

Minnesota Mining & Manufacturing Company

INTEROFFICE CORRESPONDENCE
SAINT PAUL, MINNESOTA

November 3, 1960

Report No. 1

CHEMOLITE MONTHLY WATER REPORT

The management of the Chemolite plant decided last August to expand the monthly well water sampling program to include phenol, fluoride and other pertinent determinations plus water consumption, pumping level, etc. The writer was assigned to bring the report up to date every month.

The analytical section of our Central Research is furnishing all the laboratory services. They have requested that the water samples be sent to the laboratory on the third Tuesday of every month to fit their present working schedule. It was also agreed that the results of these analyses be distributed to all those concerned at the Chemolite plant so that the repetition of analytical efforts for the well water analyses could be eliminated.

This is the first of these monthly reports. Please advise if you do not wish to continue to receive this regular report or if you know of someone who wishes to receive this report but whose name is not on the mailing list.

Monthly Chemical Analysis

The main purpose of this monthly analysis, in addition to furnishing certain chemical characteristics of the well water for the use of various process engineers in the Chemolite area, is to gain the necessary information about the spreading of contamination from local pollution sources to different wells so that sufficient warning can be obtained and adequate measures can be provided in time to assure a continuous supply of good quality process water. In order to secure the specific information described above, the analytical program is designed to include certain determinations as pollution indicators such as phenol, fluorides, chlorides, surfactants, etc.

The first set of water samples was taken on September 20, 1960. A total of six samples was collected, namely well water from Well No. 1, Well No. 2, Well No. 3, Well No. 4, waste pond effluent and a sample from the spring along the river bank just north of the railroad track. A copy of the laboratory results is attached to this report as Table I.

The chloride and sulfate content of the water from all four wells beginning in January, 1960, is plotted on Figure 1. The hardness and alkalinity of the well water for the same period are shown on Figure 2. For information and data prior to 1960, refer to a comprehensive report prepared by Mr. L. C. Houdek dated January 14, 1960, entitled "Chemolite Plant, Status of Water Supply and Proposed Program".

It has been suspected that Well No. 1 has become contaminated because of the continuous increase of alkalinity and hardness in the well water. It is also suspected that the contamination is coming from the waste disposal pond. From Figure 2, the hardness and alkalinity of the water from Well No. 1 are very high in comparison to that of the other wells and pollution is indicated. However, comparing the hardness

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**Exhibit
1028**

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Court File No. 27-CV-10-28862

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DISTRICT COURT, NO. 27-CV-10-28862

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and alkalinity of the water from Well No. 1 to that from the waste disposal pond shows that both the hardness and alkalinity in the waste pond are lower than that of the well water. This means there is a possibility that the contamination in Well No. 1 may be coming from sources other than the waste pond. As mentioned in my previous report, "Proposed Program for the Determination of the Contamination of No. 1 Well from the Present Disposal Pond" dated August 1, 1960, a sewer from the boiler house carrying waste water of very high alkalinity and hardness is located only about 50 feet from Well No. 1. Because the sewer and the manholes are not watertight, it is possible the high alkalinity and hardness may enter Well No. 1 from this nearby sewer. A fluorescein dye tracing test is under preparation and the results will be reported at a later date.

From Table I it can be seen that a concentration of 0.3 ppm of surfactant as ABS was found in Well No. 1, but not in other wells. This positively confirms that Well No. 1 is definitely polluted.

Since this is the first test of the sampling program, no conclusive statement can be made. However, more information will become available as this program continues.

Monthly Water Consumption

From the past records, a continuous increase in water consumption at a rate of about 80 million gallons per year has been experienced from the year of 1949 to 1958. Ordinarily more water is used in the summer months than in the winter.

A sharp increase of water use (about 400 million gallons per year) was observed during the period from 1958 to 1959. In January, 1960, a water conservation program was initiated by the Chemolite Water and Waste Committee, of which Mr. L. C. Houdek is the chairman, and this program has been carried out in the Chemolite area through this summer.

The plant water consumption from April, 1959, to the present time is plotted as the dotted line on Figure 2. From the curve it can be visualized that a continuous decrease in water consumption was attained regardless of the increased plant activities. The average water consumption for the period from April to September, 1959, was 108 million gallons per month and the average water use during the same period in 1960 was only 95 million gallons per month. If the consumption of 1959 is used as a basis for computation, an average of 11 per cent net reduction in water consumption has resulted without considering the increase of water use due to the expansion of plant activity. This reduction of water consumption is equivalent to an average rate of 300 gpm and can only be attributed to the conservation program which has been carried out.

Condition of Existing Wells

A continuous drop in the static ground water level in the Chemolite area has been experienced during the past years. The static water levels for all four wells are plotted on Figure 3 as solid lines. It can be seen that since last winter the static level has not dropped. In fact, a general trend of increase is indicated. The static level of Well No. 3 has risen about five feet since last January and the static level in Well No. 1 also shows a slight rise.

By looking at the static level curves and the water consumption curve (dotted line on Figure 3) at the same time, it is evident that the general trend of the rising static level is coincidental with the decrease of water consumption (or total pumpage). It will not be surprising if the static level continues to rise during the winter months while water usage is usually relatively low.

The term "specific capacity" has been used very widely to express the yield of a well or to compare the yield of wells. The definition of specific capacity is expressed as "number of gallons per minute of water produced per unit foot of drawdown".

The specific capacities of all four wells, beginning in July, 1959, are plotted on Figure 4. From these curves it is indicated that the specific capacities have generally increased since the summer of 1959. Well No. 2 shows the highest yield among the four wells and the yield from Well No. 1 and Well No. 4 are comparable. Generally speaking, from the data at hand, it seems the ground water conditions at Chemulite are improved during the past year.

The lowering of the water level in a well which is pumping at a certain rate depends on the permeability of the aquifer, the shape of the cone of depression and the time of pumping, if other conditions remain the same. If the pumping level becomes stationary after a period of pumping, it indicates the natural supply of ground water to the cone of depression is equal to the quantity pumped. The amount of lowering of the water level in the well under these conditions is called drawdown. After pumping is stopped, the water level in the well begins to rise. The rate of rising is called rate of recovery. When the water stops rising in the well, the water level is measured at that time and this is called the static level. It is apparent the time is definitely a very important factor in determining the static level and the drawdown.

As far as I know, no time has been specified as to when the static level and drawdown were measured in the past - sometimes it may have been five minutes, sometimes longer. This problem has been discussed with Mr. Russ Gustafson and it is agreed that he will run a rate of recovery test for each well so that the proper time which should be allowed to elapse after the pumping is stopped can be specified before the measurement of the static level. Unless there is a rapid change in the thickness of the saturation zone of an aquifer, the specific capacity should be fairly constant. It is anticipated that after a proper time is set up, a smoother curve of specific capacity and static level can be obtained.

Determination of the Leakage from the Waste Disposal Pond

In order to determine the underflow, if any, from the existing waste pond, the total inflow and total outflow were measured. A total of four wooden weirs were installed to determine the inflow to the waste pond. These weirs were sized and designed to achieve maximum accuracy of flow readings within the possible flow variations for each location. The outflow of the pond was measured with the existing 48 inch rectangular weir located at the junction where the pond empties to the channel. The leakage along the channel was checked by the trapezoid weir at the flume.

A 55 gallon drum was placed on the west shore of the pond as a control. The lid of the drum is about six inches above the ground. The drum was filled with water to a predetermined mark and the water level in the drum was recorded at regular intervals to furnish data for evaporation and rainfall corrections.

These weirs were read at two-hour intervals for seven days, September 22, 23, 26, 27, 28, 29 and 30. The results will be reported separately at a later date.

Electrolytic Investigation of Underground Water Flow

As it was mentioned in my previous report, the Slichter electrolytic method is being used to trace the pollution from the present waste pond to our wells. A Leeds and Northrup six-point potentiometric recorder, borrowed from our instrumentation laboratory through the instrumentation section of our electrical engineering department, was installed in the boiler room about three weeks ago. A six volt battery is used as the source of electricity. This recorder registers the current (in terms of volts) between the potential pollution source (the existing phenol pit which is next to the waste disposal pond), Well No. 1, Well No. 2 and the spring which is about 1,500 feet south of the existing waste pond along the Mississippi River just north of the railroad tracks. Mr. P. H. Thompson of the instrumentation section of our electrical engineering department is responsible for maintaining the recorder and doing the analyses.

A three foot by three foot by three foot hole was dug in the phenol pit. The hole is surrounded with a small earth dike to prevent the collection of phenolic waste in the hole. A round metal basket one foot in diameter and two and a half feet high with three iron legs was placed at the center of this square hole. A line of No. 12 TW wire connects this basket and the potentiometric recorder in the boiler house, and separate lines run between the recorder and Well No. 1, Well No. 2 and the spring.

The electrolyte used in the basket is No. 2 rock salt and a small stream of water runs continuously through the basket to dissolve the salt and to carry the brine solution into the ground through the seepage around the bottom of this square hole. The basket is filled periodically to maintain a continuous supply of salt. The salt operation was started on October 18, 1960.

The ground resistances were read before and after the salt was introduced. The following phenomena have been observed during the past three weeks operation:

1. An immediate increase of conductivity between the phenol pit and Well No. 1, Well No. 2 and the spring was observed right after the salt was introduced to the basket. This could be due to the reduction of the ground resistance in the immediate vicinity of the basket because of the electrolytic characteristics of the salt.
2. A gradual increase of conductivity between the phenol pit and Well No. 1, and also between the phenol pit and the electrical ground which is located just north of the boiler house was observed. This indicates the ground water carrying a certain concentration of salt is moving from the phenol pit toward Well No. 1 and the boiler house.
3. A gradual increase of conductivity between the phenol pit and Well No. 2 was also observed. Since Well No. 2 was not completely separated from the underground pipe system until October 26, 1960, this increase of conductivity could be due to the increase of ground conductivity as mentioned in Item 2. Data obtained after October 26, 1960, will furnish the answer to this question.

It is anticipated that the conductivity study will be continued for several weeks and the findings of this study shall be reported separately at a later date.

Submitted by,

Joseph T. Ling
Joseph T. Ling, Ph. D.
Senior Sanitary Engineer

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CENTRAL ANALYTICAL LABORATORY

Report No. 3873

Date November 3, 1960

Subject: Water Analysis, Chemolite Plant

Requestor: J. T. Ling Dept. Name: Field Engineering Proj. No.: 706104

Request No.: E-7713 Dated: October 18, 1960

Report:

Six samples of water collected from the Chemolite Plant on October 18, 1960, were submitted for analysis as shown below:

RESULTS:

	Well #1	Well #2	Well #3	Well #4	Spring	Pond
pH	7.15	7.47	7.47	7.40	8.05	7.70
	ppm	ppm	ppm	ppm	ppm	ppm
T/Dissolved Solids	531	249	253	300	1053	1128
Non-volatile Diss.						
Solids	432	203	167	193	872	955
Dissolved Fe	0.09	0.07	0.05	0.08	0.07	0.16
Phenolphthalein Alk.						
as CaCO ₃	0	0	0	0	0	0
T/Alk. as CaCO ₃	345	211	207	207	639	293
T/Sulfur as SO ₄	93	22	25	39	38	241
T/Chloride as Cl	24	2	1	3	107	166
T/Hardness as CaCO ₃	372	232	233	255	539	176
Ca Hardness as CaCO ₃	212	132	133	140	272	32
Phenol	0.010	0.006	0.010	0.012	0.08	0.27
Nitrate Nitrogen					Not de-	Not de-
as Nitrogen	2.0	1.3	2.6	2.2	tected	tected
Surfactants as ABS	0.3	Not de-	Not de-	Not de-	1.3	1.2
		tected	tected	tected		
Fluoride	0.18	0.20	0.15	0.18	0.40	22.5

/s/ A. Duncan /s/ B. W. Nippoldt
A. Duncan B. W. Nippoldt

cc: J. W. Copenhaver
H. E. Freier
R. A. Helvig
L. C. Houdek
W. H. Pahl
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J. E. Smith

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CENTRAL ANALYTICAL LABORATORY

Report No. 3882
Date December 6, 1960

Subject: Water Analysis, Chemolite Plant

Requestor: J. T. Ling Dept. Name: Field Engineering Proj. No.: 706104

Request No.: B-7838 Dated: November 7, 1960

Report: Six samples of water collected from the Chemolite Plant on November 15, 1960, were submitted for analysis as shown below:

RESULTS:

	Well #1	Well #2	Well #3	Well #4	Spring	Pond
pH	7.19	7.49	7.58	7.40	7.82	7.73
	ppm	ppm	ppm	ppm	ppm	ppm
T/Dissolved Solids	524	252	254	279	1035	897
Non-volatile Diss.						
Solids	407	170	170	203	719	713
Dissolved Fe	0.16	0.08	0.08	0.08	0.11	0.14
Phenolphthalein Alk. as CaCO ₃	0	0	0	0	0	0
Total Alk. as CaCO ₃	334	212	204	207	541	333
Total Sulfur as SO ₄	95	20	26	35	35	104
Total Chloride as Cl	24	3	2	3	107	89
T/Hardness as CaCO ₃	364	236	229	246	437	112
Ca Hardness as CaCO ₃	217	142	133	151	199	26
Phenol	Less than 0.002	Less than 0.002	Less than 0.002	Less than 0.002	0.12	5.6
Nitrate Nitrogen as N	1.9	1.8	2.7	2.3	Not de- tected	Not de- tected
Surfactants as ABS	0.3	Not de- tected	Not de- tected	Not de- tected	1.6	1.3
Fluoride as F	0.15	0.15	0.15	0.15	0.18	21.0

/s/ A. Duncan /s/ B. W. Nippoldt
A. Duncan B. W. Nippoldt

AD/BWN/vf

cc: J. W. Copenhaver, H. E. Freier, R. A. Helvig, L. C. Houdek
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