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REPLY TO: P.O. BOX 3331 • 900 BUSH AVENUE • SAINT PAUL, MINNESOTA

June 26, 1967

Mr. Jarle Leirfallom
Commissioner of Conservation
Centennial Office Bldg.,
St. Paul, Minnesota 55101

Subject: Application for Permit to
Appropriate Water, 3M Property
Woodbury Village, Minnesota

Attn: Mr. Sidney Frellsen

Dear Sir:

This is in regard to the well water problem near 3M's property in Woodbury Village, Minnesota, and our application for a permit to appropriate ground water in this area. Attached please find two (2) completed copies of the Minnesota Conservation Department, Division of Water; application for permit to appropriate water.

You will recall from our previous discussions the well water problem in the vicinity of 3M's disposal site in Woodbury Village. This site is about 220 acres located in the SW $\frac{1}{4}$ and N $\frac{1}{2}$ of the SE $\frac{1}{4}$, Section 35, T28NR21W. In 1960 this site was purchased and used by a private firm to disposal waste scrap from 3M under a contract. This firm sold the site to 3M in 1962. 3M used this site for the disposal of waste scrap until April, 1966. The site is still used by the residents of Woodbury and Cottage Grove Villages for disposal of their municipal refuse.

The problem was first discovered in April, 1966, by a resident living on the property directly west of the 3M site when he noticed objectionable odor in his well water. A program was subsequently initiated by 3M to determine the cause and source of the odor in this well water. The consulting firm of Eugene A. Hickok and associates was retained to assist in solving this problem. The initial program consisted of sampling and analyzing 18 residential wells in the vicinity of the 3M site, weekly sampling of the residential wells where the objectionable odor was first noticed, pump tests and sampling of two existing observation wells and a caretakers well on the 3M site, and the drilling of a 12" x 10" diameter test well (Test Hole No. 1) on the 3M site between the waste scrap disposal area and the contaminated well. The entire program, including the sampling and analysis, was reviewed and approved by the Minnesota Department of Health.

3M 083652

MINNESOTA MINING AND MANUFACTURING COMPANY

Exhibit
1064

State of Minnesota v. 3M Co.,
Court File No. 27-CV-10-28862

In addition to our sampling of the 18 residential wells in this area, the Health Department also sampled these same wells for nitrate and surfactant analysis. The results of the laboratory analysis on these 18 well water samples showed that eleven (11) of the eighteen (18) had nitrate concentrations in excess of the maximum allowable concentrations recommended by the United States Public Health Service for use in feeding infants. These high nitrate concentrations are not the result of chemical contamination from the 3M site.

In addition to the routine analysis, we also ran analysis for trace organic chemicals using a gas chromatographic technique. This procedure was specifically designed for this purpose with the help of technical people from the State Health Dept. The results of the analysis on the (18) residential well water samples were compared with the results of the analysis on the control water samples from three wells located out of the influence of the disposal site. Based on these analysis we found no organic chemical contamination from the 3M site in the area wells sampled. The residential well that was initially found to have an objectionable odor was found to still be contaminated.

Since the residential well water sampling program was made in September, 1966, well water samples were collected again at several residential wells near the disposal site in January, 1967, to determine if there had been any changes in the water quality. The results of the laboratory analysis on these samples again showed no chemical contamination.

Drilling of test hole No. 1 was stopped at two levels in the glacial drift, three levels in the Shakopee-Oneota limestone, and one level in the Jordan sandstone for test pumping and collection of water samples for analysis. At this particular location there was about 120 feet of glacial drift and 200 feet of Shakopee-Oneota limestone. The test hole was completed about 50 feet into the Jordan sandstone resulting in a total depth of this test hole of about 370 feet. It is estimated that the Jordan sandstone is about 80 feet thick in this area. At this location no definite St. Peter sandstone formation was found between the glacial drift and the Shakopee-Oneota limestone.

The static water level was at about 95 feet. The pumping levels for each pump test were as follows:

Glacial Drift	104' - 109'
Glacial Drift	112' - 118'
Shakopee-Oneota Limestone	135' - 150'
Shakopee-Oneota Limestone	156' - 200'
Shakopee-Oneota Limestone	250' - 315'
Jordan Sandstone	318' - 370'

The 12-inch hole through the glacial drift was cased so that at each pumping level the water from the strata above was cased off.

3M 083653

Following the pump tests in the drift, the drilling of the well was continued and the casing driven to the top of the Shakopee-Oneota limestone. An open hole (no casing) was drilled through the limestone and into the Jordan sandstone. At each level of pumping in the limestone and sandstone, a "packer" was used to isolate the level being pumped to eliminate the water from above this pumping level. In other words each water sample collected at the various levels was representative of that particular level.

The pump tests were normally made for 6 or 8 hours with samples collected at the start of the test and after each hour of pumping. Laboratory analysis was generally made on the first sample, the last sample and one collected in the middle of the sampling period. The water was pumped at as fast a rate as could be obtained from the aquifer. In the glacial drift and upper level of limestone this rate was about 10 gpm (gallons per minute), but in the lower level of the limestone and the Jordan sandstone 350-400 gpm of water was pumped, which was the limitation of the pump.

The laboratory analysis included routine analyses such as COD (dilute method), chloride, sulfate, nitrate nitrogen, surfactant, etc., and analysis for trace organic solvents.

The results of the laboratory analysis on the samples collected show that the water in the drift and the upper levels of the Shakopee-Oneota limestone to a depth of about 200 feet were chemically contaminated. The concentration, however, decreased substantially with an increase in depth. Below 200 feet in the limestone and Jordan Sandstone only insignificant trace concentrations of chemicals were detected. It is believed that these trace chemicals were pulled down from the aquifer above during the high rate pumping. Isopropyl ether continues to be the dominant component with concentrations varying from 4-5 ppm in the drift to less than 0.1 ppm at levels 156' - 200'. However, we also found several organic solvents in trace concentrations tentatively thought to be methyl isobutyl ketone, methyl cellosolve, n-butyl acetate and some other organic solvents that were in still lower concentrations so that they could not be identified.

Water samples were also collected from the two existing 2-inch observation wells and the caretaker's well all located on the disposal site. One observation well is located in the northwest corner of the site and the other in the southeast corner. The caretaker's well is located east of the disposal area and equidistant between the two observation wells. The observation wells were finished in the St. Peter Sandstone and are open to both the glacial drift and the sandstone. To collect individual samples from the drift and the sandstone formation, a specially designed packer was used in the well between the drift and the sandstone to eliminate the direct contact of water between these two formations. Eight-hour pump tests were made at each formation. During this same time an eight hour pump test was also made on the caretaker's well. The laboratory analysis made on the water samples collected during each pump test at all three wells showed no chemical contamination.

3M 083654

Based on our pump tests and the results of the laboratory analysis on the water samples collected from nearby residential wells, it appears that only the initial residential well is chemically contaminated at the present time. 3M is acutely aware of this problem and intends to initiate the following step-wise program immediately to contain the chemical contamination within a defined boundary and at the same time remove the contamination from the ground water in order to prevent the contamination of any other residential wells in the vicinity of the disposal site. These steps may be modified however, as the program develops and more information becomes available.

- (1) The construction of pumping barrier wells around the disposal site designed to operate continuously to stop any further migration of the chemical contamination in the ground water.
- (2) Construction of removal wells in the immediate vicinity of the disposal pits to pump the concentrated material from the ground.
- (3) Discharge of the water from the wells to the river in an approved manner.
- (4) A regular monitoring program of residential wells in the immediate vicinity of the disposal site to be sure that these wells are kept free from any chemical contamination.
- (5) An inventory of residential wells in the vicinity of the disposal site to determine existing water levels, ground water hydraulic gradients, geologic information, etc.
- (6) Construction of test wells as necessary to design the barrier and removal well systems.

This program has been reviewed by the Minnesota Water Pollution Control Commission and on March 31, 1967, a permit was issued to 3M to discharge contaminated water from this pumping system to the Mississippi River.

Dr. George Schwartz, Geologist, University of Minnesota was retained by the Village of Cottage Grove to review the overall program. He approved this program and indicated that it should proceed as rapidly as possible. Bonestroo, Rosene, Anderlik and Associates, Consulting Engineers, have also been retained through the Villages by 3M to determine the most feasible method and route of discharging the water from the pumping well system to the Mississippi River.

The regular monitoring program of residential wells in the immediate vicinity of the site, and the inventory of residential wells (steps 4 and 5 of the program) have already been started since they will be necessary parts of any program. It is anticipated that the drilling program will start immediately so that the contamination can be contained within the present boundaries.

retained by the Villages, costs to be reimbursed by 3M

3M 083655

As Phase I of the overall program we propose to install a pump with a capacity of about 500 gpm in the existing test well (test hole No. 1). At the same time a monitoring well will be drilled in the area of what appears to be the leading edge of the contamination. The pump will be pumped 24 hours each day, 7 days a week and the water discharged to a small lake south of the 3M site. The use of this lake has been approved by Cottage Grove Village. Extensive sampling will be done to determine the chemical characteristics of the pumped water and for monitoring the quality of the lake water. The pumping from this well will not only be part of the overall barrier well pumping program but will provide an immediate containment in the area where the migration of the contaminated underground water appears to occur. The well will also be used for test pumping to determine some of the parameters required for developing the detailed design of the overall program.

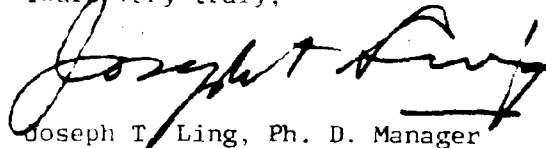
Although at this time the exact quantity of water that will have to be pumped from the proposed barrier wells and removal wells is not known, our consultants estimate that the quantity could ultimately range from 2000 gpm to 5000 gpm. It is the intention of this report to bring you up-to-date on the progress we have made and to submit the application for a permit to appropriate the ground water needed to solve the ground water contamination problem in this area. The initial withdrawal from the well (test hole No. 1) will be about 500 gpm.

Since many factors which affect this program have not been determined at this time we consider the program to be primarily experimental.

As the program continues we will keep you informed on the progress. We would be pleased to have a representative from your Department view this initial start up of the pumping and the pump tests.

If you have any questions or need any more information, please let us know. Since we would like to proceed with this program as soon as possible, your prompt action on this matter will be appreciated.

Yours very truly,



Joseph T. Ling, Ph. D. Manager
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3M 083656