

**Facility-wide Fluorochemical Investigation Work Plan
3M Cottage Grove**

Prepared for:

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**Exhibit
1933**

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INTRODUCTION

On September 23, 2003, the Minnesota Pollution Control Agency (MPCA) met with 3M staff to discuss perfluorochemicals (FC's) at the 3M Cottage Grove facility (site). At this meeting, both 3M and the MPCA acknowledged that though FCs were known to be present at the site during the completion of tasks agreed upon in the 1985 Response Order by Consent (CO), the technology was not available at that time to fully evaluate the presence and potential risk of FCs. Recent analytical advances and the completion of studies related to the risk of two perfluorooctanyl FCs, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS), now allow 3M to evaluate these and other FC compounds at the site pursuant to the CO.

MANUFACTURING

The site occupies approximately 865 acres of property. Generally, only the southeastern portion of this property has been utilized for manufacturing and testing of 3M products. The remaining portion has been used for recreation, farming or has remained as natural habitat. 3M records show that manufacturing began at the site in 1947 and that commercial production of PFOA products began about 1976. PFOS records indicate production potentially began as early as the mid 1960's. Prior to this, documents indicate FCs were being tested for product use or generated at a pilot scale in the 1950's. Generally, FC manufacturing, product storage and product testing has taken place in site buildings 7, 15, 16, and 25 (see Figure 1). In addition, FCs are a component of proprietary fire suppressant formulations tested in the area of Building 43. Production of the perfluorooctanyl FC's was phased out by the end of 2002.

SITE SETTING AND HYDROGEOLOGY

The site is located on a flat to gently undulating bluff overlooking the main channel of the Mississippi River. Both the southeast and southwest sides of the site have been steeply incised by stream activities. The site is underlain by glacio-fluvial deposits which increase in thickness from north to south across the site. These deposits are underlain by the Prairie Du Chein Group and the Jordan Sandstone Formation. The St. Lawrence Shale Formation (a confining layer) is present at the base of the Jordan Formation, approximately 200 feet below the central portion of the site (see Figure 2).

An extensive body of knowledge regarding the site hydrogeology has been developed through prior site investigations, permitting processes and in support of site operations. Figure 3, attached, provides a map of site groundwater monitoring and production well locations. Figure 4 shows the potentiometric surface from the latest round of site water level monitoring. Table 1, below, provides a summary of historic static water level elevations recorded at site monitoring wells. All site monitoring wells are finished in the upper unconfined aquifer at the site.

Table 1
Cottage Grove Groundwater Elevation Summary
1986-2002

Monitoring Pt.	1/1/1986	7/1/1994	4/25/1996	6/10/1996	7/30/1996	5/1/2000	6/1/2001	12/7/2001	7/1/2002
MW-1	742.57	751.07	757.6	756.46	756.02	751.64	758.90	755.69	756.54
MW-2	693.41	702.1		713.53	711.89	724.29	722.15	721.68	721.52
MW-3	679.42	689.83	705.8	703.07	702.02	696.21	710.75	713.51	713.08
MW-4	674.83	683.33	694.3	692.99		690.02	698.33	700.64	700.23
MW-5	749.23	756.31		760.6	759.54	757.36	763.16	759.13	762.52
MW-6	706.81	713.85							
MW-7		736.10		739.36	738.82	734.98	740.16	739.59	739.22
MW-8	699.15	700.11	702.3	702.12	701.06	700.58	705.50		703.93
MW-9	706.99	714.02	724.9	722.21	721.67	713.36	726.87	724.65	725.61
MW-10	683.92	688.30		692.25	691.30	691.73		696.29	
MW-11	678.62	687.63	694.28	693.23		687.57	699.47	701.43	699.53
MW-12	676.62	679.31	684.1	683.71	681.85	684.86	686.63	688.33	689.72
MW-13	685.09	687.21	689.1	689.01	688.09	689.31	690.48	690.73	690.91
MW-14									
MW-15			650.0	650.0	648.0	651.50	653.20	655.57	657.25
MW-16			664.0	664.0	662.0	664.41	666.09	667.07	668.57
MW-17			709.3	706.09	705.02		709.95	712.45	712.94
MW-18			714.6	711.05	711.05	700.79	713.96	716.30	717.05
MW-19						701.38	705.62	706.05	706.94

Six high-capacity pumping wells (PW-1 through PW-6) supply water to support operations at the site (see Figure 3). The groundwater from four of these wells (PW-2, PW-3, PW-4 and PW-5) feeds the on site water supply distribution system on a continuous basis for various site needs including production and sanitation. Bottled water has been provided for a number of years at the site for drinking water. The remaining two wells are utilized independently on a periodic basis for site-wide fire protection (PW-1) and air pollution control at the site incinerator (PW-6), respectively.

These six high-capacity wells were installed during the period 1947 to 1970. Four of the wells are drilled into the Jordan Formation and two of the wells are located in unconsolidated alluvium near the Mississippi River. However, all pumping wells obtain groundwater from the surficial, unconfined aquifer. Studies have documented that groundwater is constrained from downward vertical flow by the underlying St. Lawrence Formation (StL). Groundwater, below the StL, has been documented as being confined below the facility, and wells finished below the StL have produced flowing artesian conditions at pool elevation of the river.

Although historical water level data indicates a natural hydraulic gradient toward the river, pumping of the wells (which started in 1947) has created a persistent cone of depression in the groundwater beneath the developed portions of the site (see Figure 4). The cone of depression effectively limits movement of groundwater from the site to the adjacent river. All groundwater used for the production processes is treated after use, at

the site wastewater treatment facility, prior to NPDES permitted discharge to the Mississippi River. There is no potable groundwater use downgradient of the site and no wells are present between the site and the river. No discrete springs are present along the base of the bluff adjacent to the river; therefore, groundwater discharge from the area around the site enters the pool of the river by diffuse seepage.

REMEDIAL INVESTIGATION

On September 23, 2003, MPCA and 3M staff agreed that the Remedial Investigation (RI) process, as set forth in Part II and outlined in Exhibit A of the CO, should be reinitiated. Both parties agreed that the RI should build on the RI previously completed for the site.

The RI is to be focused on FC compounds for which analytical methods are currently available. To be consistent with the MPCA-approved NPDES site monitoring program, the following five FC carboxylate and sulfonate compounds ("target analytes") will be monitored at the site:

1. C6 Acid - Perfluorohexanoic acid (PFHA);
2. C8 Acid - Perfluorooctanoic acid (PFOA);
3. C4 Sulfonate - Perfluorobutane sulfonate (PFBS);
4. C6 Sulfonate - Perfluorohexane sulfonate (PFHS); and
5. C8 Sulfonate - Perfluorooctane sulfonate (PFOS).

Paraphrasing from Part II of the CO, as applied to target analytes, the purpose of this RI is to:

1. define the extent and magnitude of on-site contamination resulting from the past site waste disposal practices of FCs;
2. define the hydrology and geology of the site and the potential routes of exposure; and
3. provide information and data needed for consideration of response actions.

The following work plan will provide the information necessary for completion of the RI objectives. Specific tasks are developed to address each of the three objectives.

As possible, define the extent and magnitude of on-site contamination resulting from the past site use of FCs.

- Document and summarize the history of FC manufacturing, testing and disposal at the site. This will include the areas used for early product testing and large scale manufacturing, and the disposal locations associated with both processes. Identified potential source locations will be plotted on a site base map;
- Available historic information will be compiled on the treatment and disposal of FC wastes through the wastewater treatment plant. Identified potential disposal locations for sludge/ash will be plotted on a site base map;

- Available historic information on air releases of target analytes will be compiled and identified potential source locations will be plotted on a site base map;
- Historic information on any spills of FCs will be compiled and these potential source locations will be plotted on a site base map; and
- Historic information on soil and groundwater testing of target analytes will be compiled in tabular form.

Define the hydrology and geology of the site and the potential routes of exposure

- A table will be developed summarizing the construction details of all existing well points at the site and the aquifer depth monitored;
- A table will be developed documenting the pumping activity of the production wells at the site;
- A site potentiometric surface map will be constructed utilizing the most recent site-wide groundwater levels;
- A MODFLOW model will be developed that reflects the potentiometric surface map, site geographic features and the average annual pumping rates for the site production wells;
- Particle tracking will be completed to verify the potential groundwater receptor route at the site. The MODFLOW model will be used to validate groundwater flowing beneath the previously identified potential source areas is captured by the site production wells;
- Initially, a groundwater sample will be collected for target analytes analysis at all site monitoring wells;
- Thereafter, a monitoring well network will be proposed that focuses on known or suspect source areas ;
- A groundwater sample will be collected for target analytes analysis at each of the six site production wells and a sample will be collected from the "loop" at Building 116 cafeteria;
- To document potential groundwater discharge to surface water outside the defined zone of capture of the production well network, four sample locations will be established at the base of the bluff between the Mississippi River and the 3M facility on the north side of the railroad right of way. Based on access, the points will be established roughly equidistant between the facility wastewater outfall and directly south of MW-16. A "PushPoint" probe will be extended to the water table at these locations and a groundwater sample will be collected for target analytes analysis. Specific locations will be determined in the field based on access;
- A subsurface sampling plan, to evaluate potential contaminant transport from the Fire Training Area, will be developed;
- Sampling procedures, previously approved by the MPCA at the D1 area, will be utilized for sampling at all groundwater sampling locations; and
- All samples will be transported to the laboratory under appropriate chain-of-custody procedures.

Provide information and data needed for consideration of response actions.

The results of the facility-wide assessment will be presented in a written report to the MPCA. The report will:

- Include field methodologies and analytical results;
- Compare the analytical results to the appropriate ecotoxicological test results for PFOA and PFOS;
- Discuss the implications of submitted results; and
- Provide recommendations for additional site work or response action.

SCHEDULE

The following schedule has been developed for completing these work tasks. Note, the dates are predicated on a thirty (30) day MPCA response for each deliverable.