
Severity - Days Lost x 1,000,000 Man Hours Worked

TABLE XI (2)

A - No. of Accidents
DL - Days Lost

THE CLEVELAND CLIFFS IRON COMPANY

CAUSES OF LOST TIME ACCIDENTS, JANUARY 1, 1958 TO JANUARY 1, 1959 - MARQUETTE RANGE

TYPE OF ACCIDENT	Bunker Hill		Camb. Jack.		Cliffs Shaft		Surf. Dia. Drills		Humb-oldt		Mather "A"		Mather "B"		Miscel.		Ohio		Ore Imp. Plant		Pellet Plant		Rep ublic		Strhse Shops		Til-Den		TOTAL	
	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL
Falls, Slides of Ground	2	43			1	10					1	11	5	132															9	196
Falling chunks, materials, (shafts, chutes, mills, raises)					1	20					4	91	3	180															8	291
Falling Material					2	12					4	222	3	95									1	52					10	381
Haulage (underground)	2	260									3	6306																	5	6,566
Persons falling (ladders, roofs, platforms, etc)																					1	5			1	165			2	170
Persons falling (slipping, & stumbling)					2	35					3	27	2	60	1	2													8	124
Drilling Equipment					1	60							1	75															2	135
Handling Material					2	19							5	55															7	74
Flying Particles																					2	20	1	2					3	22
Rolling Chunks													2	154															2	154
Flying Objects	1	38			1	40					1	8													1	8			4	94
Hand Tools, Bars, etc.					1	2							1	44															2	46
Electricity					1	11																							1	11
Lifting or Pulling											1	20	2	11															3	31
Falling Down Raise											2	114	1	250															3	364
Loading Equipment					1	6000					1	24																	2	6,024
Nails, Spikes, Sharp Objects											1	2																	1	2
Falling from bench in stope					1	150																							1	150
Jumped from car																							1	9					1	9
Caught by Conveyor	1	14																			1	100							2	114
Railroad Cars																							1	9					1	9
Explosives													1	4															1	4
Fumes from Blasting	1	4																											1	4
Moving Machinery					1	10							1	60							2	103							4	173
Caught in Crusher													1	6000															1	6,000
TOTALS	7	359	0	0	15	6369	0	0	0	0	21	6825	28	7120	1	2	0	0	0	0	6	228	4	72	2	173	0	0	84	21,148

TABLE XI (2E)

A - No. of Accidents
DL - Days Lost

THE CLEVELAND CLIFFS IRON COMPANY-SAFETY DEPARTMENT
CAUSES OF LOST TIME ACCIDENTS, JANUARY 1,1958 - JANUARY 1,1959 - MESABA RANGE

TYPE OF ACCIDENT	Canisteo		Hawkins		Hill Trumbull		Holman Cliffs		Wanless		Total	
	A	DL	A	DL	A	DL	A	DL	A	DL	A	DL
Falling from Shovel Pad							1	3			1	3
Lifting or Pulling			1	2							1	2
Falling from R.R.Car			1	40							1	40
Falling from truck cab	1	8	1	8							2	16
Lowering R.R. cars, arm spun by brake			1	3							1	3
Knocked from Ladder			1	86							1	86
Handling Material			1	5							1	5
Falling from Stage							1	97			1	97
TOTALS	1	8	6	144	0	0	2	100	0	0	9	252

TABLE XI (2C)

TABLE XI (3)

THE CLEVELAND CLIFFS IRON COMPANY

SAFETY DEPARTMENT - ACCIDENT STATISTICS

EYE INJURIES - YEAR 1958

MICHIGAN Mine or Plant	Slights	Compensables	Total Injuries	Days Lost
Bunker Hill Group	3		3	1
Cambria Jackson	0		0	0
Cliffs Shaft	5		5	0
Diamond Drills	0		0	0
Electric Power Div.	1		1	0
Engrg. - Geol. Depts.	1		1	0
General Storehouse	3	1	4	9
Humboldt	1		1	0
Mather Mine "A" Shaft	7		7	1
Mather Mine "B" Shaft	5		5	4
Ohio	0		0	0
Ore Improvement Plant	1		1	0
Pelletizing Plant	9	1	10	20
Republic	1		1	2
Research Laboratory	1		1	0
Tilden	0		0	0
TOTALS	38	2	40	37

MINNESOTA Mine or Plant	Slights	Compensables	Total Injuries	Days Lost
Canisteo	7		7	0
Hawkins	5		5	0
Hill Trumbull	1		1	0
Holman Cliffs	2		2	0
Wanless	0		0	0
TOTALS	15	0	15	0
GRAND TOTALS	53	2	55	37

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

Eye Injuries

The value of our eye protection program is evident from our statistics on eye injuries. We have separated Michigan from Minnesota because Michigan operations make the use of safety goggles and eye glasses compulsory and in Minnesota eye protection is used only when the man believes he has an eye hazard or while doing certain jobs. In Michigan operations, there were forty eye injuries causing thirty seven days lost time. Most of these injuries were caused by dust entering the eye behind the glasses. Only two of these eye injuries were compensable. One was caused when the handle of a coffing hoist struck the safety glasses of the employee and caused a small cut near the eye, (18 days lost time). The other occurred when an employee was cleaning his safety glasses near where his partner was chipping iron with a chisel. A small piece of steel struck the man's eye causing eight days lost time. Total lost time from compensable eye injuries - 26 days. At Minnesota operations, there were fifteen slight eye injuries and no lost time. Grand total eye injuries all properties - 55, lost time 37 days.

SAFETY DEPARTMENT

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE XII

SHOWING TIME PERIODS
WHEN COMPENSABLE INJURIES OCCURRED

TIME	NUMBER	WORKING PERIOD
8:00 A.M. to 12:00 Noon	21	..... First Half of Day Shift
12:00 Noon to 4:00 P.M.....	20	..... Second Half of Day Shift
4:00 P.M. to 8:00 P.M.	6	..... First Half of Afternoon Shift
8:00 P.M. to 12:00 Midnight.....	17	.....Second Half of Afternoon Shift
12:00 Midnight to 4:00 A.M.....	1	.....First Half of Night Shift
4:00 A.M. to 8:00 A.M.....	8	.....Second Half of Night Shift
Total.....	73	

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

b. All Injuries (Cont.)

TABLE XIII

SHOWING OCCUPATION OF INJIRED WORKERS
(Compensable Injuries)

UNDERGROUND		SURFACE		OPEN PIT	
Miner	28	Welder	1	Truck Driver	1
Motor Brakeman	9	Euclid Truck Driver	1	Mechanic Leadman	1
U.G.Repairman	1			Car Hopper	1
Electrician Trainee	1			Electrician	1
Sub Supervisor	2			Plant Repair Helper	1
Shift Boss	1			Shift Supervisor	1
Stope Scraperman	6			General Laborer	1
Electrician	1			Welder Standard	1
Motorman	1				
Timberman	2				
Conveyor Repairman	1				
Skip Pit Man	1				
Oiler	1				
Crusher Attendant	1				
Mill Runner	1				
Chain Conveyor Attendant	1				
TOTALS	58		2		8

PELLETIZING PLANT		STOREHOUSE & SHOPS	
Foreman	1	Steel worker	1
Plant Repairman	1	Welder	1
Ball Mill Helper	1		
TOTALS	3		2

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection

Safety inspections are made by personnel of the Safety Department in company with safety foremen or other supervisors at active properties. Usually they are accompanied by a member of the Union safety committee but these men are not always available and when they are only one trip per month is made with these men. The Union safety committee man is always asked to submit a report of his recommendations and this is done most of the time. To my knowledge none of the Union safety committee recommendations have been unreasonable.

Inspection reports are submitted for each inspection covering the safety orders issued by the property supervisors and recommendations made by the safety inspector. If the Union safety committee man's report is available soon enough, a copy of it is attached to these reports.

Cooperation of all supervisory personnel has been good and has been very much appreciated by members of the Safety Department.

Idle Property

Each spring and fall season all idle property is inspected; also the fencing and caving at active properties are checked. These inspections cover the fencing, old test pits, wells, shafts and open pits. Old open pits are enclosed with fencing and the type of fence used depends on the hazard and its location in regards proximity to habitation.

The filling of old test pits and shafts was started in 1943. To date there are very few that have not been filled or capped with concrete. Those mines which have been abandoned during recent years are railed off at ledge and filled to surface or railed off, timber matting placed over the rails and a concrete cover placed at the collar of the shaft. There are still some old shafts which will need attention in the future because there is very little information on them as to whether they are filled or covered with wood timber. All these known shafts are being checked closely.

Fire Patrols and Inspections

There were no major fires underground during the year, for which we can be thankful. Fire patrols are generally done by supervisors underground during down time, with the first fire patrol starting immediately after the

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Fire Patrols and Inspections (Cont.)

last shift preceding an idle period and at least once every 24 hours afterwards. This should prevent any incipient fire from becoming a major one. On surface the police and watchmen check for any fire.

The Mesaba Range mines had no serious fires during the year.

This Department has worked with both the Ishpeming and Negaunee Fire Departments such as training in use of respiratory equipment, first aid training and checking fire hydrants.

SAFETY DEPARTMENT
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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

TABLE XIV
1958

Mine or Plant	Violations of Standards	Safety Suggestions	Recommendations	Fire Hazard	Total
Bunker Hill Group	15	25	22	4	66
Cambria Jackson		6	2		8
Cliffs Shaft	3	14	13		30
Diamond Drills	0	0	0		0
Humboldt		4	2	1	7
Mather Mine "A" Shaft	19	34	16	4	73
Mather Mine "B" Shaft	16	40	16	1	73
Ohio					0
Ore Improvement Plant	8	9	4	2	23
Pelletizing Plant	12	30	22	3	67
Strhse & Shops					0
Research Laboratory		1	2		3
Republic	4	2	8	1	15
Tilden		2	2		4
Metallurgical Pilot Plant		1	10		11
TOTALS	77	168	119	16	380

TABLE XV
1957

Mine or Plant	Violations of Standards	Safety Suggestions	Recommendations	Fire Hazard	Total
Bunker Hill	32	57	32	1	122
Cambria Jackson		1			1
Cliffs Shaft	9	26	6		41
Diamond Drills		8	3	2	13
Humboldt	3	6	3		12
Maas	11	8	3	3	25
Mather Mine "A" Shaft	17	44	11	1	73
Mather Mine "B" Shaft	6	19	13		38
Ohio	1	7			8
Ore Improvement Plant	10	7	8		25
Pelletizing Plant	3	15	5		23
Republic		4	5	1	10
Strhse & Shops		4	1		5
Research Laboratory					0
Tilden					0
TOTALS	92	206	90	8	396

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Blasting Inspections

Our safety rules require that all mining contracts underground be checked at least once every two months on blasting procedure used by the miners and a report on each inspection be turned in to the superintendent or mine captain. Purpose of this inspection is to make sure that the miners are doing their blasting correctly and not endangering the lives of other people or themselves. The blasting report form is a very simple one and requires very little time. One report form is for fuse blasting and the other for electric blasting. A total of 126 fuse and 789 electric blasting reports were received during the year for a total of 915. There were 55 violations of blasting rules and the great majority was failure to use stemming in the hole.

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

TABLE XVI

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

Mine	Fuse Blasting	Electric Blasting	Number of Violations	Number of Inspections
Bunker Hill	41	17	15	58
Cambria Jackson	33	0	29	33
Cliffs Shaft	0	241	0	241
Mather Mine "A" Shaft	52	39	5	91
Mather Mine "B" Shaft	0	492	6	492
TOTAL	126	789	55	915

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Safety Rules and Regulations

Latest addition to our safety rules covers operation of conveyor belts, one for supervisors and one for employees. These rules were approved only after considerable work by all concerned, even to the approval of the Legal Department. A total of 256 of these rules were distributed to the supervisory force and 1283 to employees.

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

TABLE XVII

RULE BOOKS DISTRIBUTED AT MICHIGAN MINES & PLANTS

Mine or Plant	Surface	Under-Ground	Open Pits & Conct. Plants	Conveyor Belts Foremen	Conveyor Belts Employees	Total
Bunker Hill Group				25	225	250
Cambria Jackson				10	110	120
Cliffs Shaft				30	20	50
Mather Mine "A" Shaft				55	343	398
Mather Mine "B" Shaft				75	425	500
Miscellaneous				20	20	40
Ohio				0	0	0
Ore Improvement Plant				0	0	0
Pelletizing Plant				15	15	30
Republic				20	100	120
Strhse & Shops				0	0	0
Tilden				6	25	31
Humboldt				0	0	0
TOTALS	0	0	0	256	1,283	1,539

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Central Safety Committee

The committee met twelve times during the year. All compensable injuries were discussed and classified as to responsibility. Several minor injuries and accidents were also discussed.

The committee did considerable work on the new rules for the operation of conveyor belts. One set of rules is for the supervisor and the other for employee.

Many other subjects, too numerous to mention in this report, were also discussed.

Committees and individuals were appointed to investigate various things such as underground toilets, industrial noise, lunch rooms, mechanical cleaners for conveyor belts, federal and state mine safety legislation, etc.

Safety Supervisors Meetings

Most of these meetings were held in the Mine Rescue Room at Mather Mine "B" Shaft. These meetings are quite similar to the Central Safety Committee meetings but are a lot more personal. There are much more detailed discussions of all operations and hazards.

Lake Superior Mines Safety Council

This Council is composed of 26 iron and copper mining companies operating in Michigan, Wisconsin and Minnesota. Purpose of the Council is for the exchange of ideas for the betterment of safety in the Lake Superior District.

The annual meeting, which attracts up to 800 mining personnel, is held in Duluth, Minnesota, usually the latter part of May. This is a one and one half day meeting. Top speakers on industrial safety are brought to this meeting, which is generally known as the best and biggest on mining safety in the United States.

The Council also holds sectional meetings on the various mining ranges of the district, with attendance mainly from that particular range, and arrangements for the meetings are made by the local safety personnel. Attendance at these meetings ranges from 60 to 135.

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Lake Superior Mines Safety Council (Cont.)

This Council was organized in 1919 and our Company is a charter member. C.C.I. employees have taken an active part in the Council since the organization and I have been elected President on two occasions, namely 1948-49 and 1957-58 and have been on the Executive and other committees for 21 years.

In connection with the Council we have 14 members who exchange statistics, injury reports and when necessary send out questionnaires on any problems.

National Safety Council

We are a charter member of this organization which came into being in 1913. For our fee we receive most any kind of information along the lines of safety. Our service includes the National Safety News, Traffic News, Supervisors Safety News, posters, work sheets, etc. The annual meeting held in Chicago each year is attended by approximately 12,000 people from all walks of life and from many foreign nations. We havebeen quite well represented at these meetings and have received much valuable information. The mining section, of which we are a member, has given us real good service. I have served as General Chairman of the Section and still belong to the Executive Committee.

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Inspection Reports from Mines and Plants

The following inspection reports are made by Mine or Department Supervisors or employees appointed by the Superintendent and are checked by the Safety Department:

Hoisting Ropes (Daily)
Skip & Cage Roads (Twice a Week)
Safety Catches on Cages (Monthly)
Ladder Roads (Weekly)
Slack Rope Alarm (Monthly)
Hoisting Engines (Monthly)
Fire Extinguishers (Twice a Year)
Fire Equipment (Four Times a Year)
Fire Prevention (Once a Year)
Blasting Inspection (Six Times a Year - Each Contract)
Old Stope Inspection (Cliffs Shaft Mine)
Fire Patrol Inspection (Idle Periods)

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Following are tables showing the kind and number of safety inspections reports made by the mine and plant foremen which were received and checked by this Department:

TABLE XVIII

Type of Inspection	Bunker Hill	Cambria Jackson	Cliffs Shaft	Maas	Mather "A"	Mather "B"	Total
Hoisting Ropes	158	84	154		182	155	733
Skip & Cage Roads	22	114			32	39	207
Ladder Roads	28	12			32	38	110
Cage Safety Catches	7	8			9	11	35
Slack Rope Alarm		8			8	12	28
Hoist Inspection	24	12	48	12	24	24	144
Skip, Cage & Ladder			37				37
Fire Extinguishers	2	1	2		2	2	9
Fire Equipment					1	3	4
Fire Prevention	23		12		11	9	55
TOTALS	264	239	253	12	301	293	1,362

Mine or Plant	Fire Extinguishers	Fire Prevention	Total
Canisteo	1	16	17
Diamond Drills	1		1
Electric Power Div.	16	8	24
General Office	2		2
General Shops	2		2
Hawkins	1	37	38
Hibbing Office		1	1
Hill Trumbull	1	17	18
Holman Cliffs	1	22	23
Humboldt			-
Mather Inn	2		2
Ohio			-
Ore Improvement			-
Pelletizing Plant	2		2
Rented Buildings	2		2
Republic	2	3	5
Research Lab.	2	1	3
Sally		1	1
Sargent	1		1
Tilden	1		1
Wanless	1	8	9
TOTALS	38	114	152

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

Fire Extinguisher Reports

These first aid extinguishers are serviced at lease two times a year, during July and January. It is our first line of defense against fires and has paid off many times over. We have in service 1,322 first aid extinguishers, most of which are the dry chemical type for oil and electric type. On the Marquette Range we have about eliminated the vaporizing type of extinguisher because of the toxic effects of the carbon tetrachloride liquid used in them. Also in time we will eliminate the soda acid type and replace it with the Karbaloy. The reason for this is that the soda acid will freeze and is hard to maintain while the Karbaloy will stand -40° and is very effective on both oil and rubber fires, as well as fires in wood, debris, etc. It also is fire retardent and prevents back flash.

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.) TABLE XIX

TYPES AND TOTALS OF FIRE EXTINGUISHERS INSTALLED AT VARIOUS PROPERTIES

MINE OR PLANT	2½ - 3 Gal. Soda - Acid	1 - 5 Gal. Non-Freeze	2½ - Gal. Foam Type	4 lb. Dry Powder	5-10-15 Lb. Dry Powder	20 - 30 Lb. Dry Powder	1 - 1½ Quart Vaporizing	1 - 3½ Gal. Vaporizing	Automatic Carbon Dioxide	5-10-15-30 Lb. Carbon Dioxide	150 Lb. Dry Powder & Nitrogen Engines	TOTAL
Bunker Hill Group	11	7		8	5	49						80
Cambria Jackson	10	8		2		16						36
Canisteo	3		1		4	11	30	5				54
Cliffs Shaft	12	3		14		52		1				82
Diamond Drills		3		13		9						25
Gen'l Strhse & Shops	19	20	1	45		16	2					103
Hawkins	8	2		1	3	25	26	9			1	75
Hill Trumbull	5				16	21	31	4				77
Holman Cliffs	11			1	6	27	50	6				101
Humboldt	3	6				30						39
Mather Inn	14			4		1	1					20
Mather Mine "A" Shaft	9	13		21	2	78						123
Mather Mine "B" Shaft	29	16		1		123						169
Ohio	6	2		10		11						29
Ore Improvement Plant		8				18						26
Pelletizing Plant		5				16					2	23
Republic		20		1	2	67					2	92
Tilden		2		1	3	10		1				17
Wanless						9	5	1			1	16
Sargent		1			2	3	4	2			1	13
McClure Plant				2		2				2		6
Carp Plant				1		2				2	1	6
Hoist Plant						2				2		4
Republic Plant						1				1		2
Escanaba Plant						1				1		2
Au Train Plant						1				1		2
Diesel Plant			5							2	1	8
Steam Plant				5		1			5	10		21
Hibbing Office	4		1				3	1				9
Ishpeming Gen'l Office	7	3	1			2						13
Rented Houses	4	6		17	1	1	1					30
Research Lab.	4					13						17
Sally					1	1						2
TOTALS	159	125	9	147	45	619	153	30	5	21	9	1,322

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

c. Safety Inspection (Cont.)

TABLE XX

SUMMARY OF DISCIPLINARY ACTION REPORTS

MINE OR PLANT	INFLUENCE OF LIQUOR		VIOLATION OF SAFETY RULE		SLEEPING ON JOB		LOSS OF TIME		INSUBORDINATION		SMOKING UNDERGROUND		CARELESSNESS		MISCELLANEOUS		NO. CONVERTED TO DISCHARGE	TOTAL	
	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	Days	No.	No.	Days
Bunker Hill Group																		0	0
Cambria Jackson																		0	0
Cliffs Shaft											1	10						1	10
Diamond Drills																		0	0
Humboldt													2	8				2	8
Mather Mine "A"	1	4	7	60	3	7	1	4	2	3	1	4					1	15	82
Mather Mine "B"			6	17½	4	19	3	10					1	3			1	14	49½
Ohio																		0	0
General Shops							2	6										2	6
General Strhse.																		0	0
Pellet Plant	1	1					8	15	8	24					1	1		18	41
Republic			1	3			1	3					2	6				4	12
District Lab																		0	0
Ore Improv.Plant																		0	0
Elec.Power Div.																		0	0
Canisteo																		0	0
Hill Trumbull																		0	0
Hawkins							1	3					1	3				2	6
Tilden																		0	0
Holman							1	3										1	3
Wanless																		0	0
TOTAL	2	5	14	80½	7	26	17	44	10	27	2	14	6	20	1	1	2	59	217½

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY

d. Ventilation

Good ventilation of our mines and plants is not only necessary because of the health of employees but for efficient operation. It has been so well recognized during the past 16 or 17 years that all properties have increased the amount of air used. As examples of the change over the years, the Cliffs Shaft Mine had only natural ventilation amounting to 55,000 c.f.m. Blasting was done mostly at lunch time and when going off shift. Now 235,000 c.f.m. is forced into the mine and blasting can be done at any time. All underground mines have main mine fans plus booster and auxiliary fans to force air into the different mining areas and to ventilate drift and mining contracts. When the system is installed correctly, a mining contract can blast and return to its work place in from 20 minutes to a half hour.

Fans at the Mather Mine handle 138,000 c.f.m., at the Bunker Hill Group it is 150,000 c.f.m. and at the Cambria Jackson 54,000 c.f.m.

Dust Sampling and Analysis

Much has been done over the years to dilute, allay and collect dust in the various occupations and in my opinion has been greatly responsible for lack of new silicosis cases among employees. Dust respirators also have helped a lot but cannot take the place of ventilation and dust collectors because the human element is too much involved. Nearly every place of work where there is a dust hazard, there is also a means of eliminating that hazard. Education of the employee by making him dust conscious has also helped. Because of a lack of personnel in the Department, we have not been able to follow up this work as completely as we would like but the supervisory force and employees have helped a lot. Most of our dust sampling during the year has been in those places where we knew there was a real problem.

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

d. Ventilation (Cont)

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

TABLE XXI

DUST SAMPLES COLLECTED - ROCK AND ORE WORK

Mine or Plant	1958 Misc.	1958 In Ore	1958 In Rock	1958 Total	1933-1958 Total
Athens*	0	0	0	0	843
Bunker Hill	0	0	0	0	30
Cambria Jackson	0	0	0	0	394
Cliffs Shaft	0	0	0	0	1,956
Humboldt	0	5	0	5	85
Lloyd**	-	-	-	-	775
Maas*	0	0	0	0	878
Mather Mine "A" Shaft	0	0	0	0	911
Mather Mine "B" Shaft	0	2	8	10	574
Negaunee **	-	-	-	-	830
Pelletizing Plant	103	0	0	103	138
Princeton **	-	-	-	-	85
Republic	0	30	0	30	57
Research Laboratory	0	0	0	0	48
Spies Virgil**	-	-	-	-	203
Tilden	0	0	0	0	103
Miscel.(Test Samples)	0	35	0	35	294
Mesaba Range	0	0	0	0	20
TOTALS	103	72	8	183	8,224

* Now a part of Bunker Hill Group
** No longer in operation

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

d. Ventilation (Cont.)

TABLE XXII

VARIOUS OCCUPATIONS WHERE DUST SAMPLES WERE COLLECTED

OPERATION	CLIFFS SHAFT	HUMBOLDT	MATHER MINE "B" SHAFT	PELLET PLANT	REPUBLIC	TOTAL
Crushing Ore		5			30	35
Drilling in Rock			8			8
Scraping Ore			2			2
Test Samples	35					35
Pelletizing				90		90
Bentonite Feed				11		11
Limestone Feed				2		2
	35	5	10	103	30	183

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

d. Ventilation (Cont.)

TABLE XXIII

AVERAGE LIGHT FIELD COUNT OF ALL SAMPLES TAKEN

Mine or Plant	1933	1934	1935	1936	1937	1938	1939	1940	1941
Athens		32.90	14.12	28.32	26.69	12.85	12.59	9.89	7.28
Cambria Jackson*									
Cliffs Shaft	17.94	14.56	8.29	8.98	15.53	9.86	10.36	7.77	8.18
Lloyd		9.90	12.42	39.25	20.25	10.84	13.47	11.73	8.05
Maas		7.46	27.55	35.75	150.98	11.24	36.90	8.71	17.29
Mather Mine "A" Shaft									2.42
Mather Mine "B" Shaft*									
Negaunee		53.80	17.77	33.25	59.06	56.26	25.49	10.79	14.02
Princeton*									
Spies Virgil					70.61	26.99	1.80	8.40	6.97
Tilden				67.52	285.27	74.60	60.40		49.60
Gardner Mackinaw		27.77		8.61	48.53				
Miscellaneous			8.66	3.00	6.80	14.73			

* Not in operation during this period

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

d. Ventilation (Cont.)

TABLE XXIII (Cont.)

Mine or Plant	1942	1943	1944	1945	1946	1947	1948	1949	1950
Athens	25.80	4.90	8.33	6.64	4.17	7.39	7.49	7.07	4.71
Cambria Jackson		12.10	6.21	17.05	11.99	9.30	13.81	6.86	9.50
Cliffs Shaft	7.55	5.99	6.23	8.18	6.34	8.64	5.12	6.26	3.46
Lloyd	6.95	5.01	14.45	6.49	9.38	11.17	12.97	11.72	11.32
Maas	8.46	12.48	8.78	8.17	9.29	6.08	21.08	10.55	4.45
Mather Mine "A" Shaft	5.58	6.64	7.57	8.39	7.72	10.88	9.50	8.40	7.01
Mather Mine "B" Shaft						2.23	4.16	2.46	6.68
Negaunee	17.02	4.65	11.81	11.92	6.67	7.05	5.48		
Princeton		10.59	6.32	8.48					
Spies Virgil			5.59	14.22	3.59	11.65	5.24	10.12	18.78
Tilden				24.18	66.92	33.65	2.93	4.38	3.74
Gardner Mackinaw*									
Miscellaneous	3.00								

*No longer in operation

SAFETY DEPARTMENT

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YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

d. Ventilation (Cont.)

TABLE XXIII (Cont.)

Mine or Plant	1951	1952	1953	1954	1955	1956	1957	1958
Athens *	4.15	2.71	2.37					
Bunker Hill				1.19	2.33	3.00		
Cambria Jackson	8.32	4.54	6.80	1.38	4.56	2.17		
Cliffs Shaft	4.90	2.76	4.45	2.79	2.31	***	1.95	***
Humboldt			1.59	27.57	6.34	10.04	3.15	40.97
Lloyd**	6.28	4.72	5.17	4.58	5.09			
Maas	4.84	4.93	7.06	5.25	4.14	1.73		
Mather Mine "A" Shaft	8.75	5.86	5.15	3.77	1.38	5.29	7.50	
Mather Mine "B" Shaft	5.04	5.40	5.56	6.41	4.81	2.36		3.96
Mesaba Range				20.28				
Negaunee*	2.27	1.70	2.60					
Pellet Plant						17.65	9.77	25.40
Princeton **								
Republic						4.67	3.65	24.39
Research Lab.						5.29		
SpiesVirgil **	6.05	5.29	4.75	4.14				
Tilden	6.34		3.05		2.36	1.68	1.82	

* Now a part of Bunker Hill Mine
** No longer in operation
*** All test samples

SAFETY DEPARTMENT

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

e. Mine Safety, Fird Aid and Mine Rescue Courses

First Aid Training

A total of 155 employees received first aid training under supervision of a representative of the U. S. Bureau of Mines and assisted by a representative of our Safety Department. Also a one day work shop was held for 25 supervisory employees covering everything new in first aid.

All members of our Safety Department were recommended for renewal of U.S.Bureau of Mines First Aid Instructors Certificates.

Mine Rescue Training

Mine Rescue training was conducted by a representative of the U. S. Bureau of Mines, assisted by personnel of the Safety Department. A total of 155 employees took this training. Instructors Certificates of Mine Rescue Training were renewed for members of the Safety Department.

A workshop conducted in January by the Bureau of Mines was attended by 25 supervisors from our various properties.

SAFETY DEPARTMENT

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

e. Mine Safety, First Aid and Mine Rescue Courses (Cont.)

TABLE XXIV

MINE RESCUE TRAINING - MICHIGAN MINES

OCTOBER-NOVEMBER, 1958

Mine or Department	No. of Men Trained
Bunker Hill Group	24
Cambria Jackson	2
Cliffs Shaft	23
Engrg. & Geol. Depts.	4
Mather Mine "A" Shaft	52
Mather Mine "B" Shaft	50
TOTAL	155

FIRST AID TRAINING - MICHIGAN MINES

OCTOBER-NOVEMBER, 1958

Mine or Department	No. of Men Trained
Bunker Hill Group	24
Cambria Jackson	2
Cliffs Shaft	23
Engrg. & Geol. Depts.	4
Mather Mine "A" Shaft	52
Mather Mine "B" Shaft	50
TOTAL	155

In addition to the above, a workshop was held in January, 1958 with Bureau of Mines personnel in charge, covering new ideas in Mine Rescue and First Aid. About 25 supervisory personnel attended this two day session.

SAFETY DEPARTMENT

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

e. Mine Safety, First Aid and Mine Rescue Courses (Cont.)

TABLE XXV

Material	No. Distributed
1" Compresses (Band Aids)	40,428
Cotton-Tipped Merthiolate Applicators	1,816
Knuckle-Bandages	1,098
Plain Gauze Pads (3"x3")	318
Oz. of Spirits of Ammonia	256
Rolls of Adhesive Tape (½")	128
Oz. of Tincture of Merthiolate	99
2" Compress Bandages	68
Picric Acid Gauze Pads (for burns)	80
5/8 oz. Tubes of Foille (for burns & abrasions)	77
1" Roll Bandages	51
3" Compress Bandages	46
Leather Finger Cots	62
2" Roll Bandages	51
Triangular Bandages (40" Cravat)	23
3" Roll Bandages	35
2 oz. Bottles (For Tincture of Merthiolate)	20
Oz. of Absorbent Cotten	8
Scissors	2
Forceps	1
TOTAL	44,667

SAFETY DEPARTMENT

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11. ACCIDENTS AND PERSONAL INJURY (Cont.)

f. Miscellaneous

As President of the Lake Superior Mines Safety Council, attended all section and executive meetings until the new President took over the duties in June.

On request of Lt.Governor Hart, sent him the names of three mining men from Upper Michigan who were appointed members of the Michigan Industrial Safety Advisory Council.

On various occasions we took visitors to the active properties and departments and in turn we visited other company properties to learn methods, etc.

Checked all properties on use of the new file cards, which give information in case of accident, to see if they were up to date. This was done a number of times during the year because of transfers and lay-offs.

Attended meetings of the Negaunee Business & Professional Association.

Attended and took part in the Mather Mine SubCommittee on Subsidence.

Attended meetings on House Bills #66 and #74 - Sanitary Bill for U.G. Lunchrooms and Toilets.

A record of industrial noise was made at the operating properties and reports were sent in to all those concerned. We have a record of nearly every piece of noisy equipment operated on the Range, except the Diesel Plant. Readings will be taken there at any time it is in operation.

Assisted a number of church organizations on fire inspections and made recommendations for extinguishers.

Assisted the Ishpeming Ski Club during tournaments by serving as first aid teams.

Took air samples of exhaust of diesel loader at Cliffs Shaft Mine and had analyses for nitrogen oxides made by the U.S.Bureau of Mines. O.K.

Sampled cabs of the Jet Piercers for carbon monoxide and these proved O.K.

SAFETY DEPARTMENT

ANNUAL REPORT

YEAR 1958

11. ACCIDENTS AND PERSONAL INJURY (Cont.)

f. Miscellaneous (Cont.)

Assisted personnel of the Ore Improvement Plant to check gases in oil storage tank after a leak had developed. Furnished gas masks to protect workers in tank.

Attended meetings in honor of 25 and 40 year employees in Ishpeming,Michigan and Hibbing, Minnesota. Also meetings of the Steering Committee on T.V. programs at Ishpeming, Marquette and Iron River.

A number of mining safety movies were shown at the operating properties for all supervisors.

After several years of experimenting, we finally were able to find an ear muff which is acceptable to employees working around the Cliffs Shaft 15th Level crushing plant. With these ear muffs, the high frequencies are kept out but normal conversation can be heard.

Worked with the U. S. Bureau of Mines and the Michigan Department of Health on air and dust analysis and received free silica determinations from these people on settled dust at the Pellet Plant. There was no charge for these analyses.

TABLE XXVI

COMPARISON OF FREQUENCY, SEVERITY RATING
(Taken from Available Statistics)

		Frequency	Severity	1957 Lake Superior District Frequency	1957 Lake Superior District Severity
1956*	National Rating, Coal Mining (Underground)	21.45*	7,353*		
1956*	" " Other Mining (Not incl. Coal)	20.45*	2,869*		
1954-1956*	" " Metal Mining (Underground)	29.97*	4,954*		
1957	Lake Superior District Mines (26 Cos. Reporting)	15.54	2,839		
1958	The Cleveland-Cliffs Iron Co. Compensable Injuries	17.37	5,078		
1958	" " " All Injuries	22.13	5,093	15.54	2,839
1958	" " " Open Cut Mining	16.19	536	5.65	2,411
1958	" " " Concentrating Plants	17.48	444	12.47	1,356
1958	" " " Sub-Level Caving	0.00	0	26.03	2,793
1958	" " " Stoping	37.04	15,727	33,73	8,872
1958	" " " Block Caving	31.50	8,065	49.79	4,594
1958	" " " General Shops	15.72	1,360	5.17	252
1958	" " " Top Slicing	-	-	27.71	526
1958	" " " Shaft Sinking & Develop.	-	-	26.92	1,122
1958	" " " Elec. Power Div.	0.00	0		
1958	" " " General Roll	0.00	0		
1958	" " " Miscellaneous	21.60	43	0.82	8

* Latest figures available.

SUMMARY OF MINING ENGINEERING DEPARTMENT ACTIVITIES - 1958

1. The combination of Mr. Ralph E. Magnuson's duties previous to his appointment as Chief Mining Engineer and the duties of Chief Mining Engineer resulted in a continuation of the very close association with the activities of the Recording, Ad Valorem & Fire Insurance Department and the Mining Engineering Department. A reduction of salaried personnel in August necessitated the reorganization of the Mining Engineering Department as of August 15, 1958. Maxwell H. Madsen and Einer D. Lindquist were transferred to the Department from the Industrial Engineering and Operating Research Departments, therefore, the Mining Engineering Department's Annual Report for 1958 will include not only the activities of the Recording, Ad Valorem & Fire Insurance Department but also those Industrial Engineering activities not reported elsewhere.

2. The underground properties continued mining and development work which necessitated engineering assistance in the surveying and mapping of this work. Stockpiles were surveyed, estimates of the ore in stock were calculated, ore reserves were estimated for valuation purposes and all shafts were gauged during the year.

3. The open pit properties called for engineering assistance in mine surveying and mapping, drilling and blasting control, checking of tailings basins and the estimating of ore in stockpile.

4. The Field Engineering Crew carried on with the necessary subsidence surveys, property line control, drill hole control; assisted in the construction of the Pilot Plant with the establishment and maintenance of lines and grades for building and machinery installation; assisted at the open pits, when necessary, on pit surveys and stockpile estimating; and supplied the survey control necessary for the additional improvements at the Cliffs Fourth Addition to the City of Negaunee.

5. Throughout the year, Mr. Magnuson continued to provide the Cleveland Tax Department with assistance in compiling data for the Federal Income Tax Returns.

6. The reduction in departmental personnel of 17 men (8 Helpers; 5 Surveyors; 3 Draftsmen; and 1 Printer) and the transfer into the Department of 5 men (3 Engineers; 1 Surveyor; and 1 Draftsman-Printer) resulted in a complete reorganization of the Department as of August 15, 1958.

A. MINING ENGINEERING DEPARTMENT STAFF

The reduced ore sales resulted in reduced operating schedules from March to September, 1958. All salaried personnel except the Chief Mining Engineer were placed on the reduced working schedule of one week off in five. The "honey do" week was covered by unemployment compensation. Considerable effort was devoted to arranging schedules to provide the necessary engineering coverage.

The following personnel changes were made during the year:

1. In January, Robert J. Flynn was assigned to the project of preparing long range mining plans for both the Humboldt and Republic Mines and was the only Mining Engineer assigned to the open pit mines.

2. Effective as of January 16, Allan H. Heikkinen was transferred back into the Mining Engineering Department and was assigned to the Republic Mine as Surveyor.

3. Because of further curtailment at the Bunker Hill Mine, Robert E. Anderson and Clyde C. Anderson, Surveyors, were transferred, effective as of January 16, to "A" and "B" Shafts of the Mather Mine, respectively, as Surveyor Helpers.

4. Effective as of January 16, Arthur W. Hemmila and Donald E. Lampi, who had been Surveyor Helpers at the Mather Mine, "A" and "B" Shafts, were transferred to the Mather Mine, "B" Shaft bargaining unit.

5. Effective as of March 15, John R. Sleeman, Assistant Mining Engineer assigned to the Bunker Hill--Maas Mines, was transferred to the Bunker Hill roll.

6. After the Humboldt Mine was shut down, Albert Henry, Surveyor, was assigned to the Research Laboratory for the period of the shutdown.

7. Because of the change in operating schedule at the Republic Mine in June, Robert J. Flynn and Clifford H. Amel were assigned as full-time engineering personnel for the mine, and Allen H. Heikkinen was brought into the Ishpeming Office for general open pit engineering duties.

8. The transfers into the Department, transfers out of the Department and layoffs as of August 15, 1958 are listed as follows:

   Transfers into the Department

   Maxwell H. Madsen (one-half Mining Engineering and one-half Industrial Engineering)
   Einer D. Lindquist (one-half Mining Engineering and one-half Industrial Engineering)
   Edward C. Rosar from the Operating Research Department
   John R. Sleeman from the Bunker Hill Mine
   Gideon S. Johnson from the Geological Department

Transfers out of the Department

To Research Laboratory - Robert E. Anderson
Henry C. Coron, Jr.
George B. Manzoline
Louis R. Miller, Jr.
Martin D. Tasson
Allan E. Wakkuri

To Police Department - Allan L. Bjork
Charles W. Cornish
Lembit L. Liivoja

To Land & Timber Department - Clyde C. Anderson

To Office Services - Anselm H. Mantyla

Layoffs

Allen H. Heikkinen
William R. Lehmann
Arnold A. Sundell

9. Assignments and responsibilities following the reorganization of the Mining Engineering Department as of August 15, 1958 were:

Daniel P. Isaacson assumed the responsibility for all underground surveying and related work. Harley E. Clickner assumed the responsibility for the preparation of estimates and special mine planning. These two men were responsible for stockpile surveys, shaft gaugings, etc.

Eino A. Koski was assigned the responsibility for engineering assistance in planning for main level development and underground equipment installation.

Maxwell H. Madsen, in the time that he was available to the Mining Engineering Department, was assigned the responsibility of triangulation calculations and the application of IBM equipment to engineering calculations.

Einer D. Lindquist, in the time that he was available to the Mining Engineering Department, worked on special engineering studies.

Edward C. Rosar and Carl A. Koski assisted Messrs. Isaacson and Clickner in their work.

LeRoy Hosking and Frank A. Koski were assigned the responsibility for subsidence surveys, engineering control for construction work and surface surveys. Ernest A. Oja assisted them.

10. Eino A. Koski, Underground Development Engineer, terminated his employment with The Cleveland-Cliffs Iron Company as of December 1, 1958.

Following the reorganization of the Mining Engineering Department because of the reduction in personnel effective as of August 15, 1958, considerable time was spent by Daniel P. Isaacson and Harley E. Clickner in developing a Monthly Activity Schedule for the Department. With the reduced personnel, it was necessary to schedule in advance in order that adequate engineering coverage was provided for the operating properties. A master schedule for the entire month, which covers those Engineers and Surveyors who have been assigned to the pools, was prepared and posted on the Mining Engineering Department's bulletin board. This schedule was modified on a day to day basis as required. Use of the schedule to date has assisted materially in an orderly control and effective distribution of engineering personnel.

The Recording, Ad Valorem and Fire Insurance Department responsibilities were handled by Robert G. Fountain, Donald W. Carlson and Mrs. Bernice Belaire. Mr. Fountain, as Recorder, was responsible for the recording of all land transactions concerning Mining Department lands, the preparation of the annual tax list, Negaunee house acquisitions, etc. Mr. Carlson was responsible for the various reports, requests, etc., necessary in connection with the payment of Michigan Ad Valorem Taxes, Republic house moving and fire insurance. Mrs. Belaire was the stenographer, assisting Messrs. Fountain and Carlson until August 1, 1958 when she was transferred to the IBM Department as a Key Punch Operator.

The following table shows the personnel of the Mining Engineering Department, their position and the period of employment:

TABLE I

Name	Position	Entered	Left	1958 Employment
Ralph E. Magnuson, Jr.	Chief Mining Engineer			12 months
Harley E. Clickner	Engineer			12 months
Robert J. Flynn	Engineer			12 months
Oiva W. Hakala	Technical Foreman			12 months
LeRoy Hosking	Engineer			12 months
Daniel P. Isaacson	Engineer			12 months
R. Charles Kincaid	Engineer			12 months
Carl A. Koski	Engineer			12 months
Eino A. Koski	Engineer		December 1	11 months
Frank A. Koski	Engineer			12 months
Einer D. Lindquist	Engineer	August 15		4½ months
Maxwell H. Madsen	Engineer	August 15		4½ months
James P. Meyers	Engineer	January 1		12 months
Bernhardt H. Petersen	Technical Foreman			12 months
Edward C. Rosar	Engineer	August 15		4½ months
William H. Stannard	Chief Draftsman			12 months
Lembit L. Liivoja	Draftsman		August 15	7½ months
Anselm H. Mantyla	Draftsman		August 15	7½ months
George B. Manzoline	Draftsman		August 15	7½ months
Louis R. Miller, Jr.	Blueprint Machine Operator		August 15	7½ months

Name	Position	Entered	Left	1958 Employment
Gideon S. Johnson	Blueprint Machine Operator--Draftsman	August 15		4½ months
Jean C. Jensen	Stenographer			12 months
Clifford H. Amel	Surveyor			12 months
Clarence P. Ayotte, Jr.	Surveyor			12 months
Allan L. Bjork	Surveyor		August 15	7½ months
Charles W. Cornish	Surveyor		August 15	7½ months
Albert Henry	Surveyor		March 15	2½ months
Allen H. Heikkinen	Surveyor		August 15	7½ months
Alfred B. Nault	Surveyor			12 months
Ernest A. Oja	Surveyor			12 months
John R. Sleeman	Surveyor	August 15	March 15	7 months
Allan E. Wakkuri	Surveyor		August 15	7½ months
Clyde C. Anderson	Helper		August 15	7½ months
Robert E. Anderson	Helper		August 15	7½ months
Henry C. Coron, Jr.	Helper		August 15	7½ months
Arthur W. Hemmila	Helper		January 16	½ month
Donald E. Lampi	Helper		January 16	½ month
William R. Lehmann	Helper		August 15	7½ months
Arnold A. Sundell	Helper		August 15	7½ months
Martin D. Tasson	Helper		August 15	7½ months

The following table shows the personnel of the Recording, Ad Valorem and Fire Insurance Department, their position and period of employment:

TABLE II

Name	Position	Entered	Left	1958 Employment
Robert G. Fountain	Recorder			12 months
Donald W. Carlson	Insurance Examiner			12 months
Bernice Belaire	Stenographer		August 1	7 months

The following table shows the length of service in the Company and in the Mining Engineering Department of those employed at the end of the year:

TABLE III

Name	Date Started Company Service	Length of Service In Company	Date Entered Mining Engineering Department	Length of Service Mining Engineering Department
Ralph E. Magnuson, Jr.	June, 1946	12 years, 7 months	February, 1957	1 year, 11 months
Jean C. Jensen	July, 1951	7 years, 5½ months	July, 1951	7 years, 5½ months
William H. Stannard	November, 1940	18 years, 2 months	November, 1940	18 years, 2 months
Gideon S. Johnson	June, 1948	10 years, 7 months	August, 1958	4½ months
Harley E. Clickner	June, 1952	4 years, 5 months	June, 1952	4 years, 5 months
Robert J. Flynn	April, 1953	5 years, 8 months	April, 1953	5 years, 8 months
Oiva W. Hakala	July, 1951	7 years, 6 months	July, 1951	7 years, 6 months
LeRoy Hosking	June, 1950	8 years, 7 months	March, 1954	4 years, 10 months
Daniel P. Isaacson	November, 1940	13 years, 4½ months	November, 1940	13 years, 4½ months
R. Charles Kincaid	July, 1951	7 years, 6 months	July, 1951	7 years, 6 months
Carl A. Koski	June, 1941	14 years, 1 month	June, 1941	14 years, 1 month
Frank A. Koski	February, 1927	27 years, 8 months	January, 1936	18 years, 9 months
Einer D. Lindquist	July, 1951	7 years, 6 months	August, 1958	4½ months
Maxwell H. Madsen	September, 1943	15 years, 3½ months	August, 1958	4½ months
James P. Meyers	June, 1952	6 years, 6½ months	January, 1958	1 year
Bernhardt H. Petersen	June, 1949	9 years, 6½ months	June, 1949	9 years, 6½ months
Edward C. Rosar	November, 1952	4 years, 2 months	August, 1958	4½ months
Clifford H. Amel	May, 1944	14 years, 7½ months	May, 1944	14 years, 7½ months
Clarence P. Ayotte, Jr.	April, 1948	10 years, 8½ months	April, 1948	10 years, 8½ months
Alfred B. Nault	September, 1941	17 years, 4 months	September, 1946	12 years, 3½ months
Ernest A. Oja	January, 1942	16 years	March, 1943	14 years, 10 months
John R. Sleeman	February, 1947	11 years, 11 months	February, 1947	11 years, 6 months

Time spent in the Armed Forces is not included in this table.

The following table shows the length of service in the Company and in the Recording, Ad Valorem and Fire Insurance Department of those employed at the end of the year:

TABLE IV

Name	Date Started Company Service	Length of Service in Company
Robert G. Fountain	August, 1951	7 years, 4 months
Donald W. Carlson	August, 1936	19 years, 1 month

Name	Date Entered Recording, Ad Valorem and Fire Insurance Department	Length of Service Recording, Ad Valorem and Fire Insurance Department
Robert G. Fountain	August, 1951	7 years, 4 months
Donald W. Carlson	August, 1936	19 years, 1 month

Time spent in the Armed Forces is not included in this table.

The following sheets show in tabular form (Tables V, VI, VII and VIII), the personnel of the Mining Engineering Department and the Recording, Ad Valorem and Fire Insurance Department and the mines to which they were assigned prior to August, 1958 and after August, 1958:

TABLE V

MINING ENGINEERING DEPARTMENT STAFF - PRIOR TO AUGUST, 1958

	BUNKER HILL--MAAS	CAMBRIA-JACKSON	CLIFFS SHAFT	HUMBOLDT
MINE ENGINEER	Harley E. Clickner	Combined		No
ASS'T MINE ENGINEER			Carl A. Koski	Operations
SURVEYOR		with	Allan L. Bjork	after
HELPER		Mather Mine,		March,
				1958
TECHNICAL FOREMAN	Bernhardt H. Petersen	"B" Shaft	James P. Meyers	

	MATHER "A"	MATHER "B"	REPUBLIC	OPEN-PITS--GENERAL
MINE ENGINEER	Oiva W. Hakala	R. Charles Kincaid	Robert J. Flynn	
SURVEYOR	Clarence P. Ayotte, Jr. Charles W. Cornish	Alfred B. Nault Allan E. Wakkuri	Clifford H. Amel	Allen H. Heikkinen
HELPER	Robert E. Anderson William R. Lehmann	Clyde C. Anderson Arnold A. Sundell		
TECHNICAL FOREMAN		Eino A. Koski (Development Engineer)		

	FIELD ENGINEERING
MINE ENGINEER	LeRoy Hosking
ASS'T MINE ENGINEER	Frank A. Koski
SURVEYOR	Ernest A. Oja
HELPER	Henry C. Coron, Jr. Martin D. Tasson

OFFICE	
DISTRICT ENGINEER	Daniel P. Isaacson
DRAFTSMEN	William H. Stannard (Chief) Lembit L. Liivoja Anselm H. Mantyla George B. Manzoline
DEPARTMENT CLERK	Jean C. Jensen
BLUEPRINT MACHINE OPERATOR	Louis R. Miller, Jr.

TABLE VI

RECORDING, AD VALOREM AND FIRE INSURANCE DEPARTMENT

PRIOR TO AUGUST, 1958

Recorder	- Robert G. Fountain
Taxes and Fire Insurance	- Donald W. Carlson
Stenographer	- Bernice Belaire

TABLE VII

THE CLEVELAND-CLIFFS IRON COMPANY
MINING ENGINEERING DEPARTMENT

PERSONNEL ASSIGNMENTS - AFTER AUGUST, 1958

Chief Mining Engineer . . . . . Ralph E. Magnuson, Jr.
Department Secretary & Stenographer . . . . . Jean C. Jensen
Chief Draftsman . . . . . William H. Stannard
Draftsman & Printer . . . . . Gideon S. Johnson

General Engineering & Office

*Industrial Engineer . . . . . Maxwell H. Madsen
*Industrial Engineer . . . . . Einer D. Lindquist
Mining Engineer . . . . . Eino A. Koski

General Field & Surface Engineering

Mining Engineer . . . . . LeRoy Hosking
Mining Engineer . . . . . Frank A. Koski
Surveyor . . . . . Ernest A. Oja

General Underground Engineering

Mining Engineer . . . . . Daniel P. Isaacson
Mining Engineer . . . . . Harley E. Clickner
Mining Engineer . . . . . Edward C. Rosar
Mining Engineer . . . . . Carl A. Koski

Bunker Hill--Maas Mine

Technical Foreman . . . . . Bernhardt H. Petersen
Surveyor . . . . . John R. Sleeman

Cliffs Shaft Mine

Mining Engineer . . . . . James P. Meyers

Mather Mine, "A" Shaft

Technical Foreman . . . . . Oiva W. Hakala
Surveyor . . . . . Clarence P. Ayotte, Jr.

Mather Mine, "B" Shaft--Cambria-Jackson Mine

Mining Engineer . . . . . R. Charles Kincaid
Surveyor . . . . . Alfred B. Nault

Republic Mine

Mining Engineer . . . . . Robert J. Flynn
Surveyor . . . . . Clifford H. Amel

* Shared with Industrial Engineering Department

TABLE VIII

RECORDING, AD VALOREM AND FIRE INSURANCE DEPARTMENT

AFTER AUGUST, 1958

Recorder - Robert G. Fountain

Taxes and Fire Insurance - Donald W. Carlson

1. DISTRIBUTION OF TIME

The following table shows the distribution of time for the year at the different properties and jobs and the percentage of time spent on each property:

TABLE IX

Property or Account	Total	%
Mining Engineering General	1,307.75	22.540
Bunker Hill Mine	579.75	9.992
Bunker Hill Mine Subsidence	48.75	.840
Cambria-Jackson Mine	67.25	1.151
Cambria-Jackson Mine Subsidence	12.00	.207
Cliffs Shaft Mine	477.00	8.221
Humboldt Mine	184.75	3.184
E&A HM-36 (Plant Expansion - Preliminary Design)	12.50	.216
E&A HM-44-B-2-a-2 (Plant Expansion - Field Engineering)	7.00	.121
Mather Mine,		
"A" Shaft	970.50	16.727
"A" Shaft Subsidence	8.75	.151
"B" Shaft	844.00	14.547
"B" Shaft Subsidence	27.25	.470
E&A NM-115-ME (Crusher and Conveyor - 10th Level)	67.00	1.155
E&A NM-127-ME (9th Level Conveyor)	31.00	.534
E&A NM-140-ME (7th Level Conveyor Belt Extension)	2.50	.043
E&A NM-142-ME (Discharge Excavation for Incline to Shaft)	6.00	.104
E&A NM-144A (Diamond Drilling)	4.25	.074
E&A NM-144-9-d (Drifting for Drill Stations - 9th Level)	4.50	.078
E&A NM-144-10-d (Drifting for Drill Stations - 10th Level)	2.25	.039
E&A NM-145-5-v (Ventilation - 5th Level)	1.00	.017
E&A NM-145-9-d (Drifting - 9th Level)	33.75	.582
E&A NM-145-10-b (Pockets, Trenches and Equipment - 10th Level)	6.00	.104
E&A NM-145-10-d (Drifting - 10th Level)	77.75	1.340
E&A NM-146-9-d (Drifting - 9th Level)	33.25	.574
Ohio Mine	12.75	.220
Ore Improvement Plant	75.75	1.306
Republic Mine	560.25	9.656
Pelletizing Plant	64.00	1.103
E&A MI-17 (Empire Core Drilling)	12.25	.211
E&A MI-48 (Republic Expansion Program)	1.00	.017
Tilden Mine	53.75	.927
Canadian Cliffs--Project 17	3.50	.060
Electric Power Department--Account P2-722.1	5.00	.086
Idle and Abandoned Properties	1.50	.027

Property or Account	Total	%
Marine Department	3.25	.056
Morris Mine Inspection	8.00	.138
Land Offer 3719	2.00	.035
E&A CC-822 (Fourth Addition - City of Negaunee)	58.25	1.004
E&A CC-825 (Cascade East End Drilling)	53.25	.918
E&A CC-859 (West Tilden Area Drilling)	1.75	.030
E&A CC-867 (Isabella Area Drilling)	10.25	.177
E&A CC-868 (Ogden--Schoolhouse Area Drilling)	7.25	.125
E&A CC-927 (Dismantling of Building, Lot 30, Iron Plat)	1.50	.027
E&A CC-955 (Wisconsin Drilling)	1.00	.017
E&A CC-961-E-1 (Pilot Plant - Field Engineering)	33.25	.574
E&A CC-962 (Isabella Area Drilling)	7.00	.120
E&A CC-979 (Development - Bunker Hill Mine)	5.50	.095
E&A CC-981 (Development - Maas Mine)	3.50	.060
	5,802.00	100.000%

2. COSTS

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

TABLE X

	1956	1957	1958
Salaries	$255,394	$261,552	$181,952
Overtime & Special Allowances	6,525	4,269	45
Travel	1,603	567	510
Dues & Subscriptions	173	137	165
Telephone & Telegraph	687	806	683
Printing, Stationery & Office Supplies	589	1,023	372
Heat, Light, Power & Water	372	(32)	(9)
Furniture, Fixtures & Office Equipment	326	467	0
Payroll Taxes (Unemployment)	244	812	1,733
Old Age Benefits Tax	946	2,360	3,254
Auto Expense	5,155	6,239	2,571
Entertainment	564	125	117
Field Equipment & Maintenance	2,553	1,405	845
Building Alterations	772	143	61
Repairs & Maintenance	49	375	150
Insurance	1,414	708	538
Postage, Express & Freight	214	108	56
Stock Supplies	10,147	4,762	1,852
Miscellaneous	0	(444)	397
Depreciation	4,120	6,881	5,569
Donations	8	0	0
Group Annuity	9,240	10,002	6,414
Property & Franchise Taxes	0	156	0
Totals	$301,095	$302,421	$207,284

B. AUTOMOBILES

Because of a cutback in the Mining Engineering Department's budget, two cars were turned in in March, 1958. They were a Ford Ranch Wagon (1953 model - #48), which had been operated by the Field Engineering Crew, and a Ford Ranch Wagon (1956 model - #77), which had been operated by the Humboldt Mine Engineering Crew. The Ford Ranch Wagon (1956 model - #85) was operated by the Field Engineering Crew during the remainder of the year. The Ford Ranch Wagon (1957 model - #115) was operated throughout the year by the Republic Mine Engineering Crew. The Chevrolet Carryall (1955 model - #69) was used for the transportation of underground personnel to and from the mines. The Plymouth Suburban (1957 model - #106) was used for general departmental use.

The Ford 4-door Sedan (#G-5088), assigned to the Chief Mining Engineer, was turned in during March, 1958, due to a cutback in the number of Company cars rented from Glove Auto Leasing, Inc.

The following table shows the mileage covered in 1958, the total mileage to the end of the year and the date the cars were received in the Department:

TABLE XI

Car	Miles 1958	Miles Total	Date Received	Date Disposed of
Ford Ranch Wagon (1953 model), #48	1,100	60,950	7/30/53	3/14/58
Ford Ranch Wagon (1956 model), #77	2,643	26,648	11/30/55	3/31/58
Ford Ranch Wagon (1956 model), #85	7,860	38,909	6/1/56	
Ford Ranch Wagon (1957 model), #115	15,945	27,395	5/8/57	
Chevrolet Carryall (1955 model), #69	4,044	33,801	5/21/55	
Plymouth Suburban (1957 model), #106	14,129	31,130	3/20/57	

C. MAP REPORTS

Since the discontinuation of the bound volumes containing maps which show the yearly mining activities, such as, the advancement of the underground development and mining, the photographs of construction progress, the open pit cross-sections and the logs of diamond drill holes, the only manner in which this can be made of record is to print additional copies of the large scale, 1":50' mine working maps which are filed for future reference. In addition, the large scale drawings are substituted for the more convenient-

sized, annual report maps in order to fulfill the map report requirements called for in the majority of the existing mining leases. These agreements stipulate that map reports showing the status of the various properties as of December 31 shall be submitted.

The following table shows the companies for which sets of working tracing prints were prepared and the Michigan mine or mines in which that company has an interest:

TABLE XII

Company	Mines For Itself	Mines As Operating Agent
The Cleveland-Cliffs Iron Company	Bunker Hill Cambria-Jackson Maas Ohio Tilden	Athens Humboldt Mather Republic
The Athens Iron Mining Company for Pickands Mather & Company		Athens
The Negaunee Mine Company Partner: Bethlehem Steel Company		Mather Mine, "A" Shaft "B" Shaft
Humboldt Mining Company Partner: Ford Motor Company		Humboldt

Because of the reduced operating schedule at the mines, it was felt that printing of new maps on a quarterly basis rather than on a monthly basis would be more adequate and economical with regard to both time and material. This would relieve the Mine Engineers of posting the tracings every month and give the mine superintendents more of the Engineers' time for other work at the mines which was felt to be more important with the reduced number of engineering personnel.

At the end of each quarter, the Mining Engineers, assigned to the soft ore properties, inspected the underground workings and posted the quarterly mining progress, the advance of the development contracts and the diamond drill holes. Two sets of these quarterly progress were made; one set to be used by the Manager and the other set sent to the Superintendent for his use. Numerous prints of the various sub-level maps upon which there was active mining operations were printed, trimmed and folded to pocket size. These maps were carried by the Mine Captain, Foremen and Shift Bosses who used the maps in their day to day production planning.

The next few paragraphs describe the map reports sent out by the Mining Engineering Department:

ATHENS MINE

One set of quarterly progress maps, with mining advancement colored in red, was sent to Mr. E. L. Joppa, General Manager, Mines, of the Pickands Mather & Company throughout the year.

CLIFFS SHAFT MINE

One set of mining progress maps of the Bancroft and Section 10 Leases was forwarded to the Duluth Office of the Oliver Iron Mining Division after each of the tri-annual surveys, showing the work done during that four-month period in color. The final issue of these progress maps for the year 1958 also showed the ore areas that were used in calculating the estimate of ore reserves as reported to the Michigan State Tax Commission.

HUMBOLDT MINE

Two sets of monthly maps, showing stripping and mining advancement, were prepared and sent to Mr. R. L. Bodor, Manager, Mining Properties, and Mr. V. E. Kral, Resident Manager, of the Ford Motor Company through March, 1958.

Annual maps were also sent to Mr. Harry B. Weber, fee-owner of the Weber Lease.

MATHER MINE

A complete set of working maps of both "A" and "B" Shafts was forwarded to Dr. Donald M. Fraser, Chief Geologist of the Bethlehem Steel Company, at the end of each quarter, showing the mining progress in color.

MICHIGAN STATE TAX COMMISSION

During the first part of September, copies of all maps which show any active workings were sent to Mr. Harry J. Hardenberg, Deputy State Geologist. Outlined on the maps were the known ore areas which were used for calculating the ore reserve tonnages. A supplementary map report was sent to the Michigan State Tax Commission at the end of any year in which any large increase in ore reserves is discovered after the appraisal date of October 1st. No such supplemental report was necessary for 1958. Upon the discontinuance of the making of the annual report-size prints, the large 50':1" working maps were prepared to be used as a permanent record of the ore reserve tonnages reported to the Michigan State Tax Commission. These are kept on file in the Ishpeming Mining Engineering Department.

NEGAUNEE MINE

Prints of the Bunker Hill main levels were sent to the Negaunee Mine fee-owners. The yearly progress for 1958 was colored.

OHIO MINE

Maps of the yearly mining progress, both stripping and ore operations, were sent to the Department of Conservation, State of Michigan, from

whom we lease the Beaufort Property. Tables, showing the production from the various leases, the concentrate and heavy media tonnages, percentage recovery, etc., were sent to the State of Michigan in accordance with the Beaufort Lease mill reject agreement.

TILDEN MINE

Maps of the yearly mining progress, both stripping and ore operations, were sent to the Hanna Coal & Ore Company.

D. MINING LEASES - Robert G. Fountain

The following mining leases and options were executed and placed on file in 1958:

Lease No. 174

Five year easement for ninety-nine year lease from Juneau County, Wisconsin, to The Cleveland-Cliffs Iron Company, dated July 5, 1958, covering various descriptions in Townships 17 and 18 North of Ranges 3 and 4 East, Juneau County, Wisconsin.

Lease No. 175

Five year easement for ninety-nine year lease from Emil J. Duschek to The Cleveland-Cliffs Iron Company, dated August 12, 1958, covering the $N\frac{1}{2}$ of the $NE\frac{1}{4}$, Section 2, T. 17 N., R. 3 E. and the $S\frac{1}{2}$ of the $N\frac{1}{2}$ and the $N\frac{1}{2}$ of the $N\frac{1}{2}$ of the $S\frac{1}{2}$, Section 36, T. 18 N., R. 3 E., Juneau County, Wisconsin.

Lease No. 176

Three year easement for ninety-nine year lease from Julie A. Small to The Cleveland-Cliffs Iron Company, dated October 4, 1958, covering the $NW\frac{1}{4}$ of the $NE\frac{1}{4}$, Section 25, and the $E\frac{1}{2}$ of the $NE\frac{1}{4}$ of the $NE\frac{1}{4}$, Section 26, all in T. 18 N., R. 3 E., Juneau County, Wisconsin.

Lease No. 177

Three year easement for ninety-nine year lease from Charles L. Krupa and wife to The Cleveland-Cliffs Iron Company, dated September 20, 1958, covering the $N\frac{1}{2}$ of the $NE\frac{1}{4}$ and the $NE\frac{1}{4}$ of the $NW\frac{1}{4}$, Section 1, T. 17 N., R. 3 E., Juneau County, Wisconsin.

Lease No. 178

Five year easement for ninety-nine year lease from T. E. Darrow and wife to The Cleveland-Cliffs Iron Company, dated September 19, 1958, covering various descriptions in Sections 1, 9, 12 and 23, T. 17 N., R. 3 E., and Sections 33 and 34, T. 18 N., R. 3 E., Juneau County, Wisconsin.

Lease No. 179 - Quebec Cobalt

Option until December 31, 1958 extended to December 31, 1959 from Normanville Mining Company to The Cleveland-Cliffs Iron Company to acquire a half interest in various mining claims in the Province of Quebec, Canada. Option dated June 1, 1958 and extension dated November 1, 1958. Also filed under this number are the underlying agreements.

The following mining leases and options were terminated in 1958:

Lease No. 108

Agreement between The Cleveland-Cliffs Iron Company and Mather Iron Company, dated August 3, 1951, covering the operation of the Webster Mine ($N\frac{1}{2}$ of the $NE\frac{1}{4}$ and the $SE\frac{1}{4}$ of the $NE\frac{1}{4}$, Section 26, T. 48 N., R. 31 W., Baraga County, Michigan). Termination dated October 20, 1958, effective December 31, 1958, also sets forth ownership of the parties in the commingled tailings.

Lease No. 164

Forty year mining lease from The Cleveland-Cliffs Iron Company to Hanna Coal & Ore Corporation, dated March 1, 1956, covering a half interest in portions of the Tilden Mine ($N\frac{1}{2}$ of Section 26, T. 47 N., R. 27 W., Marquette County, Michigan). Terminated December 31, 1958.

Lease No. 168

Three year option for one hundred year mining lease from Thomas J. Wright and wife to The Cleveland-Cliffs Iron Company, dated November 13, 1956, covering an undivided one-half of the $E\frac{1}{2}$ of the $SE\frac{1}{4}$, Section 24, T. 41 N., R. 18 W., Delta County, Michigan. Notice of termination dated December 5, 1958.

Lease No. 169

Four and one-half year option for one hundred year mining lease from Leo J. Spielmacher and wife to The Cleveland-Cliffs Iron Company, dated November 13, 1956, covering the $W\frac{1}{2}$ of the $SW\frac{1}{4}$, Section 19, T. 41 N., R. 17 W., Schoolcraft County, Michigan. Notice of termination dated December 5, 1958.

Lease No. 173

Four prospecting permits from the U. S. Bureau of Land Management to The Cleveland-Cliffs Iron Company, dated August 1, 1957, covering various lands in Delta and Schoolcraft Counties, Michigan. Notice of termination dated June 26, 1958.

E. MINE SUMMARIES

1. BUNKER HILL--MAAS MINES - Bernhardt H. Petersen, Mining Engineer

The Engineering Crew at the beginning of the year consisted of an Operating Engineer, a Mining Engineer, an Assistant Engineer and two Surveyors. On January 15, the crew was reduced by two Surveyors, and on March 15 by an Assistant Engineer. On August 15, there was a further reduction of a Mining Engineer and the addition of a Surveyor. No further changes were made for the balance of the year.

A resume of engineering activities at the Bunker Hill Group during the year of 1958 is as follows:

a. The establishing of grades and lines for the excavation and installation of a new timber yard to the West of the shops building.

b. Stockpile surveys were conducted on the Northeast, Southeast and West stockpiles.

c. The cage runners from the collar of the shaft to the old Negaunee Mine Skip Pit, a distance of approximately 1,400 feet, were plumbed and plotted.

d. The Maas and Bunker Hill Shafts were gauged.

e. The installation of the rock reject belt for the 14th Level screening system was completed early in the year.

The balance of the time was spent on various routine projects such as: establishing line and grade for development headings; quarterly surveys; quarterly maps; tax maps; weekly, monthly and annual reports; capital expenditures forecasts; E&A requests; production and cost of production estimates; steel requirements; block estimates; block analysis; development and mining layout; and general mine operating problems.

2. CAMBRIA-JACKSON MINE - R. Charles Kincaid, Mining Engineer

a. In the spring and fall, the Survey Crew gauged the shaft runners and recorded the data.

b. During May, the Mining Engineer prepared a report on the capping of the Hartford No. 1 Shaft with 21' of reinforced concrete.

c. The North and South stockpiles were surveyed and calculated at the end of the shipping season.

d. The Mining Engineer was responsible for writing the monthly and annual reports, revising the budgets, figuring contract miners' incentive earnings, calculating the Michigan State Tax and Federal Tax Estimates and laying out development plans.

3. CLIFFS SHAFT MINE - James P. Meyers, Mining Engineer

a. Engineering personnel gauged all the "C" Shaft runners, both counterweight and conveyance, twice during the year. The runners were gauged in the method which is standard at all other mines, therefore, at every set. The counterweight compartment runners continue to be gauged by climbing through the shaft ladder road and measuring each set with a yardstick.

b. Tri-Annual Surveys were conducted, the maps posted and reports compiled and forwarded to the Oliver Iron Mining Division of the United States Steel Corporation.

c. Accurate production and analyses records were maintained throughout the year by the engineering personnel as per the 1954 Mixing Agreement of The Cleveland-Cliffs Iron Company and the Oliver Iron Mining Division of the United States Steel Corporation. All monthly analyses reports to the Lessor were undertaken and prepared by the engineering personnel.

d. Engineering personnel spent some time on various "time studies" conducted at the mine throughout the year. A number of studies were made on tests of several types of percussion drill machines and several types of tungsten carbide bits.

e. The annual estimate of proven ore reserves and the attending reports were prepared and submitted. The annual "operating" estimate of proven, probable and prospective ore reserves was also prepared and reported upon. Several other reports of other than routine nature were also prepared and submitted.

f. Some time was spent planning and assisting in the operation of various pillar recovery projects throughout the year.

g. The routine underground surveys necessary for the mining and development contracts, the location and marking of lease boundaries underground, the location and noting of mining limit elevations and the resurveying of pillars in some old stopes were taken care of as called for throughout the year.

h. Results of all testing programs were tabulated and reported upon by the Mining Engineer. Several cost studies were also prepared, specifically, upon crushing costs, screening costs, bit costs, truck maintenance costs, underground tractor-loader costs, shop costs, wire rope costs, etc.

i. Tests with threaded carbonized steel were followed and reported on early in the year.

j. Following the installation of a larger capacity fan at the collar of the Moro Shaft, a ventilation survey was made to determine the new ventilating characteristics in the mine. In conjunction with the ventilation survey, a survey of air temperature conditions at points adjacent to the respective fan discharges and mine discharge areas was also made.

k. A study of the productivity of the various teams of miners employed at the Cliffs Shaft Mine was made in the first quarter of the year. This study was made so that improvements in the mine's overall efficiency and productivity might be wrought in the future.

l. Geological plan maps were posted once during the year by the engineering personnel. These maps are of use in planning development and mining.

m. Several old open pits within the boundaries of the Cliffs Shaft Mine were surveyed prior to the installation of new safety fencing. The pit areas to the East of "C" Shaft, which are adjacent to and connected with the Cliffs Shaft Mine underground workings, were thoroughly investigated prior to an inspection by a government party.

n. Some time was spent preparing several fiscal budgets, production estimates and financial forecasts. Reductions in working forces were made and ensuing changes in mining contracts and mining activities required attention.

o. Time was spent in preparation for the institution of the new IBM time keeping system at the mine.

p. A review of lean ore areas was made during the year and bulk samples were collected in several areas for investigation. This review was made in conjunction with a study of the mine's remaining mineable ore reserve.

q. Sampling of the daily product by mechanical means has been under way for some five months. Average analyses obtained by both mechanical and manual means have been computed and tabulated over this five month period. The resulting data has been reported upon by engineering personnel.

r. Time was also spent upon numerous other projects, some of which are as follows:

1. Tabulation of safety infractions and accidents plus the preparation of graphs with this information.

2. Maintaining tram car records.

3. Maintaining shop records until the advent of the IBM time keeping system.

4. Fencing of idle and abandoned properties within the bounds of the Cliffs Shaft Mine Area.

5. Various labor and grievance problems and meetings.

6. Ventilation and air cleaning near the underground diesel tractor-loaders. (Devices - Exhaust Scrubbers)

7. Monthly drill footage records and bit data.

8. Review of incentive systems. Recalculation of incentive rate sheets so as to incorporate new wage increases.

9. Review of underground sampling systems.

10. Bit grinding wheel test.

11. Review of royalty payments, etc., in connection with Oliver Leases.

12. Stockpile survey.

13. Checking percussion drill machine maintenance and performance.

14. Accident reports and investigations.

15. Sound control.

16. Various other mine duties.

4. HUMBOLDT MINE - Robert J. Flynn, Mining Engineer

a. During the first quarter of the year, Mr. Robert J. Flynn was assigned to the project of long range planning for the removal of ore and subsequent stripping of the open pit orebodies.

b. It was decided that the Humboldt Mine should be the first property to be studied.

c. The first project encountered was the position of a pit road to serve the life of the orebody. Estimates were made comparing the yardages of rock and earth for a footwall or a hangingwall road. It was decided that the more economical position was to run the road to the North on the hangingwall.

d. A new estimate was made of the ore and stripping to be removed for the proven and probable ore, including the necessary yardage for the ultimate pit road to remove this material.

e. Backing up to present day needs, a plan map and corresponding sections were completed showing the opening of the 1510 bench. This estimate included stripping yardages to be removed and the ore reserves available.

f. Some work was also done on the economics of the probable ore formation known as the "Eastward extension."

5. MATHER MINE

a. "A" SHAFT - Oiva W. Hakala, Mining Engineer

1. During the year several changes were made in the engineering personnel at the mine. A reduction in personnel required some

adjustment in the service rendered by the Department.

2. Personnel at the beginning of the year consisted of the Mining Engineer and a four-man Survey Crew. During the year, the Survey Crew was reduced to one man, who was to obtain help as required from the Central Office Engineering Department. It was found that the helper was required about 75% of the time.

3. In addition to the day to day providing of lines and grades for development work, the Survey Crew, during the early part of the year, spent a considerable amount of time and effort on monthly maps. Each month, it has been the practice to print four complete sets of maps and distribute those to the District Superintendent, Mine Superintendent, Mine Captain and Mining Engineer. In addition, monthly point maps were printed for the Mine Captain, Mine Foremen and Shift Bosses. Since the curtailing of operations and personnel, the printing of all maps was changed from a monthly basis to a quarterly basis except for one set of maps for the mine which is still being printed each month. This step reduced the work load of the Survey Crew considerably and, to date, the change has been satisfactory. Another step which was taken in an effort to improve operations was to have the Mine Foremen post the mine maps up to date twice each month. The Foremen post all physical details such as drifts, raises, mills and drifting. The posting of maps by the Foremen serves two purposes. It saves the Mine Surveyor three to four days of time which normally is required to check the physical details mentioned above, and by posting the mine maps the Foremen keep better informed. The posting of maps by the Foremen has been carried on since October and has worked well.

4. Other duties performed by the Engineer or engineering personnel were shaft gauging, ore estimates, stockpile surveys, supply requirements, cost analyses, capital and operating expenditure forecasts, present and future mine operations and planning. In addition, weekly and monthly reports, as well as a detailed annual written report, were written for management. Monthly and annual reports were prepared for the Engineering Department.

b. "B" SHAFT - R. Charles Kincaid, Mining Engineer

1. The Surveyor assigned to this property took care of the day to day surveying of the mining and development contracts, calculating survey data and posting analysis maps.

2. The shaft was gauged during the spring and fall by the Survey Crew.

3. The Mather Mine, "B" Shaft's standard and special ore stockpiles were surveyed in the fall to determine the balance of ore in stock at the end of the shipping season.

4. The test hole drilling program continued throughout the year. The program required the presence of the Mining Engineer and Surveyor to lay out and locate the drill holes.

5. The Mining Engineering Department personnel conducted a check survey on the footwall heading on 10th Level during the year.

6. A considerable amount of the Surveyor's time was required with the excavation and installation of the 7th Level West belt extension, the 9th Level West mining conveyor and the 10th Level crusher-conveyor system.

7. The Mining Engineer was responsible for writing the monthly and annual reports, laying out development and mining areas, figuring contract miners' incentive earnings, determining the monthly steel and annual timber requirements, calculating the Michigan State and Federal Tax Estimates and the 1959 production and cost estimates.

6. REPUBLIC MINE - Robert J. Flynn, Mining Engineer

PIT WORK

a. The monthly pit progress was surveyed and the maps posted and distributed to the interested personnel.

b. The shovel location map was maintained during the year. This map shows the location of the ore removed on a daily basis. This information is charted with the metallurgical results of the treated ore and is expected to be an aid in the concentrating and pelletizing of the lower benches of the Republic orebody.

c. The oxygen used in jet piercing is calculated on a monthly basis. This is done to enable us to correlate the oxygen usage with machine-piercing time, and also to determine any line loss we may be experiencing.

d. Various procedures and practices were tried to economize this method of drilling but no definite results have yet been established.

e. Twenty-two major field blasts were fired during the year with twenty being in ore and two in rock. These blasts contained 1,023 holes. These holes were surveyed, the water level checked, the volume and powder charge calculated, and the loading of the holes supervised. The continued checking and dewatering of the blast holes has enabled us to increase our usage of the prilled ammonium nitrate to approximately 60%.

f. Iron pin surveys were completed to extend our network of control North of the present mining operations, into the Park City Area, and also to replace the pins deleted by our present mining operations.

g. The mine engineering force assisted the Mine Geologist in the mapping of outcrops encountered in his inspection of the Republic orebody.

h. The engineering and layout necessary for a new pit service road, oxygen line and power line to serve the North end of the pit was handled by the mine engineering staff.

i. The location, ore and stripping requirements and layout of a road system necessary for the opening of the 1560 bench were calculated. This road system is now under construction.

j. Various projects that were studied during the year were:

1. The 1959 and 1960 ore and stripping requirements.

2. The trackage requirements and necessary stockpile area for various phases of expansion.

3. A stripping dump map showing dump areas available for our ultimate stripping needs.

4. An examination of the location of the permanent pit road for the ultimate life of the mine.

5. The present oxygen usage and a cost analysis at an expanded rate of drilling.

DIKES

a. The engineering force handled the engineering and layout of a new 20-inch line from the mill to the dike area.

b. Elevations were run to various points in the tailings system in order to check the tailings and backwater elevations during the year.

c. Water samples and weir readings were taken monthly at the assigned locations in the tailings system.

GENERAL

a. A map showing ore, stripping and new construction during the year was drawn.

b. The drilling and blasting information for the mine annual report was compiled.

c. The concentrate stockpiles were surveyed twice during the year.

d. A contract was let to J. Kielinen & Son for the extension of the "E" line of the mill 72 feet to the North. The layout and inspection of this work is being handled by the engineering personnel.

F. MISCELLANEOUS ACTIVITIES

1. FIELD ENGINEERING CREW - LeRoy Hosking and Frank A. Koski, Engineers

a. EAGLE MILLS AREA

1. New installations in the area covered by the District Map were surveyed and posted.

b. PELLETIZING PLANT

1. At the Pelletizing Plant, control points for future work were established and the surface survey brought up to date.

2. The travelling grate was lined and leveled several times, and the stockpiles were surveyed and calculated three times.

3. Cross-sections were run and plotted for the extension to the thawing shed.

c. PILOT PLANT

1. Necessary surveying was done for the Pilot Plant construction, the steelwork leveled and squared, pipelines and utilities surveyed, tailings line run and graded, lines and grades set for the placing of equipment in the plant and stakes set for the grading of the roads and plant area.

d. ORE IMPROVEMENT PLANT

1. At the Ore Improvement Plant, control points were run in for future survey work and new installations surveyed and posted.

2. Conveyors were lined and leveled, and the motor-generator set was lined to eliminate vibrations and breaking shafts.

3. A survey was made for the construction of settling basins, and plans and estimates made for the contracting and completion of two basins. Necessary construction work was done along with work on pipelines, pumps, drains, etc.

e. NEGAUNEE

1. The possibility of the City of Negaunee using water from the wells South of the Cambria-Jackson Mine to supplement the Teal Lake water supply was investigated. The amount of water and quality were determined, maps and easements prepared and material lists and estimates of costs furnished to the City.

2. Plans, detail sketches and bids for additional improvements in the Cliffs Fourth Addition were prepared and the work contracted. All construction staking was done and permanent monuments set in the plat.

3. A traverse was run across the North side of Sections 4 and 5, T. 47 N., R. 26 W., for corner location purposes.

4. The Miller Building on Iron Street was checked for movement and a complete subsidence check was made of other points not covered in mine area subsidence records.

5. An ownership map was made of the SW¼ of the SW¼, Section 31, T. 48 N., R. 26 W., based on the Davidson & Clancey title opinion of September, 1954.

6. The selection of a site and preparation of documents for the location of the proposed elevated water tank.

f. CASCADE AND CLIFFS DRIVE AREAS

1. In the Ogden--Isabella Area, survey control was run, diamond drill holes located and a base run for seismic work.

2. The principal base line was run for seismic work East of the Richmond Mine.

3. Surveys were run in the Ogden--Schoolhouse Lake Area for survey control and tentative drill hole locations.

g. TILDEN MINE

1. One stockpile survey was run and a complete re-survey made of the stocking ground area.

2. In October, the annual pit survey of the East and West Pits was made and posted.

3. A re-estimate of reserves concerned in the Jackson Iron and Steel Agreement was made on the basis of the latest cross-sections.

h. MATHER MINE

1. Surface surveys were run of the mines and subsidence areas and the maps posted. The annual report maps were also brought up to date.

2. The subsidence grids at both "A" and "B" Shafts were checked and extended and an attempt was made to locate auxiliary triangulation points to tie the Mather Mine, "A" Shaft grid into the triangulation system.

3. All subsidence work was calculated and posted to date and additional check levels run in questionable areas.

4. Water elevations were checked in the "A" Shaft wells.

i. CAMBRIA-JACKSON MINE

1. Regular subsidence checks were made in this area and the caves inspected.

j. BUNKER HILL--ATHENS

1. The possibilities of diverting the mine discharge flow were investigated. The most desirable of these was surveyed, mapped and cost estimated for possible future use if necessary to by-pass the Barasa Property.

2. The mine surface was surveyed and the maps posted.

3. The subsidence grid was checked and extended in both the Bunker Hill and Athens Areas, and a subsidence check also made of the new pins across the East side of the Maas cave.

4. All cave areas were also inspected for new breaks.

5. A photo-map of the Bunker Hill--Maas Area was made indicating owners, house moving problems and the present and probable subsidence areas.

k. HUMBOLDT MINE

1. A survey of the pit was made during the spring and a re-survey of a portion of the pit made in the fall.

2. Survey control was run to the North and a survey made of the stripping dump on Republic Steel Property.

3. Control lines and levels were run for construction work on the new mill expansion program which was started late in the year.

l. REPUBLIC MINE

1. Several maps were prepared of possible new school locations for the Republic School District. These sites were also investigated and located in the field.

2. Considerable information was compiled and maps furnished to Republic Township for work on their plans for an elevated tank for the village water system.

3. A map showing the location and probable schedule of house moving was prepared and sent to the Michigan Public Service Commission. (This was for use regarding the application of Upper Peninsula Power Company to buy out the Republic Township electric utility.)

4. Lines and grades were run for use in the current house moving program.

m. STOCKPILES

1. Regular stockpile estimate work was started in October, and stockpiles were surveyed and calculated for the Mather Mine, "A" and "B" Shafts, Cambria-Jackson, Cliffs Shaft, Humboldt and Republic Mines and at the Pelletizing Plant.

2. Permanent points for stockpile surveys were established at Mather Mine, "A" and "B" Shafts, Cambria-Jackson and Tilden Mines and the Pelletizing Plant.

3. New surveys were made of the entire stocking areas of the Pelletizing Plant and the Tilden Mine.

n. TOWNSITES

1. Several maps were made showing the more desirable townsite locations.

2. One general townsite map was prepared and one completed showing long range, low grade development possibilities together with the necessary associated requirements such as tailings basins, pipelines, water supply, dumps, railroads, etc.

o. TRIANGULATION

1. Prior to the spring break-up, preliminary work was done in locating and checking various proints which would be of value in bringing the triangulation system of coordinates South of Negaunee to the Cascade District and East into the Eagle Mills Area.

2. Permanent points were later set at these locations and the survey work completed toward Cascade. Some field work remains toward the Eagle Mills Area, and it is intended to establish more points South of the present Cascade Area stations to carry the system to the East along with the establishment of a check base line near the South boundary of the system.

3. Adoption of the triangulation coordinates made necessary the tying in of numerous surveys in the field to the new system and the recalculation of most on a triangulation basis thus resulting in considerable office work, which has not as yet been completed.

p. RAILROADS

1. A composite map of the Ishpeming--Negaunee Area was assembled for use in the investigation of railroad relocation.

q. MISCELLANEOUS

Among the miscellaneous jobs performed during the year were the following:

1. Check survey of Land Department leases in Section 6, T. 47 N., R. 27 W., and the location of lease descriptions at North Lake.

2. Location of a part of the boundary of the Village of Palmer.

3. Survey of the coal pile at Marquette for the Pelletizing Plant.

4. Inspection of the Lloyd Mine cave.

5. Setting up standard note forms.

6. Leveling generator at the McClure Plant.

7. Tracing lease descriptions in lot line dispute for Land Department.

8. Preliminary layout of townsite, roads and railroads in Albanel District, Canada, and estimates of quantities and costs.

9. Posting and revising maps for Annual Report.

10. Numerous trips to the airport, shops, storehouse, etc.

11. Lines and profiles of proposed ski hill at Suicide Hill.

2. INDUSTRIAL ENGINEERING ACTIVITIES - Einer D. Lindquist, Engineer

a. STATISTICAL METHOD OF COMPUTING GRADE OF ORE FROM DIAMOND DRILL HOLE ANALYSIS

The basis of this study was a Bureau of Mines report titled, "A Comparative Study of Statistical Analysis and Other Methods of Computing Ore Reserves, Utilizing Analytical Data from Maggie Canyon Manganese Deposit, Artillery Mountains Region, Mohave County, Ariz."

Based on the methods outlined in the report, diamond drill hole analyses from the Company's exploration of the New Richmond Pit were studied. The purpose of this study was to determine the value of statistical analysis in determining average grade of an orebody, and to determine if possible the minimum amount of drilling required to give satisfactory results.

Frequency distributions were made on the Crude Iron analysis, Concentrate Iron analysis, Roasted Head Iron analysis and the percent Weight Recovery. The standard deviation and confidence limits were computed for each frequency distribution. The formula for computing the confidence limits can be altered to determine the correct amount of footage necessary to give the degree of accuracy required.

The computations for Crude Iron analysis show that the orebody was over drilled by 5,473 feet. This over drilling came about because the uniformity of the orebody is such that a lesser number of samples would have given acceptable results.

The study indicates that the use of Statistical Analysis during a drilling program could save considerable money by helping to determine when enough drilling has been done. Additional studies should be made of this technique before it could be allowed to carry any weight in determining the cut-off point in a drilling program.

b. METHODS STUDY OF THE MATHER MINE, "B" SHAFT STEEL SET FABRICATING SHOP

As a result of the methods study, roller conveyors and a gib boom crane have been installed to handle work in process. Since the improvements, one man has been eliminated from the five-man crew.

c. TIME STUDY OF INGERSOLL RAND "DOWN THE HOLE DRILL"

A time study was made at the Tilden Mine on a "Down the Hole Drill" machine using a 6½ inch diameter bit. From the study, a cost per foot and per ton was developed. The cost per foot of hole including purchase of rig was $2.15 per foot. The cost per ton including purchase of rig was $0.086 per ton.

d. COMPARISON OF MATHER MINE, "A" AND "B" SHAFTS INCLINE DRIFTING METHODS

This study was undertaken to compare the present method in use in the Mather Mine, "A" Shaft incline drift being driven from 9th to 12th Level to a proposed method for the Mather Mine, "B" Shaft incline to be driven from 10th to 12th Level. At "A" Shaft, the drilling is done with a three-boom crawler mounted jumbo. The broken rock is removed from the breast by a 48 inch scraper. The broken rock is transported up the incline on a conveyor belt that is loaded with the 48 inch scraper. The operation is stopped after 300 feet of drifting and the conveyor belt is extended.

The drilling would be done in the proposed "B" Shaft method with a truck mounted jumbo. The broken rock would be loaded into skips by an Eimco #635 crawler mounted loader. A conveyor would be installed as drifting progressed but not put into use until the incline is completed.

The study showed that the proposed "B" Shaft method would take one year and two months less to drive and complete a 3,000 foot incline conveyor drift than the "A" Shaft method.

Since this study was completed, additional methods have been proposed. A study is now in progress to evaluate these various methods.

e. STATISTICAL ANALYSIS OF CLIFFS SHAFT SAMPLING

A comparison by statistical analysis between mechanical and hand sampling of Cliffs Shaft Lump was made. Frequency distributions were determined for both sampling methods. Standard deviations and confidence limits were computed for both methods. The standard deviation for the mechanical Iron analysis was ± 1.54% as compared to

± 2.26% for the hand sample. The manual Iron analyses 99% confidence limits had a 0.72% Iron greater spread than mechanical Iron analyses. Based purely on the statistical data, the conclusion was that the mechanical sampling was the more reliable of the two methods.

f. MATERIALS HANDLING STUDY FOR THE PROPOSED MATHER MINE, "B" SHAFT WINZE

This study was still in progress at the close of the year. Multiman and Machine Time Charts have been completed which depict the handling of supplies through the main shaft and winze as compared to handling supplies through the main shaft alone. The transportation of men by the proposed methods is now under study.

g. HUMBOLDT MINE MODEL

The initial work has been started on the building of a simple model of the Humboldt Pit to aid the mine management in planning pit development.

h. HELPING WITH STOCKPILE AND UNDERGROUND SURVEYS

This fall, several weeks were spent helping with the various stockpile surveys. Assistance was given the Underground Surveyor at the Mather Mine, "A" Shaft when the crew was short-handed.

3. ORE ESTIMATES

The following table shows a comparison of the tonnages as reported to the Michigan State Tax Commission:

TABLE XIII

Mine	Tons As of 8/31/57	Tons As of 8/31/58
Athens	401,560	251,757
Bunker Hill	5,350,071	4,220,275
Cambria-Jackson	268,526	83,743
Cliffs Shaft	1,077,977	863,425
Maas	2,113,094	1,543,865
Pioneer & Arctic	1,423,106	1,291,258
Mather,		
"A" Shaft	7,305,597	7,008,600
"B" Shaft	14,222,340	11,690,245
Total Developed Ore	32,162,271	26,953,168
Undeveloped Reserves		
Section 3, 47-27	302,378	302,378
Grand Total All Ores	32,464,649	27,255,546

The above table does not include the open pit properties as they are valued according to the Low Grade Iron Ore Bill, House Bill No. 315.

4. STOCKPILES

Estimates of the ore in stock were made by the Mining Engineering Department at the Bunker Hill, Cambria-Jackson, Cliffs Shaft, Humboldt, and Republic Mines, Mather Mine, "A" and "B" Shafts and the Pelletizing Plant.

The following table shows the comparison of the ore in stock on November 1, 1957 and November 1, 1958:

TABLE XIV

Mine	November 1, 1957	November 1, 1958
Bunker Hill	183,294	154,790
Cambria-Jackson	679	35,781
Cliffs Shaft		
Lump	59,333	87,839
#1 Crushed	0	39,585
#2 Crushed	2,759	0
Humboldt	118,427	96,467
Lloyd	111,356	111,356
Maas	121,366	108,650
Mather,		
"A" Shaft	80,731	402,812
"B" Shaft	144,671	463,655
Republic	145,867	55,209
Pelletizing Plant	8,291	5,704
Tilden	69,263	70,403
Totals	1,046,037	1,632,251

5. SHAFT GAUGING

The runners in the various operating shafts were gauged on the dates shown on the following table:

TABLE XV

Mine	Date
Bunker Hill	May 9 October 17
Cambria-Jackson	May 1 October 3
Cliffs Shaft (including counterweight runners)	January 17 July 16
Maas	December 3

Mine	Date
Mather,	
"A" Shaft	May 3
	October 11
"B" Shaft	April 19
	October 25

6. SUBSIDENCE

Throughout the year regular meetings of the Mather Mine Subsidence Subcommittee were attended. On December 18, a meeting of the Range Subsidence Committee was attended.

The spring subsidence survey of the Mather Mine, "A" Shaft iron pin grid indicated a definite slump to the East. In order to determine whether or not this was an indication on surface of the effects of Mather Mine, "A" Shaft mining and to determine if the movement was continuing, a series of monthly surveys were made throughout the summer months. These surveys did not show any continuing movement. At the same time, it was decided to resume measuring water levels in the wells which had been drilled in the same general area of the iron pin grid. The measurements indicated that the water table was reduced and was level. No unusual conditions were observed. Close attention will be given to the grid and water wells again in the spring of 1959 and, if necessary, a similar program will be carried out during the summer months.

During the summer of 1958, considerable time was devoted to an attempt to establish triangulation control on all or a portion of the Mather Mine, "A" and "B" Shafts iron pin grid. The reduction in personnel in August made it necessary to abandon this project. It was felt that if we could determine lateral movement as well as vertical movement, additional information would be available for the subsidence study. Dr. Leonard Obert of the Bureau of Mines contends that lateral movements can be more indicative than vertical movement but such a project takes time and men which are not available.

During the year, both the Mather Mine, "B" Shaft and Bunker Hill iron pin grids were expanded as shown on the maps in Figures 1 and 2.

7. RAILROAD RELOCATION

Mining operations at the Bunker Hill Mine and the Mather Mine, "A" and "B" Shafts call for a major relocation of the railroad facilities in the Ishpeming and Negaunee Area. During 1955 and 1956, a considerable amount of time and effort was devoted to an engineering plan for the relocation of the DSS&A and C&NW. The continued mining of the Bunker Hill orebody necessitated the abandonment of that portion of the tracks which lay over the orebody. In order to accomplish this, a two phase plan was devised. The first phase would relocate these two railroads

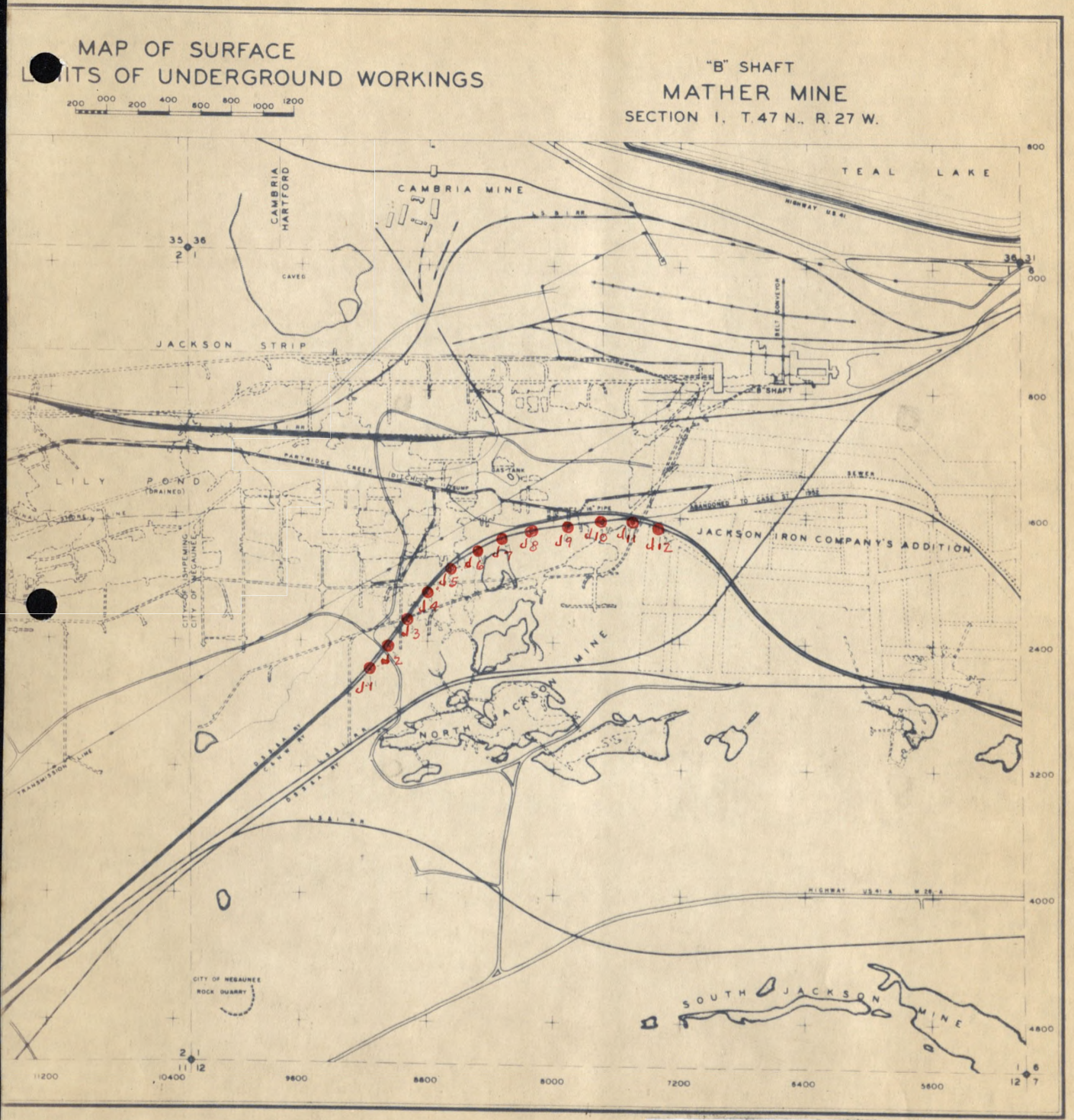

FIGURE 1
MINING ENGINEERING DEPARTMENT
ANNUAL REPORT
1958

Cambria & Mather Mine, "B" Shaft
Addition to Subsidence Grids

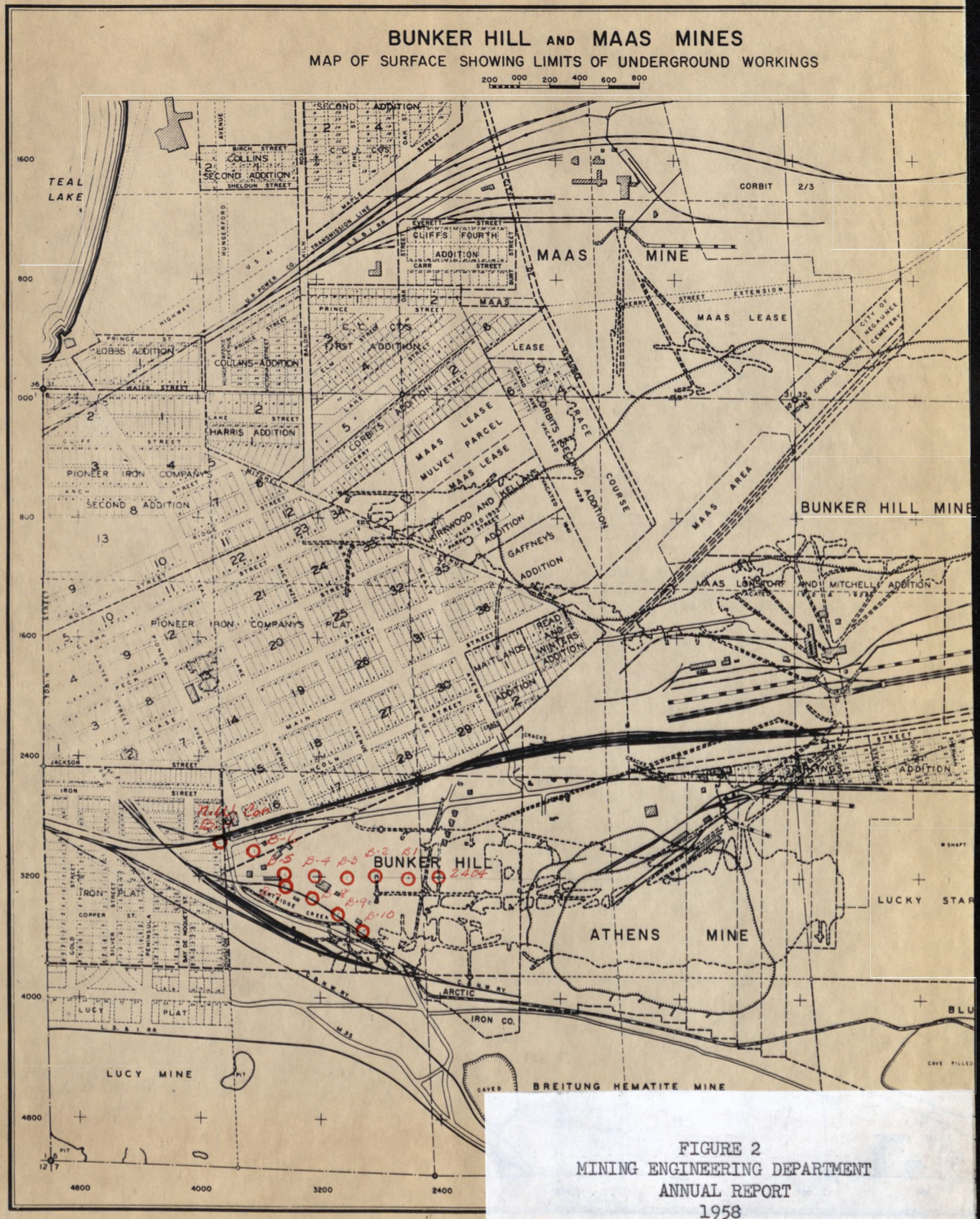

FIGURE 2
MINING ENGINEERING DEPARTMENT
ANNUAL REPORT
1958

Bunker Hill Mine
Addition to Subsidence Grids

to the East and North of the Maas--Negaunee caves and would parallel the LS&I main line tracks over Sections 1 and 2, South of the Mather Mine. The reduced operating schedule which followed the slump in the iron ore market in 1957 and 1958 made it necessary to abandon these plans. During 1958, it became apparent that the Mather Mine's mining operations were progressing to the South faster than had been originally anticipated. Because of this it was felt to be necessary to begin planning for the relocation of the LS&I across Sections 1 and 2 and the Phase 2 portion of the original relocation. As of the end of 1958, this planning was still in its preliminary stages. The map in Figure 3 shows the general location of the Phase 1 and 2 relocations and the proposed relocation of the LS&I and Phase 2.

8. TRIANGULATION

During 1958, the triangulation net which had been established for survey control in the immediate vicinity of Ishpeming and Negaunee was extended South from Negaunee to the Cascade Area. The reasons for this extension were two-fold. The first was to establish accurate survey control in the Cascade Area and, secondly, it would be possible to continue the extension West to provide control in the Empire and Tilden Areas. It is planned that the net would then be tied in with the Oliver Iron Mining Division's net which runs South from Ishpeming to National Mine. A considerable amount of time was spent by the Field Engineering Crew in locating suitable sites for triangulation survey stations, the establishment of these points and the turning of angles between points. Following the August reorganization, Maxwell H. Madsen was assigned to the adjustment and calculation and other related office work for this project. The adjustment and calculations were made using the least square technique. Following the completion of this work in November, a start was made to review the adjustment of the original net. One object of this review is to organize and compile all of the available data in such a manner that, as soon as time on the IBM equipment is available, this work can be recomputed electronically. This review will be started in the immediate vicinity of Mather Mine, "A" and "B" Shafts and will be followed by a complete review of the underground survey control.

The location of the survey points established for the extension of the triangulation network from Negaunee to Cascade is shown on the map in Figure 4.

G. HOUSE MOVING ACTIVITIES - Donald W. Carlson

A total of seven houses was moved in the Republic Area in 1958 at Company expense. Two other houses were moved by Schuette, but they were houses which had been purchased by the Company and the moving cost was paid by the new owners. Both of these houses were moved to privately owned land - one to Smith's property just across the Michigamme River near the bridge South of the mine, and the other was moved to a lot on the North end of Republic near the old road from Humboldt. These were Republic District Houses Nos. 10 and 4 and both of them were located on School Street.

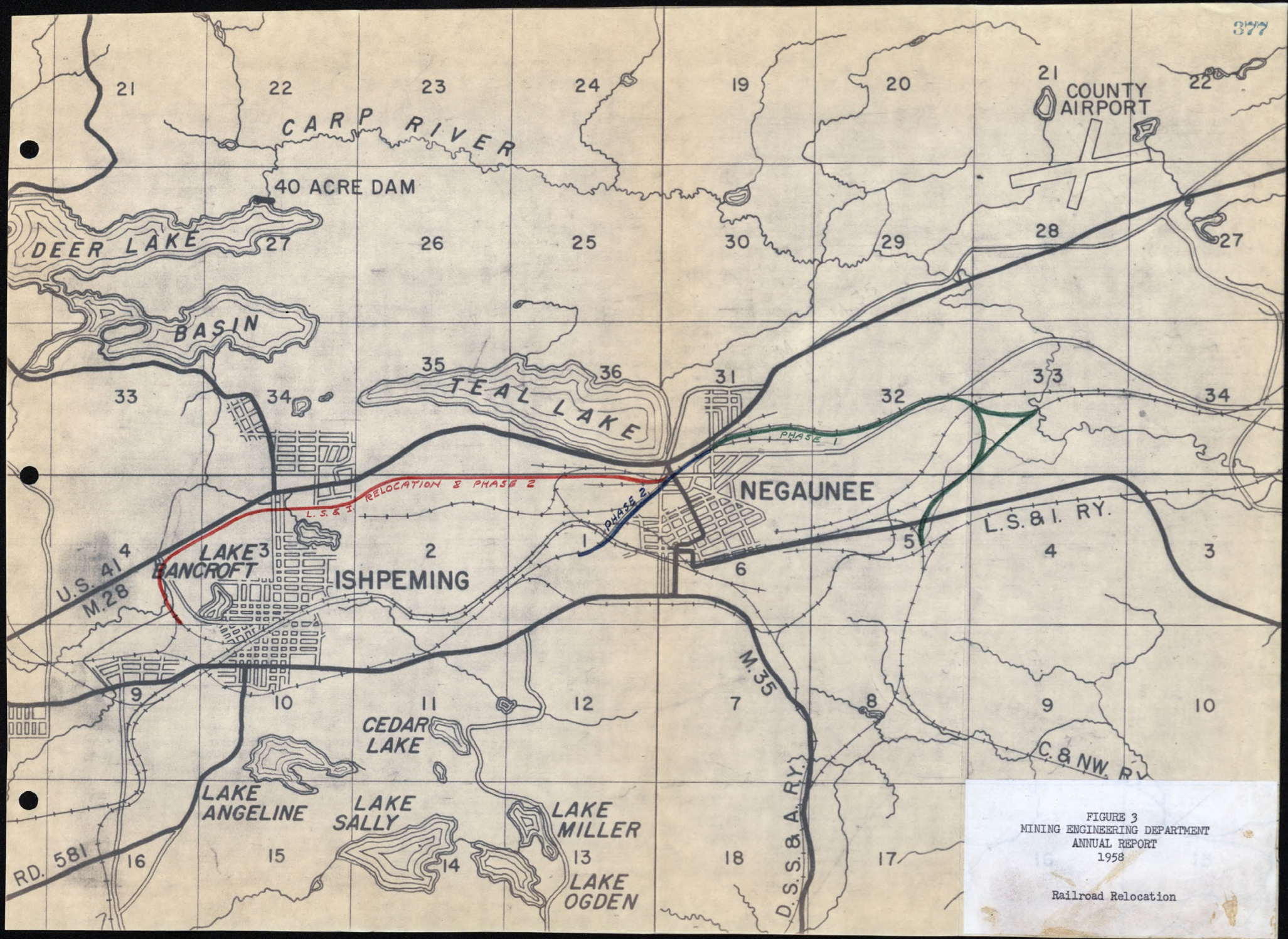

FIGURE 3
MINING ENGINEERING DEPARTMENT
ANNUAL REPORT
1958

Railroad Relocation

FIGURE 4
MINING ENGINEERING DEPARTMENT
ANNUAL REPORT
1958

Triangulation Network

Indicated in green on the maps in Figures 5 and 6 are the houses torn down or moved by outside parties and in red the houses moved by the Company in 1958.

In 1958, the following transactions took place:

7 houses were moved - 6 to Plat and 1 to privately owned land (1 of these was from real estate and involved exchange of deeds to lots)

5 houses were purchased outright - 2 are being rented, 2 are vacant and 1 sold for salvage

3 houses being removed on "tear-down agreements"

4 Company houses were sold outright - 2 to be moved at the owners' expense and 2 to be torn down for salvage

H. MICHIGAN AD VALOREM TAXES - Donald W. Carlson

During the year, Mr. Magnuson continued to have the responsibility for the Michigan Ad Valorem Taxes which continued the consolidation of making the estimates of ore reserves for mine valuations, the preparation of the tax lists, the recording of valuations on non-mining properties, the requesting of checks and the payment of taxes due. The normal sequence of events from the establishment of valuations through to the payment of taxes held throughout the year. The mine valuations were calculated by Harry J. Hardenberg, State Mine Appraiser, and were submitted by him to the local assessors by February 15. The conference between the Mine Appraiser and Company representatives was held in Lansing on January 16. At this conference, an opportunity is afforded the mining company to discuss the mine valuations before they are reported to the local assessors. Any data which will have an effect or should be reflected in the calculations of the mine valuations are discussed. It is sometimes possible to get the Appraiser to make changes in his tentative valuations. During the early part of March, the local Boards of Review in each city and township hold public meetings to permit the taxpayers an opportunity to view the assessment rolls. At this time, the valuations of non-mining properties are established. If necessary, it is possible to protest valuations which have been established by the local assessors. In 1958, no protests were made. The meetings of the Boards of Review in the following cities and townships were attended by Company representatives:

TABLE XVI
ATTENDANCE AT MEETINGS OF BOARDS OF REVIEW

Assessing District	Date	Name of Representative
Negaunee Township	3/4/58	Donald W. Carlson LeRoy Hosking
Sands Township	3/4/58	Donald W. Carlson LeRoy Hosking

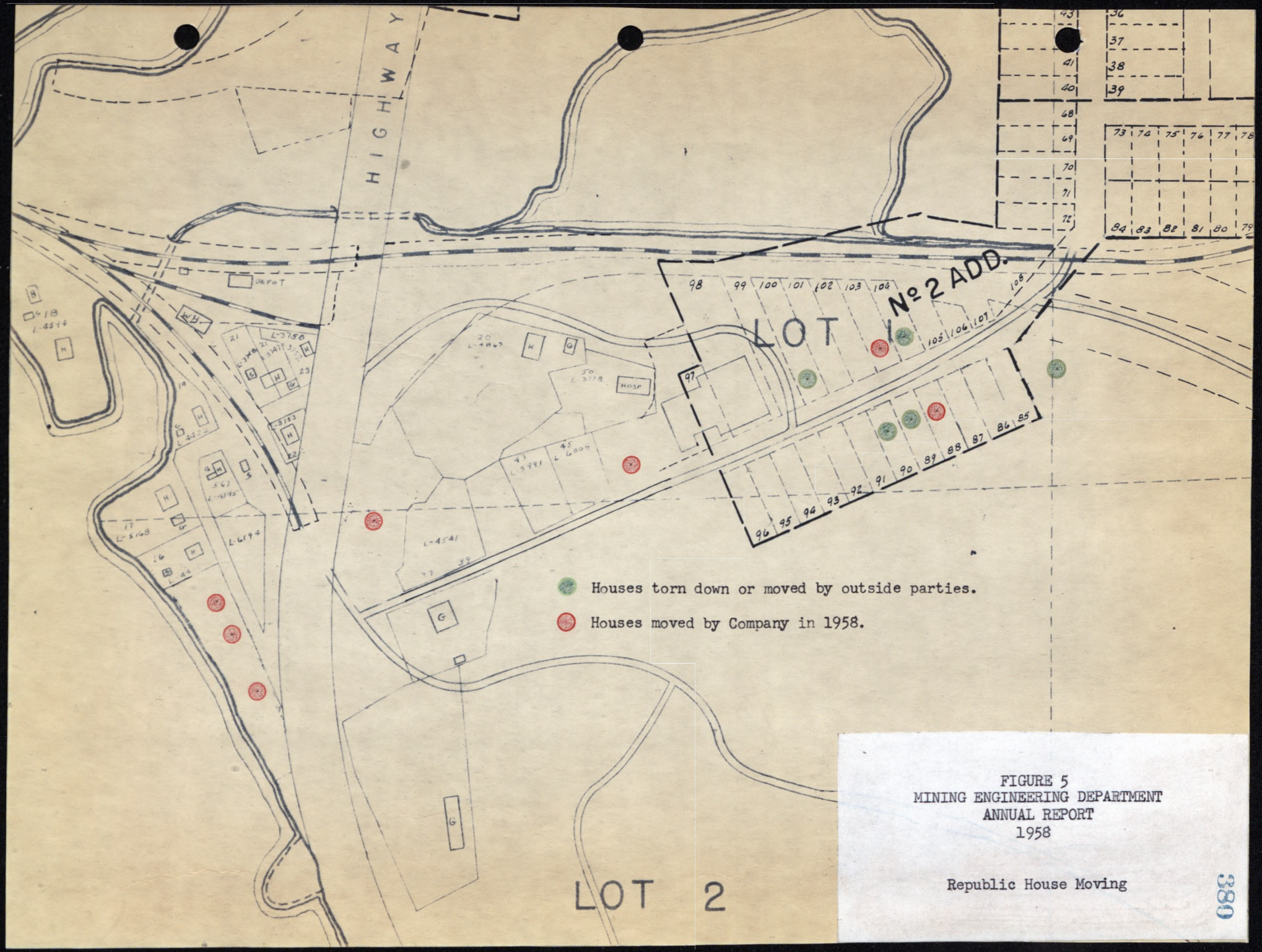

FIGURE 5
MINING ENGINEERING DEPARTMENT
ANNUAL REPORT
1958

Republic House Moving

FIGURE 6
MINING ENGINEERING DEPARTMENT
ANNUAL REPORT
1958

Republic House Moving

Assessing District	Date	Name of Representative
Forsyth Township	3/4/58	Donald W. Carlson LeRoy Hosking
Tilden Township	3/5/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Ely Township	3/5/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Humboldt Township	3/5/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Champion Township	3/5/58	Ralph E. Magnuson, Jr. Donald W. Carlson
City of Ishpeming	3/7/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Mansfield Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Crystal Falls Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Hematite Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Bates Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Iron River Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Mastadon Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Republic Township	3/10/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Spurr Township	3/10/58	Robert G. Fountain LeRoy Hosking
Michigamme Township	3/10/58	Robert G. Fountain LeRoy Hosking
Ishpeming Township	3/10/58	Robert G. Fountain LeRoy Hosking
Richmond Township	3/10/58	Robert G. Fountain LeRoy Hosking

Assessing District	Date	Name of Representative
Marquette Township	3/10/58	Robert G. Fountain LeRoy Hosking
City of Negaunee	3/11/58	Ralph E. Magnuson, Jr. Donald W. Carlson
City of Iron River	3/24/58	Ralph E. Magnuson, Jr. Donald W. Carlson
City of Marquette	3/24/58	Ralph E. Magnuson, Jr. Donald W. Carlson
Village of Mineral Hills		By Mail

Representatives of the Land Department attended the Board of Review meetings in the following townships to check the rolls for the Mining Department:

TABLE XVII

AuTrain Township

Limestone Township

The properties in the townships which lie beyond the iron-formation are Electric Power Department's lands and power installations.

In October, the County Board of Supervisors at their annual meeting established the budgets for the county, township and school districts within the county. These budgets along with the valuations which have been established provide the mill rate.

With the above information and the tax list, tax receipts were prepared for each city and township. These tax receipts were delivered or mailed to the various treasurers who filled in the valuation for each description, the mill rate and the tax due. After the completed tax receipts were returned, the information was checked against the data obtained from the rolls of the Boards of Review as to valuation, the mill rates checked against the County Board of Supervisors' report on mill rates and the estimate of tax due was checked. Next, a request was prepared and submitted to Cleveland for the necessary checks to cover the taxes which were due. Michigan Ad Valorem Taxes are due and payable as of December 10 and a penalty is imposed after January 19. The request for checks were submitted early enough to permit the checks to be delivered in Ishpeming near the end of 1958. All checks were delivered during the first week of January. The tax receipts were stamped paid by the various treasurers at the time that the checks were delivered. The following table is a tabulation showing the 1958 valuations as compared to the 1957 valuations:

TABLE XVIII

Mine	Valuation 1958	1957
Cliffs Shaft	$ 4,780,000	$ 5,130,000
Cambria-Jackson	395,000	590,000
Mather Mine,		
"A" Shaft	8,830,000	8,800,000
"B" Shaft	10,345,000	9,695,000
Maas (Including Pioneer & Arctic)	2,585,000	3,075,000
Athens	655,000	880,000
Bunker Hill	2,595,000	2,930,000
Humboldt	1,422,000	1,573,000
Ohio	392,000	355,000
Republic	1,756,000	1,760,000
Tilden	345,000	285,000
Pelletizing Plant	1,330,000	1,090,000
Ore Improvement Plant	490,000	110,000
Totals	$35,920,000	$36,273,000

The next tabulation shows the amounts requested to pay the taxes as of January 19, 1959:

TABLE XIX

Assessing District	1958 Valuation	1958 Taxes	1958 % of Total	1957 Valuation	1957 Taxes	1957 % of Total
City of Ishpeming	$14,851,500	$689,109.60	60.88	$15,169,050	$687,916.47	61.78
City of Negaunee	16,898,795	774,023.97	66.60	17,510,795	742,807.92	69.72
City of Marquette	238,510	10,974.09	1.00	238,510	10,353.38	1.044
Champion Township	44,780	1,259.50	2.27	44,780	1,175.92	1.875
Ely Township	18,750	603.20	.52	18,750	587.09	.529
Forsyth Township	190,840	7,295.81	11.67	191,140	6,177.65	11.99
Humboldt Township	1,429,350	39,844.59	76.27	1,580,050	41,093.15	78.93
Ishpeming Township	165,560	4,556.66	9.58	152,735	4,118.90	10.79
Marquette Township	609,665	15,609.58	30.73	609,665	14,162.52	31.96
Michigamme Township	21,050	916.35	1.98	21,050	792.00	2.008
Negaunee Township	2,546,096	72,903.77	77.74	1,926,146	48,635.34	73.82
Republic Township	1,835,750	47,929.21	61.91	1,822,300	46,013.09	63.11
Richmond Township	79,090	2,025.00	8.50	76,955	2,331.73	9.2
Sands Township	178,950	5,576.03	43.23	178,950	4,518.49	44.44
Tilden Township	366,115	11,869.86	13.10	306,115	8,069.55	11.28
AuTrain Township, Alger County	181,415	7,012.24		181,415	5,959.51	
Limestone Township, Alger County	10,875	339.67		10,875	336.16	
Spurr Township, Baraga County	393,200	19,205.29		356,200	17,998.85	
Crystal Falls Township, Iron County	7,600	357.20		5,600	235.20	
City of Iron River, Iron County	8,900	485.41		11,320	457.38	
Iron River Township, Iron County	6,250	181.25		6,250	168.13	
Village of Mineral Hills, Iron County	(6,250)	60.51		(6,250)	49.22	
Sagola Township, Dickinson County	400	16.40				
Knight Township, Iron County, Wisconsin	21,000	1,185.87		21,000	1,164.87	
Totals	$40,104,441	$1,713,341.06		$40,439,651	$1,645,122.52	

I. 1958 LEGISLATIVE COMMITTEE

The 1958 Michigan Legislature appointed a Legislative Committee to study mining problems. House Resolution No. 28 created a special committee to investigate the problems arising in the construction and operation of iron and copper ore beneficiating plants. The membership of the committee was as follows:

Representatives James Goulette, Iron Mountain
Louis Mezzano, Wakefield
Einar Erlandsen, Escanaba
Gilbert Wales, Stambaugh
Clayton Morrison, Pickford
Dominic Jacobetti, Negaunee
D. J. Massoglia, Laurium

While the resolution states that the committee was to study low grade problems, the committee indicated that it would look into any mining problem which could be solved by legislation.

In preparation for the Legislative Committee hearing, a committee representing industry was selected. This committee, assisted by Messrs. Frank Pardee and Joe Green, held several meetings to determine the position the mining industry should take, what data should be offered, what presentations should be made and who should make the presentations. The original concept of industry's position was to go into the whole general tax picture as related to the mining industry and particularly in a year such as 1958. Requests for legislative aid would be made by recommending amendments to the low grade iron ore bill, by asking for help in connection with stockpile valuations and a recommendation for equalization between mining and non-mining properties. As background for these requests and recommendations, it was decided that a report on the general economic condition of the mining industry, a discussion on low grade operations, a resume of the competitive situation of underground operations and a discussion of possible legislative action in connection with water would be prepared and presented to the Legislative Committee at a public hearing.

After several meetings, the first broad objectives outlined above were narrowed down. The general feeling was that, because of the existence of other legislative committees which had been and were investigating taxes and water, the present committee was covering ground someone else had or would be covering. In addition, it was felt that the general make-up of this committee was inimical with the mining industries; consequently, it would be foolish to lay before them all of the present day problems of the mining industry.

It was decided that the following formal presentations would be made:

1. A general review of economic conditions in the iron mining industry of Michigan by Mr. J. S. Abnor of Pickands Mather & Company.

2. A paper on low grade iron operations by Mr. E. W. Geist of M. A. Hanna Company.

3. A paper on water supply by Mr. S. W. Sundeen of The Cleveland-Cliffs Iron Company.

In order that the industry committee would have direction and a spokesman, Mr. S. W. Sundeen was chosen to act as chairman.

A meeting of the Legislative Committee was held on Friday, October 10, at the Dickinson County Courthouse in Iron Mountain. At this meeting, which was a public hearing, the committee heard the presentations mentioned above and other suggestions for remedial legislation which would encourage the further development of the mining industry in the Upper Peninsula. From the information gathered at this meeting, the committee will propose legislation for submission to the 1959 session of the Michigan Legislature.

J. HOUSE ACQUISITIONS

1. CITY OF NEGAUNEE - Robert G. Fountain

From time to time, property is offered for sale in various parts of Negaunee. In 1958, because of the reduced operating schedule, acquisitions were confined to those areas which will be affected in the immediate future. The following acquisitions were made during 1958:

TABLE XX

House No.	Description	Purchased From	Purchase Price	Purchase Date
Maas House #225	Lot 9, Block 32, Pioneer Plat	Annie Auvinen	$11,000	8/22/58
Maas House #226	Lots 1, 2, 3 & 4, Block 2, Kirkwood & Kellan's Addition	Kellan Heirs	$30,787.04 plus Lots 15 and 16, Block 4, CCI Second Addition & Maas House #176	12/4/58
Jackson House #74	E½ of Lots 6 & 7, Block 3, Jackson Addition	Mabel Martin Estate	$6,000	1/28/58

2. REPUBLIC - Donald W. Carlson

In connection with the house moving program at Republic, certain house acquisitions were made when it was possible to purchase at a figure lower than the moving cost. In most instances, these houses were either torn down or moved by the purchaser. The following acquisitions were made during 1958:

TABLE XXI

House No.	Description	Purchased From	Purchase Price	Purchase Date
No Number	Parcel 455, Park City	Charles A. Johnson	$1,300	6/6/58
Republic House #12	Parcel 520, Park City	Victor Manginen	$2,800	6/4/58
Republic House #13	Parcel 460, Park City	Anne Hooper and Marie Lind	$3,700	6/13/58
Republic House #14	Lot 23, Republic	Lorraine A. Leaf and H. E. Ardella Leaf	$5,000	12/18/58
Republic House #15	Lot 22, Republic	Eliza Martell, et al.	$3,950	12/24/58

Respectfully submitted,

Ralph E. Magnuson, Jr.

Ralph E. Magnuson, Jr.
Chief Mining Engineer

REM:jcj

2/13/59

RESEARCH LABORATORY

ANNUAL REPORT - YEAR 1958

The Annual Report for 1958 is subdivided into seven main sections. They are as follows: (1) General Information, (2) Pyrolysis and Agglomeration, (3) Research and Development and Flotation Projects, (4) Microscopy Section, (5) Fluosolids Reactor Pilot Plant, (6) Sampling Studies, and (7) Research Pilot Plant.

The Annual Report highlights various projects worked on during the year. No specific test data, conclusions, or recommendations are presented. Some of the projects which were minor in nature have been omitted, however, have been referred to in the Monthly Reports.

PART I

GENERAL INFORMATION

DISTRIBUTION OF CHARGES:

Listed below is a tabulation for the last eight years showing the Laboratory staff and total hours as reported on the cost sheets. The number of staff people fluctuated considerably during 1958 due to shutdown of the MOC Pilot Plant, economic layoffs, and temporary transfer of personnel to work on special projects. The number of employees listed for 1958 is based on the status as of December, 1958.

	Staff			
Year	Engineers	Technicians	Total	Total Hours
1958	11	23	34	69,555
1957	13	30	43	98,205
1956	13	26	39	68,888
1955	10	17	27	55,275
1954	8	15	23	50,982
1953	8	18	26	66,005
1952	6	13	19	47,958
1951	6	11	17	31,369

The number of hours spent on specific projects is tabulated below. Approximately 54% of the time was devoted to the first four major projects, those being: (1) Operating Underground Mines, Cliffs Group Studies, and Ore Improvement Plant, (2) Development of Regrind Reflotation Flowsheet, (3) M.O.C. Flowsheet Development, and (4) Agglomeration Research Projects.

Summary of Time Distribution 1958

Project		Hours		% of Total Time
*Operating Mines - Cliffs Group Studies, OIP, etc.		12,224		17.6
Regrind-Reflotation Special Study		10,057		14.4
MOC Flowsheet Development		8,129		11.7
Agglomeration Research		7,013		10.1
Additive Studies	2,026		2.9	
General Agglomeration Studies	1,858		2.7	
Fuel Sample Tests	712		1.0	
Screen Efficiencies (Eagle Mills)	492		.7	
Agglomeration Studies - U.G.	459		.6	
899 Reagent Study	276		.4	
Eagle Mills Plant Control (Quenching)	274		.4	
Balling Studies (Batch)	274		.4	
Small Scale Balling Study	247		.4	
Special Gas-Air Measurements	124		.2	
MES Shaft Furnace Tests	122		.2	
Moisture Segregation Studies - U.G.	85		.1	
Study of Fe-SiO_2 Ratio	64		.1	
Test Work ACL Process		5,320		7.6
**MOC Pilot Plant		4,305		6.2
***Plant Control Samples, Humboldt, Republic, Eagle Mills		3,980		5.7
Flotation Study		3,509		5.0
Study of Agglomerate Properties at elevated Temp.		2,276		3.3
Research & Study		1,923		2.8
Special Studies, Tilden, Richmond, Cascade, etc.		1,748		2.5
Regrind Study		1,658		2.4
Eagle Mills Balling Study		1,644		2.4
New Pilot Plant		1,303		1.9
Drill Core Testing, Empire, Isabella, Ogden, etc.		921		1.3
Project 17 Samples		834		1.2
Outside Exploration Samples, Land Offers, Special Samples		604		.9
Brazilian Ore Sinter Tests		590		.8
One-Square-Foot Pelletizing Furnace		508		.7
Ore Improvement Plant		279		.4
Aerofall Mill Tests		221		.3
Quebec Cobalt - O.E. 1244C		144		.2
Flowsheet Development, Humboldt - Republic		136		.2
Empire Flowsheet Development		120		.2
Humboldt Magnetite Study		109		.2
Total		69,555		100.0

* For January & February - Includes 346 hours/month for two special men working on sampling program.

** Includes men working at MOC Plant through February.

*** For January thru August - Includes Operating Metallurgists time.

Chemical Charges:

Presented below is the distribution of Research chemical charges for 1958. The 13,662 samples submitted resulted in 24,242 analyses. The number of determinations for 1958 was roughly 8,500 less than the analyses made in 1957.

TOTAL NUMBER OF DETERMINATIONS ANALYZED IN 1958 FROM RESEARCH LABORATORY SAMPLES

Account	Analyses	Account	Analyses
Maas Mine	60	Land Offer 3734	46
Bunker-Hill Mine	2	3736	36
Humboldt Mine	377	3741	24
Republic Mine	270	3742	26
Cliffs Shaft Mine	117	3744	12
Pellet Plant, Eagle Mills	18	Outside Exploration 1151	26
Mather Mine "A" Shaft	23	1202	18
Mather Mine "B" Shaft	21	1208	29
Negaunee Mine Co. "Experiments & Investigations"	1056	1233	15
		1405-C	8
Cliffs Group Study	4519	1415-C	61
Ore Improvement Plant	176	E&A N.M. 128	14
Richmond Special	167	144 A	406
Flotation Study	1402	144 C	11
Tilden Special	188	148	171
Cascade Special	239	MI 13	470
MOC Development, Humboldt	1012	17	240
MOC Development, Republic	928	CC 825	49
Agglomeration Research	2118	867	247
Empire Flowsheet Development	98	868	499
Lurgi Kiln Tests	434	879	156
MOC Fundamental Studies	344	947	3
Humboldt Natural Magnetite Study	290	962	483
Project 17	315	Accounts Receivable *DUVAL	15
Land Offer 3244	65	MOC-Flowsheet Development	67
3261-C	9	Operating MOC Pilot Plant	25
3276-C	40	Jubilee Ore	3
3708	18	Account No. 3	787
3714	56	10	4030
3717	21	10 & 109	138
3718	48	109	492
3719	8	54	543
3721	8	108	46
3724	12	Flotation Study - K	568
3725	11		
3726	8	Grand Total	24,242

The following analyses were made:

Iron	15,818	Lime	272
Phosphorus	372	Copper	1
Silica	5,230	Loss	5
Alumina	119	Gain	1
Manganese	30	Magnesia	111
Sulphur	369	Moisture	3
Ferrous Iron	1,796	Coal Samples	12
Metallic Iron	24	Arsenic	1
Titanium	78		
		Total	24,242

Metallurgical Reports and Memoranda:

The metallurgical reports and memoranda issued by the Metallurgical Department during 1958 are listed below. As a general rule, the reports present the results of relatively long term intense investigations while the memoranda represent projects that are usually short, preliminary studies.

Excluding plant control sample test results which are reported in Mine memorandum forms, all work completed at the Laboratory is covered in a report or memorandum.

METALLURGICAL REPORTS - YEAR 1958

Report No.	Subject
215	Microscopic Investigation of Filter Cake Samples from the Eagle Mills Pelletizing Plant
216	Updraft Sintering of Underground Ores to Attempt to Produce an Acceptable Open Hearth Charge
217 (Supplements)	Experimental Flotation - Republic Mine
218 (Supplement)	Results of Standard MOC-Magnetic Concentration Tests on Composites from Isabella District DDH No. 4, Section 32, T47N-R26W
219	Ohio Mine Concentrating Plant Operation, 1957 Season
220	Magnetic Concentration Test Results on 1957 Surface Samples
221	Ore Improvement Plant Operation, 1957 Season
222	Results of Standard Magnetic Concentration Tests on Composites from Ogden District DDH Nos. 1 & 2, Section 13, T47N-R27W
223	A Microscopic Investigation of Core Specimens and Samples from DDH Nos. 45, 50, 51, 57 & 58 at the New Richmond Area
224	Results of Standard Magnetic Concentration Tests on Composites from Ogden District DDH No. 3, Section 24, T47N-R27W
225	Results of Standard Magnetic Concentration Tests on Composites from Empire Area Drill Holes 35 & 36 Section 19, T47N-R26W
226 & Geology Report 31	Microscopic Investigation of Core Specimens and Samples from DDH No. 4 Section 23, DDH Nos. 4, 6 & 7 Section 25, and DDH Nos. 55 & 56 Section 26 at the Tilden Fire Tower Area
227	Three-Day Continuous Test of 2.5% Bentonite-To-Coal at Eagle Mills, February 19, 1958 to February 22, 1958
228 & Geology Report 32	Laboratory and Microscopic Examination of Direct Shipping Ores from Bunker-Hill, Maas, Mather Mine "B" Shaft and the Cascade East End
229 (Supplement)	Results of Standard MOC-Magnetic Concentration Tests on Composites from Cascade DDH Nos. 1 & 2, Section 29, T47N-R26W
230	Results of Standard MOC-Magnetic Concentration Tests on Composites from Isabella District DDH No. 5 Section 29, T47N-R26W
231	MOC Tests of Humboldt and Republic Rougher Concentrates in the Lurgi Pilot Plant Kiln at Frankfurt/M, Germany; January-February, 1958
232	Results of Standard Magnetic Concentration Tests on Composites from Ogden District DDH No. 4, Section 24, T47N-R27W
233 (Supplement)	Pilot Mill Concentrate Regrind Study
234	1957 Mine Ore Structure Study
235	A Preliminary Examination of C.C.I. Laboratory Pellets
236	A Laboratory Investigation of the Sintered Product Produced from Test No. 5 and No. 6 at the Mines Experiment Station using Mather "B" and Athens Ore
237	Magnetic Concentration Test Results on Sandspit and "B" Group Grand Composites - Albanel Area
238	Mineralographic Examination of Pellets from Lurgi Test No. 10
239	Progress Report of Laboratory Pilot Mill Testing Utilizing Humboldt Rougher Magnetite Concentrate
240	Cliffs Group Structure Studies covering the Period 1/1/58 - 3/31/58
241	Results of Standard MOC-Magnetic Concentration Tests on Composites from Isabella District DDH Nos. 6, 7, and 8, Section 29, T47N-R26W

Continued - - -

Report No.	Subject
242	Preliminary Examination of Some Low Grade Iron Ore Specimens from Quebec Cobalt, Quebec, Canada
243	Mineralogical and Textural Transformation of Michigan Low Grade Ores at High Temperatures under Various Chemical Environments

METALLURGICAL MEMORANDA - YEAR 1958

Memo No.	Subject
560	Sub-Sieve Size Analyses on Cooler and Dust Products from Lurgi Kiln Test H6 (Treating Humboldt Rougher Concentrate)
561	MOC Tests Wherein Solid Fuels are Admixed with the Material to be Reduced
562	Titaniferous Samples, Project 17
563 (Supplement)	Preparation of Reagent 899 Flotation Concentrate for Balling Studies
564	Reducing the Fatty Acid Addition in Flotation by Using Fuel Oil as a "Carrier"
565	Canso East & Canso West DDH Composites, Project 17
566	DDH No. R13, Project 17
567	Batch Test Evaluation of Fatty Acid Flotation Reagents
568	Kallio Creek DDH No. 1, Project 17
569	DDH No. R1, Richmond Group, Project 17
570	New Richmond Pit Estimate, 10.00% Silicas as Class A Cut-off
571	Three-Day Continuous Tests of MOC Concentrate Being Pelletized and Hardened with the Allis-Chalmers ACL System
572	Batch Test Evaluation of West Virginia Pulp and Paper Fatty Acid Reagents
573	Tilden Fire Tower Pit Estimate, 10.00% Silica as Class A Cut-off
574	DDH No. SW3-Albanel Area, Project 17
575	1953 & 1954 Canadian Surface Samples, Project 17
576	Outline of Proposed Test Work on New Richmond and Tilden Composites at Battelle
577	The Addition of Different Amounts of Bentonite to the Pulverized Coal that is used as Fuel on the Surface of Green Pellets
578	Normand Lake, Quebec Sand Sample Mx-2055, L. O. 3261-C
579	Indian Grave DDH No. 1 - Albanel Area, Project 17
580	Redondo Beach Sand Samples Mx-2053, -2056, L. O. 3708
581	Sand Sample Mx-2058, L. O. 3714
582	Sand Samples Mx-2054 and Mx-2057, L. O. 3717
583	Metallurgical Tests on O'Keefe Ore Aerofall Mill Products, Sample No. Mx-510
584	Richmond Group DDH's 3, 4, & 5, Project 17
585	DDH No. IG-2, Project 17
586	Brief Study of Mineral Liberation in the MOC Calcining Operation
587	Quality Control Tests of Pellets from the Grate Discharge, Kiln Discharge, and Cooler Product Obtained During the Three Day Test at Allis-Chalmers' Carrollville Pilot Plant using MOC Concentrate
588 (Supplement)	Sample Nos. Mx-1689, -1690 - O. E. 1151
589	Observations of Shaft Furnace Pelletizing Tests at Mines Experiment Station Treating MOC Concentrates
590	Plateau East DDH Nos. 1, 2 & 3, Project 17
591 (Supplement)	Results of 899 and Fatty Acid Flotation in Producing Concentrates for Balling Studies
592	Albanel West DDH No. AW-1 & AW-2, Project 17
593	Kallio Lake DDH No. 3, Project 17
594	Plateau West DDH Nos. 1, 2, 4 & 6, Project 17

Continued - - -

Memo No.	Subject
595	Retesting Albanel Area Composites - Richmond and Vailliant Bay Groups, Project 17
596 & Geology Report 30	Mineralographic Examination of a Magnetic Concentrate Produced from a Beach Sand Sample, Redondo Beach, California
597	1957 Surface Samples, Project 17
598	Colloidal Silica as a Silica Depressant in Fatty Acid Flotation
599	Sample No. Mx-1372, L. O. 3718
600	The Effect of Rerolling Reground Eagle Mills Disc Feed in the Laboratory Balling Drum
601	High Intensity Separator Tests at Watenstedt, Germany on Dust Produced During Lurgi Test C-5, January 17, 1958
602	Determination of Radiation and Convection Heat Losses from the Lurgi Kiln during a Normal Period of Operation, Test C-19 (Humboldt Flotation Concentrate) at Frankfurt, Germany, February, 1958
603	Dust Loading and Gas Velocities During the Lurgi Pilot Kiln Tests of January, February, 1958 and Extrapolation of these Results to the Proposed Large CCI Kiln
604	Microscopic Examination of Jens Rhude's Spheroid Media
605	DDH R16, Richmond Group, Project 17
606	Special Samples of Pilot Kiln Solids Taken at Each Burner Lighting Port along the Test Kiln - February, 1958 at Frankfurt/M, Germany
607	Batch Test Evaluation of Fatty Acid Reagents "Aconew 500" and "Century 1475"
608	Steel Conveyor Handling Hot Sinter up a Steep Incline at Watenstedt, Germany
609	Richmond Group DDH Nos. 7 and 11, Project 17
610	Laboratory Pelletizing and Hardening Tests in Germany of Magnetic Concentrate Produced by Lurgi from MOC Kiln Calcine-Test C19 - Humboldt Flotation Concentrate
611	Sample Nos. Mx-2120-2123, Gwinn Area, Section 18, O.E. 1208
612	Sample No. Mx-1371 - O.E. 1405-C
613	DDH R6, Sample No. AMX-131, Project 17
614	Land Offer 3718
615	ACL Test Observations during the Week of April 21-24, 1958 - Humboldt and Republic Concentrates
616	Process Heat Requirements for MOC of Coarse Ore in a Kiln System Employing a Cooling Drum and Traveling Grate Heat Transfer Arrangement
617	Sample No. Mx-1373 - L.O. 3718
618	Evaluation of Binders Received at the Research Laboratory during the Past Three Months
619	Observing Ore Boat Unloading at Algoma Steel Corporation, Sault St. Marie, Ontario
620	Observing Ore Boat Loading - "Wm. G. Mather"
621	Progressive Color and Chemical Company "Emigol" Fatty Acid Emulsifier
622	Proposed Testing Plans for the May/June, 1958 MOC Campaign in the Lurgi Kiln at Frankfurt/M
623 (Supplement)	Study of the Effect of High Temperature on the Physical Strength of Agglomerates
624	Samples Mx-1376 and Mx-1377 - L.O. 3721
625	Results of Batch Tests of Swift & Company's Fatty Acid F-508
626	Observing Ore Boat Loading - "B.F. Jones"
627	Standard Laboratory MOC Results on Taconite Samples Received from Minnesota Operations
628 (Supplement)	Laboratory Comparison of the Southwestern Engineering Flotation Process with the Standard Fatty Acid and 899 Systems
629	Observing Ore Boat Loading - "Wm. G. Mather"

Continued - - -