US EPA RECORDS CENTER REGION 5
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FIVE-YEAR REVIEW REPORT FOR FMC CORPORATION SUPERFUND SITE
Anoka County, Minnesota

Prepared by

Minnesota Pollution Control Agency
In cooperation with U.S. EPA Region 5

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LIST OF ACRONYMS

AMR	Annual Monitoring Report
ARAR	Applicable or Relevant and Appropriate Requirement
BAE	BAE Systems Land and Armaments L. P.
BNR	Burlington Northern Railroad
BNSF	Burlington Northern Santa Fe
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CPT	Cone Penetrometer Testing
CSM	Conceptual Site Model
CTF	Containment and Treatment Facility
CZA	Capture Zone Analysis
EPA	U.S. Environmental Protection Agency
ERD	Enhanced Reductive Dechlorination
ESD	Explanation of Significant Differences
FYR	Five-Year Review
HBV	Health-Based Value
HRL	Health Risk Limit
IC	Institutional Control
ICIAP	Institutional Control Implementation and Assurance Plan
MCL	Maximum Contaminant Level
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
MSS	Minnesota State Statute
MWW	Minneapolis Water Works
NCP	National Contingency Plan
NIROP	Naval Industrial Reserve Ordnance Plant
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU1	Operable Unit One
PCE	Tetrachloroethene
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SDWA	Safe Drinking Water Act
SWBCA	Special Well and Boring Construction Area
TCE	Trichloroethene
TBC	To Be Considered
ug/L	Micrograms per Liter
ug/m^3	Micrograms per Cubic Meter
UU/UE	Unlimited Use/Unrestricted Exposure
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This is the fifth five-year review (FYR) for the FMC Corporation Superfund site located in Fridley, Anoka County, Minnesota. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR was the signing of the previous FYR on 9/30/2009.

Historically, industrial and hazardous waste generated from naval ordnance manufacturing, including plating wastes, paint, paint sludges, oils, bottom ash and chlorinated and non-chlorinated solvents, was disposed of at the site. Initial removal actions conducted in 1983 included excavation of soil above one part per million of total volatile organic compounds (VOCs) and construction of an on-site containment and treatment facility (CTF) to treat and contain the contaminated soils. Soils in the CTF were deferred to the Resource Conservation and Recovery Act (RCRA) program prior to site listing.

The site consists of one operable unit (OU1) which is groundwater. The U.S. Environmental Protection Agency (EPA) signed a Record of Decision (ROD) on September 30, 1987, documenting the selection of the remedial action for the contaminated groundwater at the site. Groundwater contamination was addressed through a groundwater extraction system, installed in 1987, and a monitoring well network. The groundwater extraction system continues to operate and VOCs remain in the groundwater at and downgradient of the site. The potentially responsible party (PRP) is BAE Systems Land and Armaments L. P. (BAE) and it is operating and maintaining the remedy.

At this time, a protectiveness determination of the selected remedy at the FMC Corporation Superfund site cannot be made until further information is obtained. Vapor intrusion sampling was conducted at the Minneapolis Water Works (MWW) and initial data shows that there may be a potential pathway for vapor intrusion. Further information will be obtained to determine whether the vapor intrusion pathway is complete and whether vapor intrusion poses an unacceptable risk. It is expected that these actions will take approximately twelve months to complete at which time a protectiveness determination will be made.

Soil removal actions were conducted prior to implementation of the ROD and decision documents for the site. EPA and the Minnesota Pollution Control Agency (MPCA) have found the soil removal actions to be protective of human health and the environment. It is currently unclear whether the soil removal actions cleaned up site soil to levels that allow for unlimited use and unrestricted exposure (UU/UE). Institutional controls (ICs) may be needed to assure that soil remains protective in the long term.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: FMC Corp. (Fridley Plant)		
EPA ID: MND006481543		
Region: 5	**State:** MN	**City/County:** Fridley, Anoka County

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: State MPCA
Author name (Federal or State Project Manager): Shanna Schmitt
Author affiliation: MPCA Project Manager
Review period: 12/9/2013 - 9/30/2014
Date of site inspection: 1/16/2014
Type of review: Statutory
Review number: 5
Triggering action date: 9/30/2009
Due date *(five years after triggering action date)*: 9/30/2014

Issues and Recommendations Identified in the Five-Year Review:

OU(s): *OU1*	**Issue Category:** Remedy Performance			
	Issue: Enhanced reductive dechlorination (ERD) pilot study to evaluate ERD as a potential alternative remedy is ongoing.			
	Recommendation: Complete ERD pilot study evaluation and assess restart of groundwater extraction well RW-2.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State/EPA	6/30/2015

OU(s): *OU1*	**Issue Category:** Remedy Performance			
	Issue: Capture zone analysis indicates a limited percentage of the targeted groundwater capture zone is being captured.			
	Recommendation: Complete a capture zone analysis following installation of upgraded equipment.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State/EPA	6/30/2015
OU(s): *OU1*	**Issue Category:** Site Access/Security			
	Issue: An unrestricted exposure pathway exists in the area of the two seeps.			
	Recommendation: Evaluate potential access restrictions or signage for the seep area to restrict access by the public.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State/EPA	10/1/2015
OU(s): *OU1*	**Issue Category:** Remedy Performance			
	Issue: Contaminant concentrations which exceed surface water standards are being discharged to the Mississippi River at the seeps.			
	Recommendation: Further evaluate remedial options including system enhancement and ERD. Ecological effects resulting from the discharge of VOC-impacted groundwater at the seeps should also be evaluated.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State/EPA	6/30/2016
OU(s): *OU1*	**Issue Category:** Monitoring			
	Issue: A full evaluation of potential vapor intrusion has not been completed.			
	Recommendation: Evaluate potential vapor intrusion pathways which could be affected by site contaminants.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State/EPA	9/30/2015
OU(s): *OU1*	**Issue Category:** Institutional Controls			
	Issue: Need to evaluate existing ICs, and need to develop and implement long-term stewardship procedures.			
	Recommendation: Develop an Institutional Control Implementation and Assurance Plan (ICIAP) to evaluate the effectiveness of the existing ICs, the need for any additional ICs, and to ensure that long-term stewardship procedures are developed and implemented.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP/State	State/EPA	9/30/2015

Protectiveness Statement(s)	
Operable Unit: Soil	*Protectiveness Determination:* Protective
Protectiveness Statement: Soil removal actions were conducted prior to implementation of the ROD and decision documents for the site. EPA and MPCA have found the soil removal actions to be protective of human health and the environment. It is currently unclear whether the soil removal actions cleaned up site soil to levels that allow for unlimited use and unrestricted exposure. ICs may be needed to assure that soil remains protective in the long term.	

Protectiveness Statement(s)		
Operable Unit: OU1 - Sitewide	*Protectiveness Determination:* Protectiveness Deferred	*Addendum Due Date:* 9/30/2015
Protectiveness Statement: At this time, a protectiveness determination of the selected remedy at the FMC Corporation Superfund site cannot be made until further information is obtained. Vapor intrusion sampling was conducted at the Minneapolis Water Works and initial data shows that there may be a potential pathway for vapor intrusion. Further information will be obtained to determine whether the vapor intrusion pathway is complete and whether vapor intrusion poses an unacceptable risk. It is expected that these actions will take approximately twelve months to complete at which time a protectiveness determination will be made.		

I. INTRODUCTION

The purpose of a FYR is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

EPA prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA Section 121 states:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

EPA interpreted this requirement further in the NCP; Title 40 of the Code of Federal Regulations (CFR), Section 300.430(f)(4)(ii), states:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action."*

The Minnesota Pollution Control Agency conducted a FYR on the remedy implemented at the FMC Corporation Superfund site in Fridley, Anoka County, Minnesota. The MPCA is the lead agency for developing and implementing the remedy for the site. EPA, as the support agency, has reviewed the supporting documentation and provided input to MPCA during the FYR process. MPCA has conducted this FYR pursuant to EPA guidance and requirements.

This is the fifth FYR for the site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. The site consists of one operable unit, groundwater, which is addressed in this FYR. Additionally, a removal action for soils was conducted prior to the site's listing on the National Priorities List (NPL). Although a CERCLA remedial action was not selected for soils, site soils are evaluated in this FYR because it is unclear whether the previous soil removal action cleaned up the site soils to levels that allow for UU/UE. Background information about the site is provided in Appendix A.

II. PROGRESS SINCE THE LAST REVIEW

The protectiveness determinations from the 2009 FYR are provided in Table 1, and the status of the issues and recommended actions from the 2009 FYR are in Table 2. The MPCA's position regarding the 2009 FYR protectiveness determination for OU1 differed from the EPA protectiveness statement and was included in Appendix A of the 2009 FYR; it is also provided below, following Table 1.

Table 1: EPA Protectiveness Determinations/Statements from the 2009 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Groundwater (OU1)	Short-term Protective	The remedy selected to address groundwater contamination is currently protective of human health and the environment in the short term. In order for the remedy to be protective in the long term the following actions need to be completed: • The monitoring well network must be expanded and the groundwater plume must be fully defined; • Maximum Contaminant Level (MCL) or health-based cleanup values are to be achieved at the site boundary; • Updates to the site monitoring plan need to be completed; • The capture of the groundwater extraction system must be further evaluated; • A complete risk assessment is to be conducted with regard to the seep; • Effective ICs are to be in place at and near the site that are protective in the short [term] and apply to all activities that may lead to potential exposure; In order to assure long-term protectiveness, the need for additional controls on BAE and nearby properties will be evaluated; • Remedial action addressing exposure at the seep must be completed (if determined to be necessary by the risk assessment); • Further evaluation needs to be conducted for additional remedial action utilizing data collected from additional investigations; • Improvements to data evaluation and presentation within Annual Monitoring Reports to be made.
Soil	Protective	Soil removal actions were conducted prior to implementation of the ROD and decision documents for the site. The EPA and MPCA have found soil removal actions to be protective of human health and the environment. Continued monitoring of CTF monitoring wells and data evaluation is required to assure continued long-term protectiveness. In addition, ICs may need to be implemented to assure the CTF remains protective in the long term. A review of ICs will be conducted in an IC plan to determine what additional ICs are needed.
Sitewide	Short-term Protective	The selected remedy to address groundwater contamination at the site is protective of human health and the environment in the short term. In order for the groundwater remedy to be protective in the long term, actions identified in the protectiveness statement for groundwater and recommendations section of this FYR must be implemented. The soil removal actions and CTF have been identified by the MPCA and EPA as protective, although ICs may be needed to assure long-term protectiveness.

MPCA's Position in the 2009 FYR Regarding the Short-Term Protectiveness of the OU1 Remedy at FMC Corp. Site:

It is the MPCA's position that the remedy to address groundwater contamination at the above referenced site is currently not protective of human health and the environment in the short term. This determination, which differs from the EPA's, was made due to the documented discharge of trichloroethene (TCE) associated with the site, to the Mississippi River through a groundwater seep on the banks of the Mississippi River. Because of the discharge of contaminated groundwater to the Mississippi River, the MPCA is not able to concur with the EPA that the remedy is protective in the short term. MPCA understands that this discharge which is a symptom of an ineffective groundwater remedy is one of the factors that has resulted in EPA determining that the groundwater remedy is not protective in the long term. The MPCA is uncomfortable with separating the protectiveness determination into short-term and long-term protectiveness at a site where the remedy has been in place for over 21 years. In addition, the MPCA has the following specific concerns regarding the protectiveness of the remedy:

- **Use as a Drinking Water Supply**
  This section of the Mississippi River is classified by the State of Minnesota, and used, as a domestic drinking water supply (Class 1C). The contaminated groundwater being discharged into the river exceeds the MCL for TCE. Therefore, it is the MPCA's position that the selected remedy is not protective in the short term, since it is allowing water that is unsuitable for the river's classified use to enter the Mississippi River.

- **Recreational use:**
  The Mississippi River in this section of the river is also utilized and classified by the State of Minnesota as unlimited and unrestricted use recreational waters to be protected as a drinking water supply (Class 2Bd). The seep directly discharges water exceeding the MCL for TCE to this recreational waterway. Given the use of this portion of the river, direct dermal contact and/or ingestion of water exceeding MCLs, either deliberate or accidental, is possible in this area. This potential exposure pathway is directly related to the discharge from the seep to the Mississippi River. Again, it is the MPCA's position that the selected remedy is not protective in the short term, since it is allowing water that is unsuitable for the river's classified use to enter the Mississippi River.

- **Access in the area of the seep is Not Restricted:**
  While the MPCA recognizes that the steep embankment makes accessing the seep by humans and other large mammals difficult [Sic]. However human access to the area is not restricted by any physical means, such as fencing. Therefore, direct human contact with the water being discharged at the seep, which exceeds the MCL for TCE, needs to be considered as a potential exposure pathway. Furthermore, access to the seep by small mammals and other wildlife is unhindered.

Summary [of MPCA's Position in the 2009 FYR regarding the Protectiveness of OU1]

The groundwater contaminant plume discharges to the Mississippi River at levels that do not meet the standards associated with the waters' use and therefore is not protective of human health and the environment.

The discharge of contaminated groundwater to the Mississippi River at unacceptable levels is a symptom of an inadequate groundwater remedy. This inadequacy is ongoing. It is for this reason that MPCA is unable to concur that the remedy is currently fully protective of human health and the environment.

Table 2: Status of Recommendations from the 2009 FYR

OU #	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
1	Evaluate additional applicable or relevant and appropriate requirements (ARARs) for inclusion in revised decision documents, if applicable	MPCA EPA	MPCA EPA	3/1/2010	Considered But Not Implemented	12/09/2009
1	Utilize data from additional subsurface investigation, further evaluation of extraction well capture zones and expanded monitoring well network to evaluate current groundwater extraction remedy	BAE MPCA EPA	MPCA EPA	7/1/2010	Ongoing	N/A
1	Further investigation of extraction well capture zones following EPA document entitled: A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems	BAE	MPCA	7/1/2010	Completed	10/16/2013
1	Additional subsurface investigation on the Burlington Northern Railroad (BNR) portion of the site	BAE	MPCA	5/1/2010	Completed	1/1/2012
1	Evaluate the need to better define RAOs	MPCA EPA	MPCA EPA	12/1/2010	Considered But Not Implemented	10/16/2013
1	Improve the monitoring well network in the confined aquifer in the BNR portion of the site	BAE	MPCA	10/1/2010	Completed	1/1/2012
1	Improve the monitoring well network in the unconfined aquifer downgradient of the BNR portion of the site.	BAE	MPCA	10/1/2010	Completed	1/1/2012
1	Update the site groundwater monitoring plan	BAE	MPCA	12/1/2009	Completed	1/1/2012
1	Update the site receptor monitoring plan	BAE	MPCA	12/1/2009	Completed	1/1/2012
1	Evaluate additional groundwater ARARs for points downgradient of the site	MPCA EPA	MPCA EPA	2/1/2010	Considered But Not Implemented	12/09/2009
1	Evaluate exposure/risk and options to control exposure/risk to human health and the environment at the seep	BAE MPCA	MPCA	7/1/2010	Under Discussion	N/A
1	Evaluate information obtained from additional investigation to identify other potential remedies	BAE MPCA EPA	MPCA EPA	7/1/2010	Ongoing	N/A
1	Evaluate ICs for the site and adjacent properties by preparing IC plan	BAE MPCA	MPCA	12/1/2010	Ongoing	N/A
1	Implement recommendations from IC Plan	BAE MPCA	MPCA	12/1/2011	Ongoing	N/A
1	Improve data presentation and trend analysis in site monitoring reports	BAE	MPCA	6/1/2010	Completed	Annual reports completed by BAE

Remedy Implementation Activities

During this review period remedy implementation activities were conducted by BAE and MPCA to further optimize the remedy and explore other potential remedial options. Remedy implementation activities included installation of an on-site air stripper, installation of additional monitoring wells, conducting an in-situ ERD pilot study, and development of a proposed institutional control which would limit groundwater use throughout the vicinity of the site.

BAE, in an effort to control remedial costs associated with off-site water treatment, installed an air stripper system at the site in order to treat extracted groundwater. Treated water is now discharged to the Mississippi River under a National Pollutant Discharge Elimination System (NPDES) permit. This modification is further detailed in an Explanation of Significant Differences (ESD) signed on September 13, 2013. Due to increasing fees associated with discharge of the extracted groundwater to the publicly owned treatment works (POTW), and in anticipation of future fee increases, BAE determined, with concurrence from MPCA and EPA, that installation of an air stripper to treat extracted groundwater was a feasible alternative which would still provide protection of human health and the environment. The capital cost of the modification was approximately $450,000 with an estimated annual operating cost of $50,000 to $100,000. The most recent POTW waste water discharge fees amounted to approximately $300,000 annually.

Additional subsurface investigation work was also conducted during this review period. BAE conducted a supplemental investigation in 2011 in order to further improve the conceptual site model (CSM) for the site, specifically the various clay and sand units that affect the site hydrogeology. The supplemental investigation consisted of 26 cone penetrometer testing (CPT) borings. CPT borings generate continuous stratigraphic profiles utilizing specialized sensors and tooling advanced at a fixed rate. Approximately 10 to 12 readings are collected per foot with sensors which are advanced at a constant rate of approximately two centimeters per second. The CPT tool measures the tip stress and the frictional resistance, or sleeve stress, generated as the tool is hydraulically advanced into the ground. The CPT tool also includes a sensor to record variations in pore water pressure that occur as the tool advances. The combination of tip stress, sleeve stress, and pore-pressure data are evaluated to interpret soil characteristics.

During the subsurface investigation an additional 13 direct push borings were completed in order to further interpret CPT results and collect samples from targeted intervals for site contaminants of concern (COCs). Results of the CPT and direct push investigation provided further information regarding geologic conditions. This additional information was utilized to refine the CSM from the previously described "confined aquifer" and "unconfined aquifer" classifications. The current CSM describes geologic units in greater detail. The updated geologic strata are interpreted by BAE in the following terms:

- Lower Alluvial Sand: Interpreted as glaciofluvial sand consisting of poorly sorted silty sand, the top of this sand unit occurs from approximately 45 to 70 feet below ground surface. This lower sand is considered laterally extensive.
- Lower Clay: Clay overlies the lower sand unit throughout the majority of the site. The lower clay is entirely absent within an approximately 500-foot-wide channel extending through the middle and northern part of the site.
- Middle Alluvial Sand: The middle alluvial sand in-fills the channel eroded in the lower clay and thus occurs where the lower clay is absent. The unit is approximately 15 to 35 feet thick and

consists of fine-grained sand and silt. Where present the middle alluvial sand directly overlies the lower sand unit.

- Middle Clay Unit: The middle clay is a discontinuous unit overlying the middle alluvial sand and lower clay. The unit is approximately 10 to 30 feet thick and consists of silty clay or clay.
- Upper Sand: The upper sand is interpreted to represent the regionally mapped alluvial terrace deposits, comprised of poorly sorted fine to coarse-grained sands, as much as 45 feet thick. The unit lies at a coincident depth with the middle clay, where present.
- Surficial Clay: The shallowest stratum is an approximately 5- to 25-foot-thick clay unit which is present throughout the site.

The presence of the middle alluvial sand unit differs from the previous CSM which interpreted the lower sand unit to be confined beneath the lower clay. The middle alluvial sand may provide a hydraulic communication pathway between the upper and lower sand units.

Based on the results of the subsurface investigation BAE utilized the revised CSM to evaluate the monitoring network and implemented changes to the network including: installation of new monitoring wells, adding existing wells to the sampling schedule, abandonment of redundant monitoring wells, and modifications to well screens which cross stratigraphic units.

Institutional Controls

Institutional controls are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential to exposure to contamination and that protect the integrity of the remedy. Governmental ICs have been implemented and are outlined in the 1987 ROD to restrict groundwater use, maintain the integrity of the remedy, and assure long-term protectiveness for areas which do not allow for UU/UE. A summary of the implemented and planned ICs for the site is provided in Table 3 and further discussed below.

A Minnesota Department of Health (MDH) Special Well and Boring Construction Area (SWBCA) was initiated by MPCA during this review period and is currently under final review by MDH staff. A SWBCA is an IC issued by MDH at the request of MPCA to establish restrictions to limit access and exposure to groundwater in a designated area. A SWBCA requires that new wells and borings advanced within the subject area be subject to engineering controls and/or MDH and MPCA review prior to installation to protect against exposure to impacted groundwater. The SWBCA is not required to ensure long-term protectiveness and is not detailed in the 1987 ROD, but will serve as an additional IC that will provide an additional layer of protectiveness when implemented.

Table 3: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed?	ICs Called for in the Decision Documents?	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater at and proximal to the site	Yes	Yes	State-Wide	Requires notification of proposed construction of a groundwater supply well to the MDH commissioner	Minnesota Department of Health – Minnesota Statute 1031.205
Groundwater at and proximal to the site	Yes	Yes	State-Wide	Requires notification of proposed well to the MDH commissioner	Minnesota Department of Health – Minnesota Statute 1031.205
Groundwater at and proximal to the site	Yes	Yes	State-Wide	Addresses construction of water supply wells near contamination sources	Minnesota Department of Health – Minnesota Rule 4725.2020
Groundwater at and proximal to the site	Yes	Yes	State-Wide	Requires all buildings to be connected to municipal water supply if one is available	Minnesota Plumbing Board, Minnesota Rule 4715.0310, Use of Public Sewer and Water Systems Required
Groundwater at and proximal to the site	Yes	Yes	City-Wide	Requires all potable well installations to adhere to MDH regulations in the event connection to the municipal supply is not feasible	Fridley City Code Chapter 402.13
Groundwater at and proximal to the site	Yes	Yes	Southwest Fridley	Restrict groundwater use and exposure within the vicinity of the site. Requires written proposal and approval by MDH for any well/boring.	SWBCA. Planned for implementation in 2014. (This IC not necessary for protectiveness but will add an additional layer of protectiveness.)
Soil outside the CTF	To Be Determined	No	Soil	Restriction of land use to industrial/commercial	Potential Deed Restriction (under evaluation) – 9/30/2019

While not specifically addressed by the ROD, additional site-specific ICs include those specific to the containment and treatment facility. The CTF is managed under a post-closure hazardous waste permit (reissued January 1, 2013) under the RCRA rules. The permit issued for the CTF stipulates requirements for operation, monitoring, and maintenance of the CTF and an *Affidavit Concerning a Hazardous Waste Containment/Treatment Facility*. This notice in the Deed and notice to the local land authority have been in place since November 9, 1983. These notices restrict land use under 40 CFR Section 264.117 and Minnesota State Statute (MSS) Section 115B.16 Subdivision 1 (MSS-115B), both of which generally

provide that "no person shall use any property on or which hazardous waste remains after closure of the disposal (containment) facility in any way that disturbs the integrity of the final cover, liners or any other components of any containment system." In accordance with MSS-115B, an affidavit was filed with the zoning authority of the City of Fridley, Minnesota, and with the Regional Administrator of EPA Region 5. An executed copy of the Affidavit is also filed with the Registrar of Titles of Anoka County, Minnesota, as a memorial under Certificate of Title Number 51489. These ICs will continue to be managed under the RCRA program and not under CERCLA. However, additional ICs may be needed for the soil outside the CTF. More information is needed to determine whether the soil removal actions were conducted such that the soil outside the CTF allows for UU/UE or whether an IC is needed to restrict the land use to industrial/commercial.

Current Compliance:
Based on site inspections, interviews, and annual monitoring reports, the site is in compliance with the existing ICs.

IC Follow-up Actions Needed:
The following measures must be taken in order to ensure protectiveness in the long term: evaluating the existing ICs and developing an Institutional Control Implementation and Assurance Plan that incorporates the results of the evaluation and plans for any additional IC activities needed, including a long-term stewardship plan.

Long-Term Stewardship:
Long-term protectiveness at the site requires compliance with use restrictions to ensure that the remedy continues to function as intended. Compliance with effective ICs will be ensured through maintenance, monitoring, and enforcement of effective ICs. To that end, long-term stewardship procedures will be reviewed and a plan developed as part of the ICIAP. The plan would include regular inspection of ICs at the site and annual certification to MPCA and EPA that the ICs effectively remain and are in place.

System Operation/Operation and Maintenance Activities

BAE conducted groundwater extraction system operation and maintenance (O&M) activities during this review period. O&M and groundwater monitoring activities are summarized in annual monitoring reports submitted to the MPCA and EPA. During this review period O&M activities included cleaning and maintaining pump operations and well redevelopment. The groundwater extraction system was monitored on a weekly basis and included a visual inspection of system components and an evaluation of system flow rates. Maintenance activities were performed if flow rates were observed to be between 60 percent and 75 percent of the maximum nominal flow rate for the individual pump. Maintenance activities included cleaning of pumps and piping systems to remove iron and calcium precipitates that periodically accumulate and impede water flow.

Groundwater monitoring activities included monthly groundwater elevation monitoring at select monitoring wells to monitor the influence of the pumping wells. Groundwater elevations are also collected quarterly from a larger set of monitoring wells. Groundwater samples are collected annually from select wells, following the groundwater monitoring schedule as approved by the MPCA.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

The PRP was notified of the initiation of the FYR on 12/26/2013. The FYR was led by Shanna Schmitt of the MPCA, Project Leader for the site. Sheila Desai, EPA Remedial Project Manager, assisted in the review as the representative for the support agency.

The review, which began on 12/9/2013, consisted of the following components:

- Community Notification and Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Interviews and Stakeholder Involvement; and
- FYR Report Development and Review.

Community Notification and Involvement

Activities to involve the community in the FYR process were initiated with a notice published in the local newspaper, the "Fridley - Columbia Heights Sun Focus," on 2/21/2014, stating that there was a FYR and inviting the public to submit any comments to the MPCA (see Appendix F for copy of notice and comments received). The results of the review and the report will be made available at the site information repository located at the MPCA St. Paul office, 520 Lafayette Avenue, St. Paul, Minnesota 55110.

Document Review

This FYR consisted of a review of relevant documents including O&M records and monitoring data. Applicable groundwater cleanup standards, as listed in the September 30, 1987 ROD, the October 28, 1986 Response Order by Consent, the 1986 Minnesota Enforcement Decision Document, and the September 13, 2013 ESD, were also reviewed.

Data Review

Data reviewed as part of this FYR include data submitted to MPCA and EPA by BAE systems, including Annual Monitoring Reports (AMR) submitted for the last five years. Supplemental Investigation reports and periodic pilot test reports were also reviewed during this FYR.

Groundwater Monitoring

Groundwater monitoring data collected during the review period indicates that groundwater elevations at the site generally increased in both the upper and lower alluvium. Some of this noted water elevation increase in the upper alluvium in the more recent monitoring events may be attributed to suspended operation of extraction well RW-2 during the ERD pilot study. Groundwater elevation data presented in AMRs submitted during this review period indicate that groundwater flow in the lower alluvium is to the west, toward the Mississippi River. The 2012 AMR presents a groundwater contour map of the lower alluvium, and this map is included as Figure 6-4 in Appendix B.

Groundwater monitoring was conducted annually, following the approved groundwater monitoring schedule. A total of 32 lower alluvium wells were included on the annual sampling schedule in 2012. Of the lower alluvium wells sampled during this review period, concentrations of TCE were detected above the MCL at 23 wells during at least one sampling event. Table 6-10 in Appendix C summarizes groundwater analytical results from the 2012 AMR. Lower alluvium monitoring wells with detections which exceeded the MCL during this review period include: FMC-13, FMC-14, FMC-15, FMC-21B, FMC-28, FMC-29A, FMC-30, FMC-35A, FMC-45, FMC-53, FMC-54, FMC-54A, FMC-57B, FMC-64, FMC-70, FMC-71, FMC-76, FMC-77, FMC-78, FMC-79, MW-1, MW-3 and MW-4. The TCE concentrations detected at all other lower alluvium wells were either below laboratory reporting limits or below the MCL.

Groundwater contaminant concentrations, primarily TCE, have been evaluated by BAE utilizing Mann-Kendall statistical trend analysis. Mann-Kendall analysis is a non-parametric test to evaluate groundwater monitoring data for increasing, decreasing or stable trends. Trend analysis presented in the 2012 AMR indicates that eight of the 14 lower alluvium monitoring wells evaluated indicated decreasing trends since 2004. Four of the lower alluvium wells indicated stable trends and one lower alluvium well (MW-1) indicated a potentially increasing trend. Concentrations of TCE at MW-1, however, have been below laboratory detection limits or the MCL during seven of eight sampling events during this review period.

Groundwater elevation data presented in AMRs submitted during this review period indicate that groundwater flow in the upper alluvium is to the northwest, toward the Mississippi River. The 2012 AMR presents a groundwater contour map of the upper alluvium, and this map is included as Figure 6-2 in Appendix B.

A total of 13 upper alluvium monitoring wells were included on the annual sampling schedule in 2012. Of the upper alluvium wells sampled during this review period, concentrations of TCE were detected above the MCL at 11 monitoring wells. In general TCE concentrations detected in the upper alluvium were higher than those detected in the lower alluvium. Monitoring wells where TCE concentrations exceeded the Health Risk Limit (HRL) include: FMC-20, FMC-21A, FMC-36, FMC-46, FMC-47, FMC-48, FMC-50, FMC-51, FMC-52, FMC-72 and FMC-74. The TCE concentrations detected at all other upper alluvium wells were either below laboratory reporting limits or below the MCL.

Four monitoring wells, FMC-21A, FMC-36, FMC-48 and FMC-52, were evaluated utilizing Mann-Kendall statistical trend analysis. Of these wells two indicated there was no trend, one well (FMC-21A) indicated a stable trend and FMC-48 indicated an increasing trend since 2004. Closer evaluation of the data collected over this review period at FMC-48 indicates that TCE concentrations appear to have been relatively stable since 2008.

Groundwater Extraction and Treatment

The groundwater extraction and treatment system functioned to remove approximately 228 million gallons as reported by the four AMRs submitted during this review period (2009 through 2012). Approximately 687 pounds of TCE and 946.4 pounds of total VOCs were removed during the same period. Table 6-9 in Appendix C lists the totals per quarter of TCE mass removal. Statistics from the 2013 AMR were not available at the time of this FYR.

A capture zone analysis (CZA) was also completed and included in each AMR reviewed as part of this FYR, as recommended by the 2009 FYR. Extraction well capture was evaluated in each CZA to determine whether extraction wells were functioning adequately to capture VOC-impacted groundwater. Each CZA evaluation utilized groundwater elevation data collected during annual groundwater monitoring to calculate the approximate groundwater capture envelope. The capture zone evaluation indicated that the interpreted horizontal capture zone, compared to the targeted capture area, for both the upper and lower alluvium decreased over this review period. The estimated capture for the upper alluvium decreased from 60-70 percent of the targeted area in 2009 to 44 percent in 2012, while the estimated capture for the lower alluvium wells decreased from 60-65 percent of the targeted area in 2009 to 40 percent in 2012. Although the estimated percent of the targeted capture area decreased, the volume of water extracted was similar (i.e., no significant decrease) at each well throughout this review period.

BAE performed step-drawdown pumping tests on the lower alluvium extraction wells in 2012 in order to evaluate baseline performance parameters (specific capacity and well efficiencies). This testing and evaluation was performed in order to evaluate future performance of the extraction wells and to determine potential maximum sustainable yields. Step-drawdown tests are performed by pumping a well at several successively higher pumping rates (steps). During each step the well discharge rate is maintained until the water level in the extraction well reaches stabilization. Time and drawdown for each step is recorded. Each lower alluvium extraction well at the FMC site was pumped at a minimum three step rates, except RW-3, where four step rates were performed. Evaluation of the step-drawdown tests identified potential improvements to pumping, including optimizing pumping rates and upgrading the pumps. At the time of this FYR, pump rate optimization was ongoing, including increasing pumping rates at all three wells to approximately 60 gallons per minute, and additional system improvements were in progress. Planned system improvements include replacing an aging force main to improve flow capacity from RW-3 to the treatment system.

Enhanced Reductive Dechlorination

In September 2012, BAE initiated a pilot test to evaluate ERD as a potential remedial technology for treating dissolved-phase chlorinated VOCs at the site. ERD is a method of in-situ remediation that modifies the biogeochemical environment of the subsurface to create conditions suitable for biological degradation of chlorinated VOCs. Pilot tests are utilized to evaluate the feasibility of a full-scale remedy based on results of a smaller study area. The ERD pilot test included installation of additional monitoring and injection wells. A total of 78,390 gallons of two-percent molasses solution was injected at two injection wells over three injection events. As the molasses solution disperses through the subsurface it provides additional nutrients which encourage microbial activity. Increased microbial activity changes the biogeochemical environment to conditions which are favorable to anaerobic (oxygen deficient) degradation of chlorinated VOCs. Additionally, tracers were injected during events one (fluorescein) and three (rhodamine) to evaluate the radius of influence of the injected solution. ERD requires modification of biogeochemical conditions, and it can take a period of time for modifications to achieve favorable conditions. Due to ongoing evaluation of subsurface conditions, final evaluation of the ERD pilot test was not yet complete at the time of this FYR. Preliminary evaluation indicates that after three injection events the subsurface biogeochemical conditions appear to be favorable for biological degradation. Bioaugmentation is being evaluated for the fourth injection event as a method of enhancing the subsurface microbial population of dechlorinating bacteria in order to increase the rate of dechlorination.

Vapor Intrusion

In January and May of 2014, Minneapolis Water Works conducted a limited vapor intrusion investigation at three of its buildings. The MWW is located above and downgradient of the site's groundwater plume. The vapor intrusion investigation, which was not conducted pursuant to an EPA- or MPCA-approved sampling plan, included sub-slab soil vapor monitoring points and some indoor air sampling points. Although the data had not yet been finalized at the time of this FYR, the preliminary data showed one sample point having sub-slab concentrations (542 micrograms per cubic meter [ug/m^3]) much greater than the screening levels for sub-slab TCE concentrations; however, the indoor air concentration was much lower (8.8 ug/m^3). The indoor air concentration at that sample location is above the MPCA screening level of 6.0 ug/m^3 for indoor air and corresponds with a human health risk just at the EPA risk threshold. In this initial data, there was only one location with corresponding sub-slab and indoor air data. Although the sampling effort was not conducted pursuant to an approved sampling plan, the initial data indicate that there could be a potential vapor intrusion pathway. More data is needed to fully evaluate the vapor intrusion pathway and source of potential impacts.

Site Inspection

The inspection of the site was conducted on 1/16/2014. In attendance were Shanna Schmitt of the MPCA, Sheila Desai and Patricia Krause of the EPA, Tim Ruda from BAE, Denice Nelson and Bryan Zinda from Arcadis (BAE contractor), and Jacob Knapp and Paul Lucas from Antea Group (MPCA contractor). The purpose of the inspection was to assess the protectiveness of the remedy and the current condition of the site.

Monitoring wells, extraction wells and the new treatment system building were inspected. No issues affecting the operation of the selected remedy were observed. The Site Inspection Checklist is included as Appendix D. Photographs from the site inspection are included as Appendix E.

Interviews and Stakeholder Involvement

Interviews were conducted with BAE during the site inspection. The purpose of the interviews was to document any perceived problems or successes with the remedy that has been implemented to date. Interviews were conducted on 1/16/2014 and are listed in the Site Inspection Checklist in Appendix D.

Continuous communication between the MPCA and other stakeholders has been ongoing during this review period. Stakeholders include the City of Fridley, MWW, MDH, and a Community Advisory Group which formed during this review period. Since these stakeholders are involved with site updates and provide feedback to the MPCA on a regular basis, FYR interviews were not conducted.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

Many components of the remedy are functioning as intended by the decision documents. The groundwater extraction and treatment system is functioning to meet the remedial action objectives described in the ROD in that it is reducing general off-site migration of groundwater containing elevated contaminant levels. Although groundwater remedial objectives (MCLs or Health-Based Values [HBVs])

have not yet been achieved at the site compliance boundary (the property boundary), the groundwater extraction system continues to remove and treat VOC-impacted groundwater.

Capture zone analysis performed during this review period indicates that the groundwater extraction system was capturing an estimated nearly 40 to 60 percent of the targeted plume area. The groundwater extraction wells are positioned to capture the areas of greatest impacts as specified in the ROD. These areas include the upper alluvium on the Burlington Northern Santa Fe (BNSF; formerly BNR) property (RW-2) and the lower alluvium at the extreme southern BAE property (RW-3). Operation of these extraction wells is a remedial action requirement of the ROD. At the time of this FYR, additional modifications to the system, including new pumps and piping, were being installed in order to increase the effective capture zone of the extraction and treatment system and optimize the remedy.

At the time of this FYR, groundwater extraction from RW-3, RW-4 and RW-5 is ongoing. Groundwater extraction from RW-2 has been temporarily discontinued in order to evaluate the ERD pilot study in the vicinity of FMC-36, which is located within the estimated capture zone of RW-2, to assure pilot study results are representative, and to prevent damage to RW-2 or associated system components.

While the system is continuing to function to remove impacted groundwater and reduce general off-site migration of elevated contaminant levels, downgradient concentrations remain elevated. In addition, two seeps are present on the Mississippi River bank on MWW property. The location of the seeps (known as the east seep and the west seep) is depicted in Figure 1-2 in Appendix B. Contaminant concentrations detected at the seeps (see Table 6-11 in Appendix C) have exceeded the applicable surface water criteria[1] during this review period. The Mississippi River in the vicinity of the site is classified as Class 2Bd and is utilized as a drinking water source for approximately 500,000 people. Potential exposure to humans and actual exposure to terrestrial and aquatic plants and animals may exist at the seeps. Since 2009, concentrations of TCE and tetrachloroethene (PCE) were detected at the east seep ranging from 147 micrograms per liter (ug/L) to 17.3 ug/L and from 89.2 ug/L to 1.8 ug/L, respectively. During that same period, concentrations detected at the west seep were below the Class 2Bd TCE standard of 25 ug/L, and generally were below the PCE standard of 3.8 ug/L, with one detection at 4.1 ug/L. Access controls have not been implemented in the vicinity of the seeps and recent reconstruction in the vicinity of the seeps has increased accessibility to the seep area. Access to the seeps during periods of low flow is possible and humans, plants and animals could potentially be exposed to VOC contaminants exceeding MCL or health-based cleanup levels. TCE-impacted water exceeding the MCL and health-based cleanup values is discharged to the Mississippi River at all flow stages.

ICs at the site are functioning as anticipated by the ROD. The ICs in place and planned for the site were presented earlier, in Table 3 within Section II of this FYR.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

No, exposure assumptions, toxicity data and cleanup levels have changed since the time of remedy selection. The MDH has implemented a new HBV for TCE found in private drinking water supplies.

The ROD for the site identified potential public and/or private supply wells installed between the site and the Mississippi River as potential exposure pathways. While no wells have been installed between the site and the river, drinking water criteria applicable to private supply wells have been revised since

[1] Note that surface water criteria were not identified as ARARs in the ROD; only MCLs were identified as ARARs.

the time of remedy selection. Standards and criteria which are "to be considered (TBC)" identified in the ROD include SDWA MCLs and other federal and state promulgated standards. The MDH issues Health Risk Limits (HRLs) which are standards promulgated into law. The MCLs are applicable to public drinking water supplies as measured at the tap. The MDH HRLs are drinking water standards issued by the MDH and applied as groundwater cleanup goals enforceable by MPCA. The promulgated HRL is equivalent to the MCL, however, the MDH has issued an HBV for TCE based on new toxicity data developed by EPA. The HBV for TCE is 0.4 ug/L. While the HBV is not yet promulgated as an HRL, the MDH is expected to incorporate the HBV as a revised HRL during the next revision period. At the time of this FYR, the HBV is a TBC which would be applicable in the event that a private supply well would be installed between the site and the Mississippi River.

Exposure assumptions anticipated by the ROD indicated that the primary exposure concern was ingestion either from directly ingesting groundwater or by ingesting river water that had been impacted by groundwater discharge to the river. Direct ingestion of groundwater was expected through potential installation of drinking water wells between the site and the Mississippi River. Ingestion of impacted river water was considered due to the MWW drinking water intake located approximately one-half mile downstream of the site. Two groundwater seeps have been identified downgradient of the site on MWW property. During high water periods the groundwater seeps are below the river level; however, the seeps are exposed during lower water periods. Previously, access to the seeps was considered difficult due to the steep riverbank. Changes to the river bank during this review period have occurred which allow for greater access to the seeps. In September 2009, the hillside surrounding a 96-inch stormwater drain located just to the north of the seeps collapsed. The hillside and drain were reconstructed in the fall of 2009. Reconstruction of the hillside has resulted in a more gradual slope to the river and thus easier access to the seep area. The seeps present potential exposure points which were not considered by the ROD. While ingestion of water discharging from the seeps is the most likely route of human exposure, assessment of risk associated with discharge at the seeps to the environment has not yet been completed. Standards applicable to the seeps are surface water standards as promulgated under Minnesota Rule 7050.[2] The Mississippi River is classified as a Class 2Bd river adjacent to the site which classifies the river for all commercial, recreational and drinking water purposes. The established chronic standard for TCE and PCE for Class 2Bd waters is 25 ug/L and 3.8 ug/L, respectively.

The vapor intrusion pathway was also not considered at the time of remedy selection. A full evaluation of the vapor intrusion pathway has not yet been completed at or downgradient of the site. A preliminary investigation of vapor intrusion at the MWW property has been conducted by the MWW and has showed a potential for vapor intrusion. At the time of this FYR, finalized investigation results were not available for review, but the preliminary data, along with the fact that the investigation was not conducted pursuant to an approved sampling plan, indicate that more data are necessary to fully evaluate the vapor intrusion pathway. The MPCA, MWW and BAE anticipate further discussion of vapor intrusion results upon receipt of a finalized report from the MWW. Potential vapor intrusion at the site property and the Anoka County Park are not anticipated due to the absence of potential receptors in those locations.

[2] As noted earlier, surface water criteria were not identified as ARARs in the ROD; only MCLs were identified as ARARs.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes, information that has come to light since the selection of the remedy that may affect the protectiveness of the remedy including property redevelopment, increased groundwater use in the vicinity of the site, and reconstruction of the riverbank.

The Naval Industrial Reserve Ordnance Plant (NIROP) Superfund site and BAE RCRA facility, both located immediately north of the FMC site, are currently being redeveloped for commercial and light industrial purposes. The current redevelopment plan is to be executed in phases which will begin on the southern half of the property, immediately north of and adjacent to the FMC site. The Navy (the PRP at NIROP), EPA, and MPCA have been involved with the redevelopment of the property in order to assure that the redevelopment is conducted in a manner protective of human health and the environment. No redevelopment of the FMC site is anticipated at the time of this FYR, however, given the proximity of the site to the redevelopment, potential vapor intrusion exposure pathways may need to be evaluated along the north property boundary of the FMC site. Institutional controls which are in place or in progress are anticipated to provide protectiveness for groundwater and soil exposure risks.

The City of Fridley (the City) has indicated their intent to increase use of Fridley Municipal Well 13 located approximately one-half mile from the site. Historically this well has been utilized to supply water during emergency or high water-demand periods. The City provided formal notification to the MPCA of their intent to evaluate bringing Well 13 into regular use in a letter dated October 13, 2012. The letter also acknowledged the MPCA and MDH requirement for notification when the well is put into operation. The City, in consultation with the MDH, is in the process of developing a pumping test to evaluate potential effects that operation of this well would have on groundwater at contaminated sites in the southwest Fridley area, including the FMC site. Although influence at the FMC site is expected to be minimal, additional information is necessary to evaluate whether long-term use of Fridley 13 will affect groundwater at the FMC site.

During this review period, the riverbank collapse and reconstruction work described above has allowed for increased accessibility to the seep area. Although there is no evidence that exposure to water discharged from the seeps has occurred, due to the reconstruction of the riverbank there is a greater potential that such exposure could occur.

Technical Assessment Summary

Based on annual monitoring reports, the remedy is functioning as intended by the decision documents. The vapor intrusion pathway at MWW will be further evaluated and considered when evaluating protectiveness of the remedy. The ongoing ERD pilot study and monitoring of the river seeps will be evaluated as data is submitted. The exposure assumptions, toxicity data, and cleanup levels have changed since the remedy was selected. Evidence of actual human and/or ecological exposure is not present at this time, but additional monitoring, sampling, and/or assessment is planned for the groundwater, soil vapor, and river. Since the 2009 FYR, the adjacent NIROP and BAE sites have begun to be redeveloped for commercial and light industrial purposes. The redevelopment at these properties is not anticipated to affect the protectiveness of the remedy, and future monitoring reports for the site and adjacent property will be reviewed to verify the protectiveness of the remedy. The City of Fridley may increase their usage of Fridley Municipal Well 13 and a pump test is planned for the autumn of 2014. The pump test may provide information regarding any hydraulic connection from the site groundwater

to Well 13. Inspection and sampling, when water is present, of the seeps along the river will continue and the data will be considered when evaluating the protectiveness of the remedy.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 4: Issues and Recommendations/Follow-up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
ERD pilot study to evaluate ERD as a potential alternative remedy is ongoing.	Complete ERD pilot study evaluation and assess restart of groundwater extraction well RW-2.	PRP	MPCA/ EPA	6/30/2015	No	Yes
Capture zone analysis indicates a limited percentage of the target groundwater capture zone is being captured.	Complete a capture zone analysis following installation of upgraded equipment.	PRP	MPCA/ EPA	6/30/2015	No	Yes
An unrestricted exposure pathway exists in the area of the two seeps.	Evaluate potential access restrictions or signage for the seep area to restrict access by the public.	PRP	MPCA/ EPA	10/1/2015	No	Yes
Contaminant concentrations which exceed surface water standards are being discharged to the Mississippi River at the seeps.	Further evaluate remedial options, including system enhancement and ERD. Ecological effects resulting from the discharge of VOC-impacted groundwater at the seeps should also be evaluated.	PRP	MPCA/ EPA	6/30/2016	No	Yes
A full evaluation of potential vapor intrusion has not been completed.	Evaluate potential vapor intrusion pathways which could be affected by site contaminants.	PRP	MPCA/ EPA	9/30/2015	No	Yes
Need to evaluate existing ICs, and need to develop and implement long-term stewardship procedures.	Develop an ICIAP to evaluate the effectiveness of the existing ICs, the need for any additional ICs, and to ensure that long-term stewardship procedures are developed and implemented.	PRP/MPCA	MPCA/ EPA	9/30/2015	No	Yes

VI. PROTECTIVENESS STATEMENTS

Protectiveness Statement(s)		
Operable Unit: OU1 - Sitewide	*Protectiveness Determination:* Protectiveness Deferred	*Addendum Due Date (if applicable):* 9/30/2015
Protectiveness Statement: At this time, a protectiveness determination of the selected remedy at the FMC Corporation Superfund site cannot be made until further information is obtained. Vapor intrusion sampling was conducted at the Minneapolis Water Works and initial data shows that there may be a potential pathway for vapor intrusion. Further information will be obtained to determine whether the vapor intrusion pathway is complete and whether vapor intrusion poses an unacceptable risk. It is expected that these actions will take approximately twelve months to complete at which time a protectiveness determination will be made.		

Protectiveness Statement(s)	
Operable Unit: Soil	*Protectiveness Determination:* Protective
Protectiveness Statement: Soil removal actions were conducted prior to implementation of the ROD and decision documents for the site. EPA and MPCA have found the soil removal actions to be protective of human health and the environment. It is currently unclear whether the soil removal actions cleaned up site soil to levels that allow for unlimited use and unrestricted exposure. ICs may be needed to assure that soil remains protective in the long term.	

VII. NEXT REVIEW

The next FYR report for the FMC Corporation Superfund site is required five years from the completion date of this review.

APPENDIX A

EXISTING SITE INFORMATION

A. SITE CHRONOLOGY

Table 1: Site Chronology

Event	Date
Former FMC employee informed the Minnesota Pollution Control Agency (MPCA) of the disposal of industrial and hazardous waste from the 1940s through 1969 on the FMC site	November 1980
FMC, at the request of the MPCA, initiated an investigation of the FMC site	December 1980
Administrative Order and Interim Response Order by Consent (Consent Order)	June 8, 1983
FMC site placed on the National Priorities List (NPL)	September 8, 1983
MPCA executed an FMC site Enforcement Decision Document under the Minnesota Environmental Liability and Response Act (MERLA) that documented the MPCA's Selection of a Remedial Action (RA) for the contaminated groundwater at the site	October 16, 1986
FMC and the MPCA signed a Response Order by Consent under MERLA for the implementation of the RA	October 28, 1986
FMC site Record of Decision (ROD) is signed, which documented EPA's selection of the RA for the contaminated groundwater at the site	September 30, 1987
Initiation of groundwater extraction from the extraction wells on the FMC site	December 7, 1987
Completion of the First Five-Year Review (FYR) Report	September 30, 1992
Completion of the Second FYR Report	March 30, 1999
Extraction Well Capture Zone Analysis	June 2003 and June 2004
Completion of the Third FYR Report	March 17, 2004
Quality Assurance Project Plan for the site is updated	March 2004
Vertical Aquifer Profiling was conducted at the site to further understand site geologic conditions	August, 2004 and October 2005
Monitoring Well Network modified, eliminating long screened wells.	October 2005
Seep assessment and dye tracer study performed	August 2007
Completion of the Fourth FYR Report	September 30, 2009
Supplemental Investigation Report	May 2012
Initiation of the enhanced reductive dechlorination (ERD) Pilot Study	September 2012
On-site treatment of groundwater by air stripping begins	May 2013
Explanation of Significant Differences (ESD) issued	September 2013

B. BACKGROUND

Physical Characteristics

The FMC Corporation Superfund site is located on East River Road within the City of Fridley in Anoka County, Minnesota (see Figure 1-1 in Appendix B). The FMC site consists of 18 acres, including 5 acres purchased from FMC by Burlington Northern Railroad (BNR, now known as Burlington Northern Santa Fe [BNSF] Railroad) in 1969 and 13 acres currently operated by BAE Systems Land and Armaments L. P. (BAE). BAE was formerly known as United Defense L.P. (UDLP) and prior to that as FMC. Figure 1-2 in Appendix B identifies site boundaries as well as BAE and BNR property boundaries. The site is located approximately 1,000 feet east of the Mississippi River, approximately 30 feet above the river. Groundwater flow at the site is generally to the west and southwest toward the river.

Land and Resource Use

The BNR portion of the site currently consists of open space, a stormwater retention pond and an above-ground storage tank. The BAE portion of the site consists of open space and a containment and treatment facility (CTF) constructed to contain contaminated soil excavated from the site. The CTF is managed under a hazardous waste permit and is discussed further in the "Initial Response" section further below.

Land adjacent to the site consists of the Naval Industrial Reserve Ordnance Plant (NIROP) Superfund site to the north; industrial land use to the south; recreational land to the west; the Minneapolis Water Works (MWW) property to the southwest; and commercial/light industrial land to the east. Residential properties are located to the east of the adjacent commercial/light industrial properties and to the west across the Mississippi River. Fridley production well 13 is located adjacent to the north property boundary of the NIROP site.

Currently all of the properties on or immediately adjacent to the site are connected to municipal water. At the time of this FYR there are no known land use changes affecting the protectiveness of the selected remedy for the site.

History of Contamination

The FMC site and the adjacent NIROP site to the north have historically been utilized to manufacture advanced naval weapons systems. The northern portion of the facility was originally owned by the U.S. Navy, while the southern portion was owned by FMC. The NIROP and FMC sites were operated by FMC and later by FMC's successors UDLP and BAE. The separate property ownership necessitated the formation of the two (FMC and NIROP) Superfund sites in the 1980s and 1990s.

Disposal of waste generated by the naval ordinance manufacturing facility occurred on portions of the FMC site between the 1940s and 1969. Wastes disposed on the FMC site included plating wastes, paint, paint sludges, oils, bottom ash, and chlorinated and non-chlorinated solvents.

In 1980, MPCA staff received information regarding the past disposal practices at the site and requested that FMC initiate an investigation to determine the extent of contamination. The investigation revealed that soil in the disposal areas was contaminated with volatile organic compounds (VOCs). During the

investigation, 44 drums containing hazardous materials were discovered and disposed offsite at Resource Conservation and Recovery Act (RCRA)-approved facilities. Groundwater at the site was found to be contaminated by chlorinated and non-chlorinated VOCs. Most significantly, trichloroethene (TCE) was identified as composing approximately 98 percent of the VOC contamination. The groundwater plume associated with the site enters the river upstream of the MWW raw water intake. Additional investigation of the surface water in the Mississippi River has identified low-level TCE concentrations at the MWW intake. The MWW provides potable water to approximately 500,000 people within the Minneapolis area.

Initial Response

Soil

In June 1983, a Consent Order regarding impacted soil at the site was executed by FMC, MPCA, and EPA. Soil identified as having a total VOC concentration of one part per million (ppm) or greater was excavated if above the groundwater table. The contaminated soil was placed into an on-site engineered CTF. The CTF was constructed in compliance with RCRA requirements for an in-ground storage facility in May and June of 1983. The CTF is managed under a RCRA permit (reissued January 1, 2013). The CTF is double-lined and provides for leak detection and leachate collection. The CTF also includes a gas extraction system that was connected to a carbon filter system until November 2001. In 2001, the carbon filter system was bypassed due to low concentrations of VOC being removed. Groundwater monitoring associated with the CTF is addressed in the operations permit for the CTF and reported in the FMC site annual monitoring reports (AMRs). More information is needed to determine whether the soil removal actions allow for unlimited use and unrestricted exposure (UU/UE) outside the CTF or whether ICs are needed to restrict the land use to industrial/commercial.

Groundwater

In October 1984, a Remedial Investigation (RI) report entitled, *Summary of Analytical Data,* was submitted by FMC pursuant to the Consent Order. FMC submitted a proposed Feasibility Study (FS) in January 1985. The FS was determined to be incomplete by the MPCA. An addendum to the proposed groundwater FS was submitted to the MPCA in May 1985. The MPCA accepted the FS as complete in August 1985.

The RI identified an unconfined aquifer separated from a confined alluvial aquifer by a clay layer at the site. VOC concentrations were detected at the site in both the confined and unconfined aquifers. Groundwater monitoring was initiated at that time and continues at the site as part of the selected remedial action described in the ROD. Recent investigations have refined the site conceptual model, as described in Section II of the main body of this FYR.

Basis for Taking Action

Previous waste disposal practices have been identified as the cause of soil and groundwater contamination at the site and the basis for taking action at the site.

Soil

The 1984 RI report submitted by FMC identifies the location and extent of soil contamination found at the site prior to removal and containment of contaminated soils in 1983. VOCs, most commonly TCE, and metals were detected in soil samples collected at the site. Soil contamination was addressed through the construction and completion of the CTF to contain and treat contaminated soil. Impacted soil was excavated to the water table and placed into the engineered, double-lined CTF cell located on the east central portion of the site. The removal action was undertaken to comply with the 1983 Consent Order. The soil removal and containment successfully controlled risk to human health and the environment associated with soil contamination at the site. However, more information is needed to determine whether the soil removal in areas outside the CTF allows for UU/UE.

Groundwater

Contaminants of concern (COCs) in groundwater as stated in the ROD are: TCE, tetrachloroethene (PCE), benzene, toluene, xylene and other VOCs. TCE accounts for the majority of VOC mass in the site's groundwater. Groundwater is the only operable unit (OU1) addressed by the ROD. Groundwater at the site generally flows to the west or southwest toward the Mississippi River. This section of river is classified for use as a domestic water supply (Class 1C) and as unlimited use recreational water to be protected as a drinking water supply (Class 2Bd) and for use as industrial consumption (Class 3C) by Minnesota Rule 7050. VOC-contaminated groundwater enters the river immediately upstream of the MWW supply intake. The MWW is a municipal water supply for approximately 500,000 people within the Minneapolis area. Contaminated groundwater at the FMC site migrating to the Mississippi River could potentially increase risk to human health and the environment due to current use, potential use, and exposure to the COCs entering the river. Ecological effects resulting from the discharge of VOC-impacted groundwater at two seeps on the riverbank are also possible.

C. REMEDIAL ACTIONS

Remedy Selection

The ROD for the FMC site, dated September 30, 1987, addresses groundwater as the only operable unit for the site. The remedial action objective in the ROD was to minimize ingestion of contaminated groundwater and river water contaminated by groundwater discharges to the river. The selected remedy described in the ROD includes three parts:

- Hydraulic capture through groundwater extraction and discharge to the sanitary sewer system;
- Monitoring to assure the effectiveness of the remedy and to define termination of the extraction system; and
- Reliance on existing institutional controls to mitigate against usage of contaminated groundwater between the FMC and BNR lands and the Mississippi River by private or municipal wells.

The ROD utilizes the TCE maximum contamination level (MCL) (5 micrograms per liter [ug/l]) or health-based cleanup levels for TCE as performance criteria at the downgradient site boundary to determine system effectiveness. The site monitoring program is described in the ROD and further

detailed in the quality assurance project plan (QAPP) approved in March 2004 by MPCA. The QAPP identifies site monitoring frequency, procedure, analysis and locations.

Extracted groundwater originally had been discharged to the sanitary sewer system for off-site treatment by the publicly-owned treatment works, but is now being treated by an on-site air stripper. Treated water is now discharged to the Mississippi River under a NPDES permit. These change to the selected remedy were detailed in an ESD dated September 13, 2013. The ESD also addressed the discontinued operation of RW-1.

Groundwater Extraction System

The remedy selected by the ROD utilizes groundwater extraction for the purpose of source reduction and plume containment. The groundwater extraction system components and system design are discussed in the *Response Action Plan* (RAP), dated October 28, 1986, and agreed upon by FMC and the MPCA. The RAP specifically describes the groundwater treatment system and performance monitoring to determine hydraulic containment at the site.

Performance goals of the groundwater extraction system are identified on page 20 of the ROD; *"The groundwater pump-out is designed to reduce contamination source areas and to reduce general offsite migration of elevated contaminant levels."* Page 21 of the ROD states "the proposed remedy addresses long term concerns." Page 21 also states that, *"The selected alternative will ensure that MCLs or health-based cleanup levels are met at the site boundary,"* and that "*Upon implementation the pump-out system will prevent migration of highly contaminated groundwater from the FMC and BNR lands property boundary."*

Groundwater Monitoring

The ROD also identifies groundwater monitoring as a part of the selected remedy for the site. The monitoring plan described in the ROD consists of four parts; 1) extracted groundwater monitoring, 2) hydraulic containment monitoring, 3) aquifer monitoring, and 4) receptor monitoring. The QAPP further defines the monitoring plan for the site. Each part of the monitoring plan has specific requirements intended to meet remedial action objectives described in the ROD. The monitoring plan described in the QAPP is summarized below.

Part 1: Extracted Groundwater Monitoring.

- Monitor the extracted groundwater for VOC concentrations.
- Monitor the flow rate for each extraction well.
- Sample RW-2 and RW-3 quarterly for VOC concentrations.
- Sample RW-4 and RW-5 semi-annually for VOC concentrations.
- Monitor extracted groundwater for the duration of system operation.

The groundwater extraction and containment remedy currently utilizes four groundwater extraction wells that discharge to the Mississippi River via the storm sewer. Extracted groundwater monitoring is performed to determine flow rate and contaminant concentration.

Part 2: Hydraulic Containment Monitoring

- Collect groundwater elevation data quarterly from monitoring wells in the confined and unconfined aquifers.

Groundwater elevations are measured quarterly to monitor the capture zones of the groundwater extraction wells. The remedial performance objective of hydraulic containment monitoring is to evaluate the effect the groundwater extraction system has on the unconfined and confined aquifers.

Part 3: Aquifer Monitoring

- Sample 20 monitoring wells in the confined (lower alluvium) and unconfined (upper alluvium) aquifers annually for VOC concentrations.
- Wells are selected for sampling prior to each sampling event.
- Annual monitoring reports are submitted.
- The confined (lower alluvium) and unconfined (upper alluvium) aquifers are to be monitored for at least five years after extraction system shut down.

The unconfined and confined aquifers are monitored to evaluate the groundwater plume on- and off-site. Aquifer monitoring objectives are: obtain groundwater level measurements to evaluate capture zones of the extraction wells, collect samples for laboratory analysis to determine the extent and magnitude of contaminant migration and collect field data for natural attenuation indicators.

Part 4: Receptor Monitoring

- Monitor existing and potential receptors annually.
- MWW raw water intake is monitored.
- FMC-21A and FMC-21B are monitored.
- FMC-21 and FMC-39 were identified as receptor monitoring points in the QAPP but have since been abandoned and replaced by FMC-21A and FMC-21B.

Receptor monitoring is conducted to evaluate risk to human health and the environment. Receptor monitoring is intended to provide data to evaluate risk to downgradient receptors.

Remedy Implementation

Remedial actions to address groundwater contamination at the site were implemented as outlined in the 1986 RAP and 1987 ROD. The decision documents identify the selected remedy as a groundwater extraction system to reduce the migration of groundwater contamination in the unconfined and confined aquifers at and downgradient of the FMC site boundary. The implemented remedy also utilizes a monitoring plan to monitor performance criteria established in the ROD to identify remedial progress at the site. Institutional controls are in place to control groundwater use at and adjacent to the site.

Groundwater Extraction System

Design plans for the groundwater extraction system are described in the RAP which was included as Exhibit A to the 1986 Response Order by Consent between the MPCA and FMC. In 1987, EPA adopted this selected remedy as described in the ROD. The groundwater extraction system consisted of five – and now consists of four – extraction wells positioned to limit off-site migration of contaminated groundwater. Extracted groundwater flow can be monitored for each individual well prior to passing through a spray nozzle. Once extracted groundwater passes through the spray nozzle it is combined with the effluent from the other extraction wells and directed through the air stripper or discharged to the sanitary sewer in the event that the air stripper is not operational.

Construction of the groundwater extraction system was completed on December 7, 1987. RW-1 was found to continually run dry and has not operated since December 15, 1987. The discontinuation of RW-

1 was officially documented in the ESD dated September 13, 2013. The groundwater extraction system construction is complete and its operation is ongoing.

Extraction wells RW-1 and RW-2 are completed in the upper alluvium aquifer in the BNSFR portion of the site. RW-2 is has not operated since September of 2012 due to an ERD pilot test being conducted in the vicinity of monitoring well FMC-36.

Extraction wells RW-3, RW-4 and RW-5 are completed in the lower alluvium aquifer on the BAE portion of the site. Assessment of the extraction system capture zone performed in March 2002 identified possible benefits to increased pumping rates at RW-3 and RW-4. In October 2002 the performance of extraction wells RW-3 and RW-4 was enhanced by installing larger pumps.

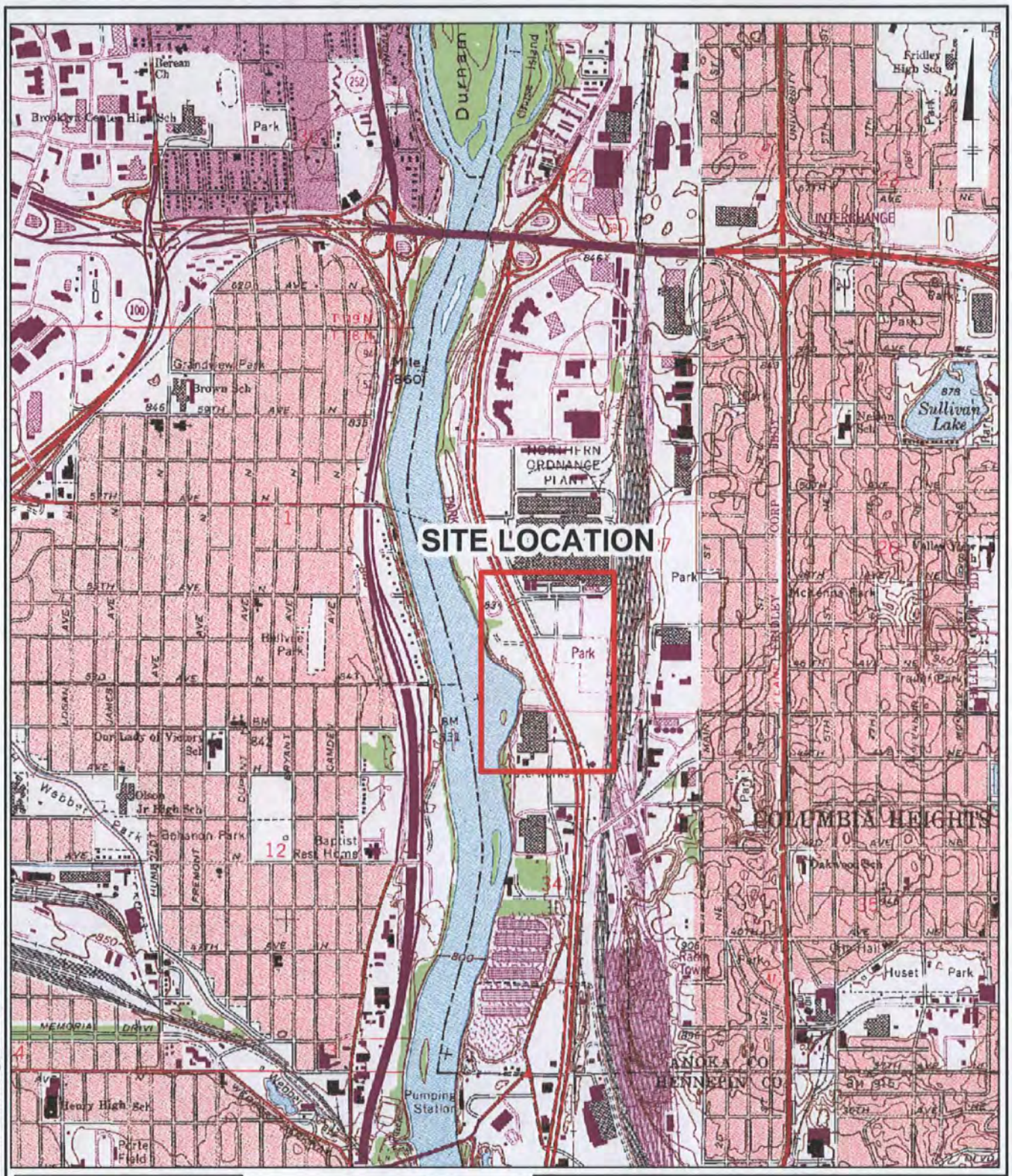
Groundwater Monitoring

Groundwater monitoring is conducted utilizing a monitoring well network arranged throughout the site and adjacent downgradient properties. The monitoring well network is utilized to collect groundwater elevation data and groundwater samples for laboratory analysis. The groundwater monitoring program is discussed in the Remedy Selection section above. Groundwater monitoring is conducted at the site in accordance with the QAPP. All samples collected are analyzed for VOCs.

Adjustments to the monitoring well network have been made since the previous FYR. These include well modifications and installation of additional wells. The changes to the monitoring well network were based on recommendations in the previous FYR. Monitoring well network modifications were necessary to collect more accurate information of aquifer conditions during sampling events. At this time, the monitoring portion of the ROD is ongoing.

APPENDIX B

FIGURES



0 1,000 2,000 Feet

GRAPHIC SCALE

NOTES:

USGS 1:24K TOPOGRAPHIC QUADRANGLE: MINNEAPOLIS NORTH

FMC CORPORATION SITE
FRIDLEY, MINNESOTA

SITE LOCATION MAP

ARCADIS

FIGURE 1-1

CITY: MPLS DIV/GROUP: 40 DB: MG
BAE-FRIDLEY, MN (MN000553)
G:\GIS\Projects\BAE_Fridley\ArcMap\Site_Location.mxd - 12/8/2009 @ 7:40:46 AM

LEGEND:

- ABANDONED WELL
- UPPER ALLUVIUM WELL
- LOWER ALLUVIUM WELL
- BEDROCK WELL
- OTHER WELL (INSUFFICIENT INFORMATION AVAILABLE)
- UPPER ALLUVIUM INJECTION WELL
- UPPER ALLUVIUM DOSE RESPONSE WELL
- UPPER ALLUVIUM PERFORMANCE MONITORING WELL
- SEEP
- PROPERTY BOUNDARY
- STORM SEWER
- STRUCTURE

0 200 400 Feet
GRAPHIC SCALE

NOTES:

AERIAL IMAGE: USGS ORTHOIMAGERY

FMC CORPORATION SITE
FRIDLEY, MINNESOTA

SITE LAYOUT

ARCADIS

FIGURE 1-2

CITY: MPLS DIV/GROUP: 40 DB: MG
LE: FRIDLEY PL: ALL (Model)
G:\GIS\Projects\BAE_Fridley\ArcMap\2013\Well_Loca_20131021.mxd, 10/21/2013, 8:54:50 AM

LEGEND:

- ABANDONED WELL
- UPPER ALLUVIUM WELL
- LOWER ALLUVIUM WELL
- BEDROCK WELL
- OTHER WELL (INSUFFICIENT INFORMATION AVAILABLE)
- MANHOLE
- SEEP
- CURRENT AND/OR PREVIOUS STRUCTURE
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED) (FEET ABOVE MEAN SEA LEVEL)

0 200 400 Feet
GRAPHIC SCALE

NOTES:
1. AERIAL IMAGE: USGS ORTHOIMAGERY
2. RW-2 NOT PUMPING SINCE SEPTEMBER 10, 2012
3. GPM - GALLONS PER MINUTE
4. * NO WATER LEVEL MEASUREMENT TAKEN
5. ** INSTALLED IN JUNE 2012

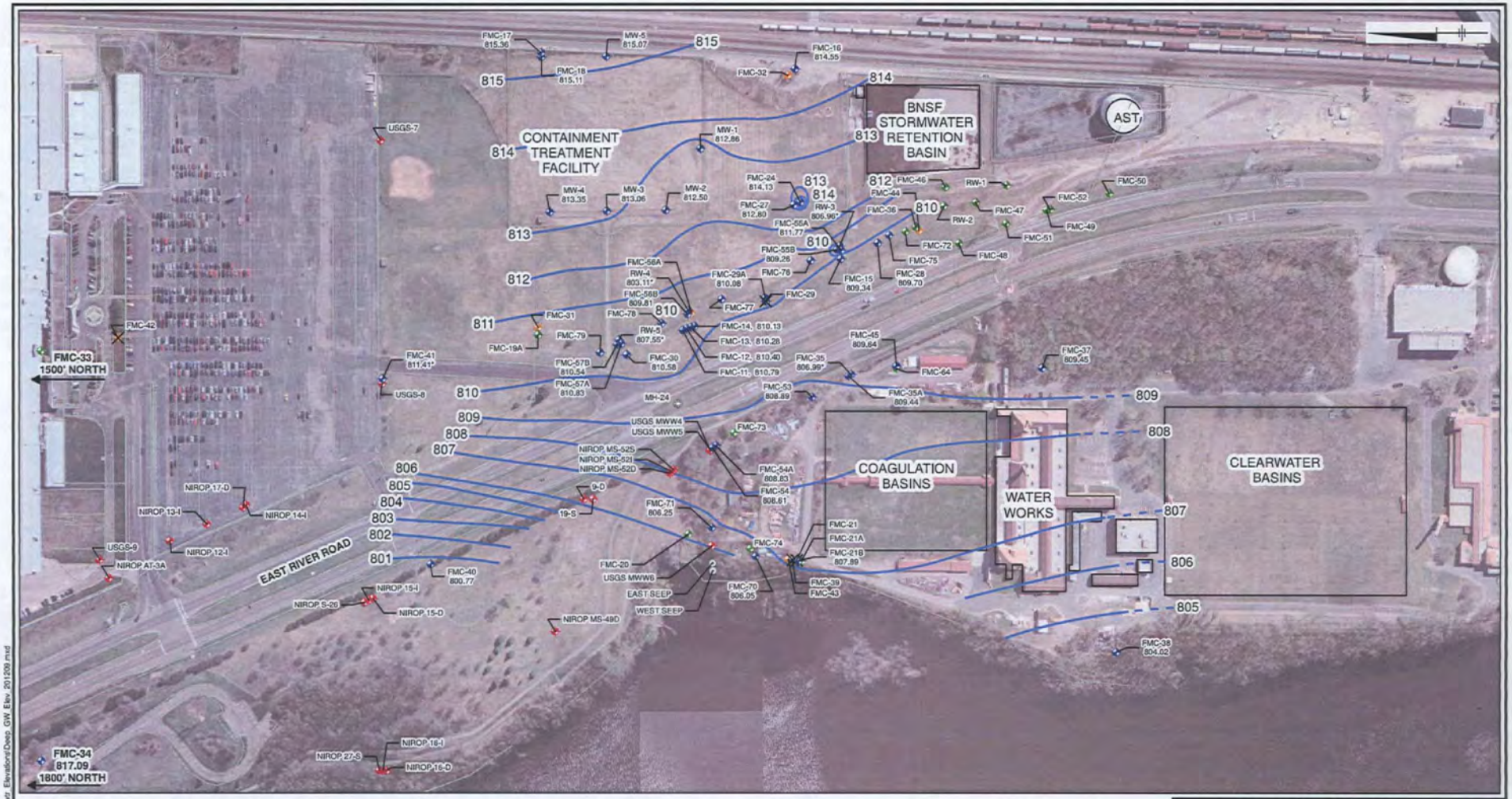
FMC CORPORATION SITE
FRIDLEY, MINNESOTA

GROUNDWATER ELEVATION CONTOUR MAP
UPPER ALLUVIUM - SEPTEMBER 2012

ARCADIS

FIGURE 6-2

CITY: MPLS DIV/GROUP: 40 DB: MG
BAE-FRIDLEY, MN (MN000553)
Path: G:\GIS\Projects\BAE_Fridley\ArcMap\Gwz_Elevations\Shallow_GW_Elev_201209.mxd



LEGEND:

- ABANDONED WELL
- UPPER ALLUVIUM WELL
- LOWER ALLUVIUM WELL
- BEDROCK WELL
- OTHER WELL (INSUFFICIENT INFORMATION AVAILABLE)
- MANHOLE
- SEEP
- CURRENT AND/OR PREVIOUS STRUCTURE
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED) (FEET ABOVE MEAN SEA LEVEL)

0 200 400 Feet
GRAPHIC SCALE

NOTES:
1. AERIAL IMAGE: USGS ORTHOIMAGERY
2. RW-2, RW-3, RW-4, AND RW-5 ARE PUMPING EXTRACTION WELLS
3. *WATER LEVEL NOT USED TO GENERATE CONTOURS

FMC CORPORATION SITE
FRIDLEY, MINNESOTA

GROUNDWATER ELEVATION CONTOUR MAP LOWER ALLUVIUM - SEPTEMBER 2012

ARCADIS

FIGURE 6-4

CITY: MPLS DIV/GROUP: 40 DB: MG
BAE-FRIDLEY, MN (MN000553)
Path: G:\GIS\Projects\BAE_Fridley\ArcMap\Gwz_Elevations\Deep_GW_Elev_201209.mxd

APPENDIX C

ANALYTICAL RESULTS

ARCADIS

Table 6-9. TCE Constituent Mass Removal, FMC Corporation Site, Fridley, Minnesota

	TCE Concentration (mg/L)				Cumulative Volume Extracted (millions of gallons)				Yearly Mass of TCE Removed Per Well (lbs)				Yearly Total Mass of TCE Extracted[1] (lbs)
Yr-Qtr	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	Total
1988-1	20.90	0.35	0.71	1.45	4.50	5.61	4.38	4.37	-	-	-	-	-
1988-2	23.30	0.20	0.74	1.20	6.37	9.90	7.39	6.63	-	-	-	-	-
1988-3	24.00	0.19	0.82	0.50	8.17	13.62	10.33	9.25	-	-	-	-	-
1988-4	8.30	0.10	---	0.63	10.21	17.97	14.16	12.56	1,648	33	86	104	1,871
1989-1	32.00	0.25	0.49	---	12.13	20.88	17.41	15.38	-	-	-	-	-
1989-2	23.00	0.20	---	0.56	13.52	24.66	19.76	18.17	-	-	-	-	-
1989-3	49.00	0.17	0.32	---	15.17	28.79	23.19	22.27	-	-	-	-	-
1989-4	44.00	0.18	---	0.91	16.10	33.30	26.61	24.93	1,795	25	37	72	1,930
1990-1	23.00	0.07	0.16	---	16.74	38.01	31.41	28.63	-	-	-	-	-
1990-2	91.00	0.21	---	0.51	17.69	41.93	35.45	31.56	-	-	-	-	-
1990-3	28.00	0.23	0.26	---	19.68	45.89	39.51	35.25	-	-	-	-	-
1990-4	30.00	0.14	---	0.28	20.85	50.01	43.79	37.87	1,597	22	32	53	1,703
1991-1	27.00	0.16	0.29	---	22.31	54.29	47.22	40.57	-	-	-	-	-
1991-2	44.00	0.20	---	0.22	23.87	59.07	50.63	43.47	-	-	-	-	-
1991-3	31.00	0.24	0.38	---	25.43	62.77	54.25	45.54	-	-	-	-	-
1991-4	40.00	0.26	---	0.74	27.17	67.80	57.61	48.07	1,883	32	40	35	1,990
1992-1	30.00	0.24	0.38	---	28.16	71.24	59.20	50.62	-	-	-	-	-
1992-2	26.00	0.19	---	0.62	29.96	75.09	61.46	53.35	-	-	-	-	-
1992-3	20.00	0.19	0.85	---	31.70	79.06	64.65	56.91	-	-	-	-	-
1992-4	14.00	0.17	---	0.83	34.70	83.33	68.01	60.90	1,278	25	58	78	1,440
1993-1	12.00	0.14	0.51	---	36.57	87.83	70.26	64.40	-	-	-	-	-
1993-2	16.00	0.17	---	1.00	38.62	91.73	72.90	67.68	-	-	-	-	-
1993-3	16.00	0.22	0.60	---	41.04	95.84	75.43	70.80	-	-	-	-	-
1993-4	20.00	0.32	---	0.70	43.19	99.76	78.21	74.33	1,142	29	50	97	1,317

Notes on Page 5.

ARCADIS

Table 6-9. TCE Constituent Mass Removal, FMC Corporation Site, Fridley, Minnesota

	TCE Concentration (mg/L)				Cumulative Volume Extracted (millions of gallons)				Yearly Mass of TCE Removed Per Well (lbs)				Yearly Total Mass of TCE Extracted[1] (lbs)
Yr-Qtr	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	Total
1994-1	6.90	0.23	0.70	---	45.78	104.29	81.16	77.70	-	-	-	-	-
1994-2	7.40	0.23	---	0.77	47.83	108.64	83.71	80.45	-	-	-	-	-
1994-3	4.00	0.07	0.29	---	49.94	111.70	86.50	83.40	-	-	-	-	-
1994-4	2.60	0.05	---	0.41	51.75	114.90	86.93	89.13	385	20	36	72	514
1995-1	6.10	0.13	0.73	---	54.20	118.88	92.35	89.40	-	-	-	-	-
1995-2	5.10	0.12	---	0.21	56.17	123.20	95.17	92.31	-	-	-	-	-
1995-3	6.40	0.09	0.34	---	57.77	127.63	97.78	95.36	-	-	-	-	-
1995-4	6.80	0.09	---	0.62	60.29	131.96	101.04	99.16	437	15	62	36	549
1996-1	5.70	0.14	0.29	---	61.94	136.10	104.02	102.17	-	-	-	-	-
1996-2	4.20	0.11	---	0.41	64.61	139.85	106.94	104.91	-	-	-	-	-
1996-3	4.10	0.08	0.36	---	66.39	143.78	109.67	107.20	-	-	-	-	-
1996-4	4.60	0.07	---	0.33	68.40	148.28	113.18	110.07	310	13	33	37	394
1997-1	6.10	0.16	0.31	---	70.48	151.64	115.70	112.20	-	-	-	-	-
1997-2	9.10	0.20	---	0.32	72.39	155.30	118.50	114.40	-	-	-	-	-
1997-3	14.00	0.13	0.39	---	73.78	158.79	122.00	116.90	-	-	-	-	-
1997-4	9.90	0.11	---	0.32	74.82	162.20	125.30	119.60	499	17	35	26	577
									-	-	-	-	-
1998-1	5.00	0.11	0.25	---	76.73	165.37	128.15	122.27	-	-	-	-	-
1998-2	7.80	0.14	---	0.32	78.55	169.60	129.98	124.51	-	-	-	-	-
1998-3	4.30	0.11	0.27	---	81.02	171.63	132.26	127.31	-	-	-	-	-
1998-4	2.80	0.08	---	0.18	83.50	175.96	135.23	130.30	344	13	21	23	401
									-	-	-	-	-
1999-1	3.50	0.07	0.23	---	85.74	180.38	137.88	132.91	-	-	-	-	-
1999-2	2.10	0.06	---	0.18	89.97	184.92	139.80	135.78	-	-	-	-	-
1999-3	3.80	0.09	0.20	---	91.65	189.03	141.99	138.20	-	-	-	-	-
1999-4	3.80	0.06	---	0.22	93.68	192.64	144.24	140.41	257	10	15	16	298
									-	-	-	-	-

Notes on Page 5.

ARCADIS

Table 6-9. TCE Constituent Mass Removal, FMC Corporation Site, Fridley, Minnesota

	TCE Concentration (mg/L)				Cumulative Volume Extracted (millions of gallons)				Yearly Mass of TCE Removed Per Well (lbs)				Yearly Total Mass of TCE Extracted[1] (lbs)
Yr-Qtr	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	Total
2000-1	1.80	0.07	0.11	---	96.47	196.77	146.46	142.96	-	-	-	-	-
2000-2	2.10	0.08	---	0.19	98.63	200.71	148.51	146.81	-	-	-	-	-
2000-3	1.80	0.06	0.21	---	101.17	203.86	150.66	149.53	-	-	-	-	-
2000-4	2.10	0.08	---	0.13	104.42	208.96	153.31	153.14	175	10	13	18	215
									-	-	-	-	-
2001-1	3.10	0.08	0.17	---	106.51	213.08	155.31	156.15	-	-	-	-	-
2001-2	2.90	0.07	---	0.15	108.82	215.49	157.14	158.33	-	-	-	-	-
2001-3	4.70	0.08	0.11	---	110.62	217.43	158.67	159.64	-	-	-	-	-
2001-4	4.90	0.08	---	0.20	113.18	219.98	160.64	161.94	285	7	15	12	319
									-	-	-	-	-
2002-1	4.50	0.49	0.98	---	115.15	221.98	162.82	164.68	-	-	-	-	-
2002-2	6.80	0.08	---	0.11	116.81	225.16	165.31	168.18	-	-	-	-	-
2002-3	4.70	0.07	0.19	---	119.44	228.99	168.27	171.94	-	-	-	-	-
2002-4	3.90	0.06	---	0.11	121.72	234.18	172.09	175.72	345	15	43	14	417
									-	-	-	-	-
2003-1	2.60	0.04	0.34	---	123.82	238.80	175.88	179.00	-	-	-	-	-
2003-2	4.43	0.04	---	0.10	126.44	244.09	180.70	182.33	-	-	-	-	-
2003-3	3.80	0.06	0.23	---	131.13	249.51	185.48	185.71	-	-	-	-	-
2003-4	5.00	0.03	---	0.06	134.06	254.36	190.32	188.43	413	7	40	9	470
									-	-	-	-	-
2004-1	3.70	0.04	0.22	---	135.79	259.59	196.39	191.36	-	-	-	-	-
2004-2	3.20	0.04	---	0.05	137.62	264.30	202.65	193.99	-	-	-	-	-
2004-3	9.80	0.08	0.17	---	140.49	268.87	206.49	196.15	-	-	-	-	-
2004-4	3.62	0.05	---	0.05	142.00	274.10	212.46	198.50	382	8	36	4	430
									-	-	-	-	-
2005-1	2.73	0.04	0.19	---	143.48	278.50	217.90	200.87	-	-	-	-	-
2005-2	1.74	0.04	---	0.04	144.79	282.01	223.01	203.01	-	-	-	-	-
2005-3	1.91	0.03	0.18	---	146.42	286.79	227.30	204.77	-	-	-	-	-
2005-4	2.79	0.07	---	0.05	149.76	290.26	231.80	206.46	156	6	30	3	196
									-	-	-	-	-

Notes on Page 5.

Table 6-9. TCE Constituent Mass Removal, FMC Corporation Site, Fridley, Minnesota

	TCE Concentration (mg/L)				Cumulative Volume Extracted (millions of gallons)				Yearly Mass of TCE Removed Per Well (lbs)				Yearly Total Mass of TCE Extracted[1] (lbs)
Yr-Qtr	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	Total
2006-1	2.89	0.06	0.20	---	152.20	294.40	236.70	208.70	-	-	-	-	-
2006-2	3.71	0.07	---	0.05	154.40	298.60	241.50	211.10	-	-	-	-	-
2006-3	3.52	0.07	0.18	---	158.10	302.60	245.40	213.50	-	-	-	-	-
2006-4	3.02	0.06	---	0.05	160.90	306.60	250.50	216.20	306	8	28	4	346
2007-1	1.74	0.04	0.15	---	162.50	309.80	254.40	218.60	-	-	-	-	-
2007-2	2.40	0.05	---	0.04	165.10	313.10	257.70	220.80	-	-	-	-	-
2007-3	2.49	0.10	0.17	---	167.30	317.20	263.00	222.00	-	-	-	-	-
2007-4	4.38	0.08	0.19	---	170.10	321.50	266.80	224.70	223	9	23	3	258
2008-1	2.43	0.05	---	0.03	171.34	325.00	270.49	227.08	-	-	-	-	-
2008-2	4.46	0.07	0.20	---	173.11	328.82	275.53	229.11	-	-	-	-	-
2008-3	2.65	0.06	---	0.03	175.00	332.80	280.86	231.11	-	-	-	-	-
2008-4	2.93	0.05	0.17	---	176.34	335.89	284.98	232.86	165	7	28	2	202
2009-1	1.96	0.04	---	0.02	177.80	338.80	289.20	234.40	-	-	-	-	-
2009-2	1.28	0.03	0.15	---	179.10	342.30	294.30	236.80	-	-	-	-	-
2009-3	1.51	0.13	---	0.03	180.60	346.10	298.80	241.50	-	-	-	-	-
2009-4	1.74	0.04	0.11	0.02	182.10	350.20	303.30	245.70	78	7	22	3	110
2010-1	1.76	0.05	0.09	0.02	183.80	353.90	307.90	249.60	-	-	-	-	-
2010-2	2.85	0.09	0.10	0.02	186.10	357.40	312.80	253.00	-	-	-	-	-
2010-3	2.20	0.06	0.12	0.02	187.80	360.90	317.80	257.20	-	-	-	-	-
2010-4	1.26	0.07	0.16	0.03	189.50	363.70	322.00	261.20	129	7	18	3	157
2011-1	0.93	0.13	0.12	0.02	191.29	365.53	324.51	264.68	-	-	-	-	-
2011-2	3.21	0.09	0.24	0.03	194.44	367.94	332.07	268.22	-	-	-	-	-
2011-3	5.53	0.08	0.19	0.03	196.42	373.16	339.97	271.93	-	-	-	-	-
2011-4	3.23	0.04	0.20	0.02	199.21	380.42	346.60	275.14	265	10	41	3	319

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Table 6-9. TCE Constituent Mass Removal, FMC Corporation Site, Fridley, Minnesota

	TCE Concentration (mg/L)				Cumulative Volume Extracted (millions of gallons)				Yearly Mass of TCE Removed Per Well (lbs)				Yearly Total Mass of TCE Extracted[1] (lbs)
Yr-Qtr	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	RW2	RW3	RW4	RW5	Total
2012-1	1.50	0.03	0.25	0.02	202.04	385.03	351.36	277.94	-	-	-	-	-
2012-2	1.44	0.05	0.15	0.02	203.73	389.78	356.16	280.62	-	-	-	-	-
2012-3	2.62	0.05	0.14	0.02	204.18	394.75	362.28	284.01	-	-	-	-	-
2012-4	1.73	0.04	0.10	0.02	204.18	398.93	367.22	286.77	66	6	27	2	101

Acronyms and Abbreviations:

--- measurement not available

- = calculation completed only on a yearly basis

[1] = For an example calculation, refer to Appendix B.

lbs = pounds

mg/L = milligrams per liter

NS = not sample

TCE = Trichloroethene

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
Well ID	Sample Date												
FMC-11	10/29/2004	3.6	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND
FMC-12	10/29/2004	4.8	ND	ND	ND	2.1	ND	ND	ND	ND	ND	ND	ND
FMC-13	10/26/2006	***8.1***	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-13 DUP	10/26/2006	***8.6***	ND	ND	ND	2.4	1.2	ND	ND	ND	ND	ND	ND
FMC-13	10/24/2007	***8.0***	ND	ND	ND	2.3	ND	ND	ND	ND	ND	ND	ND
FMC-13	10/23/2008	***11.4***	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND
FMC-13	10/15/2009	5.0	ND	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND
FMC-13	10/13/2010	3.6	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
FMC-13	10/17/2011	***8.5***	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND
FMC-13	10/11/2012	***5.3***	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-14	10/29/2004	***1200***	ND	ND	ND	***370***	120	ND	20	ND	ND	ND	ND
FMC-14	10/27/2005	***773***	2.7	ND	ND	***375***	68.5	ND	10	ND	1.5	ND	ND
FMC-14	10/27/2006	***178***	3.8	ND	ND	***120***	4.4	ND	4.3	ND	ND	ND	ND
FMC-14	10/24/2007	***564***	5.7	ND	ND	***145***	15.9	ND	30.8	ND	ND	ND	ND
FMC-14	10/24/2008	***1110***	5.2	ND	ND	***807***	128	ND	15.2	ND	3.7	ND	ND
FMC-14	10/15/2009	***321***	2.5	ND	ND	***443***	30.1	ND	6.5	ND	ND	ND	ND
FMC-14	10/13/2010	***456***	11.9	ND	ND	***121***	10	ND	14.9	ND	ND	ND	ND
FMC-14	10/19/2011	***233***	2	ND	ND	***87.6***	3.8	ND	6.1	ND	ND	ND	ND
FMC-14	10/11/2012	***301***	2.8	ND	ND	***188***	6.2	ND	8	ND	ND	ND	ND
FMC-15	10/29/2004	***260***	*64*	ND	ND	4.1	ND	ND	12	ND	ND	ND	ND
FMC-15	10/27/2005	***794***	***151***	3	*0.41*	4	1.1	ND	28.7	ND	1.8	ND	ND
FMC-15 DUP	10/27/2005	***748***	***162***	3.3	ND	***5.1***	1.1	ND	30.8	ND	1.9	ND	ND
FMC-15	10/27/2006	***376***	***107***	3.3	*1.7*	4.1	ND	ND	18.8	ND	1.3	ND	ND
FMC-15	10/24/2007	***580***	***141***	2.6	*0.72 J*	***5.7***	ND	ND	22.7	ND	ND	ND	ND
FMC-15	10/24/2008	***293***	***89.7***	ND	*0.48 J*	3.2	ND	ND	13.2	ND	ND	ND	ND
FMC-15	10/15/2009	***169***	*68.2*	ND	ND	2.7	ND	ND	9.5	ND	ND	ND	ND
FMC-15	10/13/2010	***492***	***168***	2.6	*0.7*	4.3	ND	ND	20.3	ND	1.5	ND	ND
FMC-15	10/19/2011	***236***	49.5	ND	0.17	3.5	ND	ND	7.6	ND	ND	ND	ND
FMC-15	10/11/2012	***186***	*55.8*	ND	ND	3	ND	ND	7.3	ND	ND	ND	ND
FMC-17	5/27/2004	ND	ND	ND	ND	3.8	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/25/2004	ND	ND	ND	ND	3.3	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/26/2005	ND	ND	ND	ND	2.8	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/24/2005	0.23	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/30/2006	ND	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/24/2006	ND	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-17	4/27/2007	ND	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/22/2007	ND	ND	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/29/2008	ND	ND	ND	ND	1.7	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/21/2008	ND	ND	ND	ND	2.6	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/22/2009	ND	ND	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/13/2009	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/18/2010	ND	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/11/2010	ND	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/25/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
Well ID	Sample Date												
FMC-17	10/17/2011	ND	ND	ND	ND	1.9	ND	ND	ND	ND	ND	ND	ND
FMC-17	5/10/2012	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND
FMC-17	10/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-19A	10/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-19A	10/17/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-19A	10/11/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/29/2004	***14***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/26/2006	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/24/2007	3.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/22/2008	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/13/2010	***41.4***	2	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/17/2011	***15.7***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-20	10/10/2012	***14***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-21A	11/22/2004	***50.1***	3	ND	ND	ND	ND	ND	3.3	ND	ND	ND	ND
FMC-21A	10/26/2005	***105***	4.8	ND	ND	ND	ND	ND	4.6	ND	ND	ND	ND
FMC-21A	10/26/2006	***101***	3.1	ND	ND	1.2	ND	ND	7.1	ND	ND	ND	ND
FMC-21A	10/23/2007	***54.2***	4.9	ND	ND	ND	ND	ND	6.6	ND	ND	ND	ND
FMC-21A	10/23/2008	***77.9***	3.2	1.8	ND	ND	ND	ND	5.8	ND	ND	ND	ND
FMC-21A	10/14/2009	***62.7***	3.5	1.3	ND	ND	ND	ND	10.1	ND	ND	ND	ND
FMC-21A	10/12/2010	***97.3***	4.4	ND	ND	1.2	ND	ND	15	ND	1.2	ND	ND
FMC-21A	10/17/2011	***86.4***	2.3	ND	ND	1.6	ND	ND	8.5	ND	ND	ND	ND
FMC-21A	10/10/2012	***46***	1.8	ND	ND	2.1	ND	ND	4.6	ND	ND	ND	ND
FMC-21B	11/22/2004	***22.8***	1.4	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
FMC-21B	10/26/2005	***64.0***	2.6	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
FMC-21B	10/26/2006	***155***	4.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-21B	10/23/2007	***178***	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-21B DUP	10/23/2008	***125***	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-21B	10/23/2008	***117***	4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-21B	10/14/2009	***160***	6.2	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
FMC-21B	10/12/2010	***155***	5.7	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
FMC-21B	10/17/2011	***55.5***	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-21B	10/10/2012	***79.9***	4.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-24	10/29/2004	ND	5	ND	*2*	ND	ND	ND	ND	ND	ND	ND	ND
FMC-27	10/26/2005	ND	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-27 DUP	10/26/2005	ND	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/29/2004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/27/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/24/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/23/2008	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/15/2009	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28 DUP	10/15/2009	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	**5**	**70**	**100**	**2**	**5**	**200**	**NS**	**NS**	**5**	**7**	**5**	**5**
Well ID	Sample Date												
FMC-28	10/13/2010	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/19/2011	***8.6***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-28	10/11/2012	1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-29A	10/29/2004	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-29A	10/26/2005	***6.8***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-29A	10/15/2012	3.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-30	10/29/2004	***31.0***	2.4	ND	ND	2.4	ND	ND	1.4	ND	ND	ND	ND
FMC-30	10/26/2005	***37.4***	3	ND	ND	2.6	ND	ND	1.6	ND	ND	ND	ND
FMC-30	10/26/2006	***24.9***	1.9	ND	ND	2.7	ND	ND	1.1	ND	ND	ND	ND
FMC-30 DUP	10/26/2006	***25.4***	2.1	ND	ND	2.5	ND	ND	1.1	ND	ND	ND	ND
FMC-30	10/24/2007	***22.0***	1.7	ND	ND	2.7	ND	ND	1.2	ND	ND	ND	ND
FMC-30 DUP	10/24/2007	***21.2***	1.8	ND	ND	2.6	ND	ND	ND	ND	ND	ND	ND
FMC-30	10/24/2008	***17.3***	1.4	ND	ND	2.5	ND	ND	ND	ND	ND	ND	ND
FMC-30 DUP	10/24/2008	***16.9***	1.4	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-30	10/15/2009	***13.6***	ND	ND	ND	2.1	ND	ND	ND	ND	ND	ND	ND
FMC-30	10/13/2010	***13.3***	ND	ND	ND	1.9	ND	ND	ND	ND	ND	ND	ND
FMC-30	10/17/2011	***10***	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND
FMC-30	10/11/2012	***34.9***	ND	ND	ND	3.7	ND	ND	2.3	ND	ND	ND	ND
FMC-35	10/29/2004	***41***	41	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND
FMC-35	10/26/2006	ND	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35	10/23/2007	4.2	9.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35	10/22/2008	ND	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35	10/13/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35	10/12/2010	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35	10/18/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35	10/11/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35A	11/22/2004	***10.6***	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/23/2005	***10.6***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/26/2006	***11.9***	ND	ND	ND	1.7	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/23/2007	***10.5***	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/22/2008	***5.4***	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/13/2009	***6.1***	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/12/2010	***11.6***	ND	ND	ND	1.7	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/18/2011	5	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND
FMC-35A	10/11/2012	3.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-36	10/29/2004	***3400***	***210***	ND	***18***	***79***	**450**	ND	31	ND	ND	ND	ND
FMC-36	10/27/2005	***3960***	***258***	2.8	*0.83*	***190***	**496**	ND	26.8	1.6	**8**	ND	ND
FMC-36	10/27/2006	***1410***	***265***	ND	***12.2***	***59.1***	65.2	ND	41.5	ND	ND	ND	ND
FMC-36	10/24/2007	***4520***	***586***	8.2	***8.4***	***122***	**522**	ND	37	3.8	**10.6**	ND	ND
FMC-36	10/24/2008	***9410***	***926***	12.7	***104***	***236***	**1230**	ND	*110*	***10***	**42.4**	ND	ND
FMC-36	10/15/2009	***1470***	***143***	ND	***4.5***	***55.3***	126	ND	19.1	ND	ND	ND	ND
FMC-36	10/14/2010	***6560***	***786***	ND	***7.2***	***94.8***	**757**	ND	44.8	ND	**17.5**	ND	ND
FMC-36	10/19/2011	***19600***	***1400***	22.2	***5.6***	***528***	**2230**	ND	*203*	***18.1***	**56.5**	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
Well ID	Sample Date												
FMC-36	8/9/2012	***2590***	***386***	ND	ND	***84.1***	295	ND	21.1	ND	ND	ND	ND
FMC-36	10/15/2012	***1910***	***228***	ND	ND	***102***	242	ND	ND	ND	ND	ND	ND
FMC-37	10/29/2004	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	12/15/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/25/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/23/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/22/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/13/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/18/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-37	10/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/29/2004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/25/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/25/2006	3.3	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/23/2007	3.0	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/22/2008	3.6	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/13/2009	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/12/2010	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/17/2011	4.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-38	10/10/2012	2.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-39	10/29/2004	1.2	2.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-44	10/26/2005	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/29/2004	***41.0***	6	ND	ND	***5.1***	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/26/2005	***51.7***	12.4	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/26/2006	***14.3***	6.4	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/23/2007	***18.5***	7.6	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/22/2008	***12.5***	7	ND	ND	1	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/14/2009	***13.1***	5.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/13/2010	***12.2***	6.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-45 DUP	10/13/2010	***11.9***	6.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/17/2011	***7.5***	5.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-45	10/11/2012	***12.2***	7.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-46	10/19/2011	***7***	***56.9***	ND	***82.8***	ND	ND	ND	4.9	ND	ND	ND	ND
FMC-46	10/15/2012	***7.8***	10.8	ND	***9.2***	ND	ND	ND	ND	ND	ND	ND	ND
FMC-47	10/19/2011	***61.6***	16.7	ND	ND	2.9	ND	ND	ND	ND	ND	ND	ND
FMC-47	10/15/2012	***74.1***	28	ND	ND	4	ND	ND	ND	ND	ND	ND	ND
FMC-48	10/29/2004	4.2	5.4	ND	ND	ND	ND	ND	1.8	ND	ND	ND	ND
FMC-48	10/27/2005	***7.9***	10.8	ND	ND	ND	ND	ND	2.2	ND	ND	ND	ND
FMC-48	10/27/2006	4.7	2.4	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND
FMC-48	10/25/2007	***12.6***	13.5	ND	ND	ND	ND	ND	2.2	ND	ND	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
Well ID	Sample Date												
FMC-48	10/24/2008	***23.0***	10.3	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
FMC-48	10/15/2009	***21.5***	13.7	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
FMC-48	10/14/2010	***15.1***	21.4	ND	ND	ND	1	ND	1.5	ND	ND	ND	ND
FMC-48	10/19/2011	***24.3***	11.5	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
FMC-48	10/15/2012	***20.6***	6.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-49	10/28/2005	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-50	10/14/2010	***31.7***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-50	10/19/2011	***30.5***	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-50	10/15/2012	***19.7***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-51	10/27/2006	***25.0***	3.8	ND	***2.5***	2.2	1.5	ND	ND	ND	ND	ND	ND
FMC-51	10/14/2010	***142***	10.6	ND	***2.1***	2.6	ND	ND	1.9	ND	ND	ND	ND
FMC-51	10/19/2011	***40***	3.8	ND	*0.5*	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-51	10/11/2012	***29.3***	3.1	ND	*0.59*	1.6	ND	ND	ND	ND	ND	ND	ND
FMC-52	11/22/2004	***374***	***159***	6	ND	3	ND	ND	10.1	ND	2.6	ND	ND
FMC-52	10/27/2005	***44.7***	6.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-52	10/27/2006	4.8	13.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-52	10/25/2007	***23.5***	25.9	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND
FMC-52	10/24/2008	***26.0***	46.1	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
FMC-52	10/15/2009	***13.9***	35.2	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
FMC-52	10/14/2010	***183***	44.8	3.8	ND	3.5	ND	ND	3.4	ND	ND	ND	ND
FMC-52	10/19/2011	***71.3***	31.2	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
FMC-52	10/15/2012	***143***	61.7	2	ND	ND	ND	ND	3	ND	ND	ND	ND
FMC-53	12/15/2005	***164***	2.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-53	10/26/2006	***116***	1.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-53	10/23/2007	***73.8***	10.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-53	10/23/2008	***104***	24.5	1	ND	ND	ND	ND	1	ND	ND	ND	ND
FMC-53	10/14/2009	***94.5***	17.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-53	10/12/2010	***100***	18.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-53	10/17/2011	***67.4***	12.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-53	10/10/2012	***62.1***	7.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-54	12/15/2005	***288***	6.5	ND	ND	***45.1***	ND	ND	6.9	ND	ND	ND	ND
FMC-54	10/26/2006	***218***	5	1.1	ND	***72.4***	1.4	ND	6.4	ND	1.3	ND	ND
FMC-54	10/23/2007	***544***	11.1	ND	ND	***304***	ND	ND	14.6	ND	2.3	ND	ND
FMC-54	10/23/2008	***194***	4.8	ND	ND	***113***	ND	ND	5	ND	ND	ND	***9.9***
FMC-54	10/14/2009	***176***	6.4	ND	ND	***79.3***	ND	ND	5.6	ND	ND	ND	ND
FMC-54	10/13/2010	***166***	7.3	ND	ND	***60.3***	ND	ND	4.9	ND	1	ND	ND
FMC-54	10/17/2011	***178***	8	ND	ND	***64.9***	ND	ND	5.6	ND	ND	ND	ND
FMC-54	10/10/2012	***227***	9.4	1.3	ND	***105***	ND	ND	6.5	ND	1.3	ND	ND
FMC-54A	11/22/2004	***366***	4.1	ND	ND	***175***	11.2	ND	10.8	ND	2	1.7	ND
FMC-54A	10/26/2005	***123***	3.4	ND	ND	***110***	3.2	ND	4.4	ND	1	ND	ND
FMC-54A	10/26/2006	***180***	2.8	ND	ND	***176***	6.4	ND	6.2	ND	ND	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
Well ID	Sample Date												
FMC-54A	10/23/2007	***94.2***	2.2	ND	ND	***139***	2.2	ND	4	ND	ND	ND	ND
FMC-54A DUP	10/23/2007	***98.8***	1.8	ND	ND	***145***	1.9	ND	3.2	ND	ND	ND	ND
FMC-54A	10/23/2008	***98.2***	1.8	ND	ND	***156***	1.3	ND	3.1	ND	ND	ND	ND
FMC-54A	10/14/2009	***75.3***	2.2	ND	ND	***91***	1.1	ND	3	ND	ND	ND	ND
FMC-54A	10/13/2010	***83.0***	1.8	ND	ND	***87.2***	1.2	ND	2	ND	ND	ND	ND
FMC-54A	10/17/2011	***58.2***	2.2	ND	ND	***97.9***	1.5	ND	1.6	ND	ND	ND	ND
FMC-54A	10/10/2012	***64.5***	4.6	ND	ND	***67.5***	ND	ND	2.4	ND	ND	ND	ND
FMC-55B	10/15/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-56B	10/15/2012	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
FMC-57B	10/15/2012	***6.2***	ND	ND	ND	5	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/29/2004	***73***	2.6	ND	ND	4.7	ND	ND	1.2	ND	ND	ND	ND
FMC-64	10/25/2005	***88.3***	3	ND	ND	3.1	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/26/2006	***62.1***	14.7	ND	ND	3	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/23/2007	***67.0***	8.9	ND	ND	3.1	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/22/2008	***52.0***	17.7	ND	ND	2.7	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/14/2009	***49.2***	6.9	ND	ND	1.9	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/13/2010	***63.4***	3.9	ND	ND	3.5	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/18/2011	***51.1***	5.7	ND	ND	2.6	ND	ND	ND	ND	ND	ND	ND
FMC-64	10/11/2012	***47.6***	5.8	ND	ND	2.4	ND	ND	ND	ND	ND	ND	ND
FMC-70	10/26/2005	***236***	6.9	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
FMC-70	10/26/2006	***104***	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-70	10/23/2007	***94.7***	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-70	10/23/2008	***85.4***	1.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-70	10/14/2009	***106***	7.8	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND
FMC-70	10/12/2010	***147***	7.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-70	10/18/2011	***120***	3.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-70	10/11/2012	***50.4***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-71	10/26/2006	***47.9***	1.5	ND	ND	***35.7***	1.8	ND	1.6	ND	ND	ND	ND
FMC-71	10/23/2007	***77.0***	1.7	ND	ND	***75.7***	6	ND	2.7	ND	ND	ND	ND
FMC-71	10/22/2008	***61.4***	ND	ND	ND	***135***	1.4	ND	1.5	ND	ND	ND	ND
FMC-71	10/14/2009	***32.8***	1.2	ND	ND	***61.3***	1.2	ND	1	ND	ND	ND	ND
FMC-71	10/12/2010	***28.4***	1.3	ND	ND	***40.4***	ND	ND	ND	ND	ND	ND	ND
FMC-71	10/18/2011	***107***	1.9	ND	ND	***90.7***	2.5	ND	1.3	ND	ND	ND	ND
FMC-71	10/11/2012	***19.3***	1.3	ND	ND	***17.1***	ND	ND	ND	ND	ND	ND	ND
FMC-72	10/12/2012	***8050***	***718***	5.9	*0.56*	***230***	1300	ND	42.4	***9.9***	21	ND	ND
FMC-73	10/11/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-74	10/11/2012	***525***	3.4	ND	ND	***367***	ND	ND	10.5	ND	1.4	ND	ND
FMC-75	10/12/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

Well ID	VOCs (µg/L) / Sample Date	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
FMC-76	10/12/2012	***97***	***75.7***	ND	*1.6*	ND	ND	ND	5.9	ND	ND	ND	ND
FMC-77	10/12/2012	***20.8***	1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-78	10/12/2012	***640***	5	ND	ND	***435***	10.4	ND	15.2	ND	ND	ND	ND
FMC-79	6/18/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FMC-79	10/12/2012	***31.2***	5.5	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND
MW-1	5/27/2004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/25/2004	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND
MW-1	5/26/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/24/2005	0.28	0.2	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND
MW-1	5/31/2006	***14.5***	5	ND	*1.7*	ND	ND	ND	18.9	ND	ND	ND	ND
MW-1	10/24/2006	ND	ND	ND	0.2 J	ND	ND	ND	2.4	ND	ND	ND	ND
MW-1	4/27/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/22/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	5/29/2008	2.3	1.6	ND	*0.26*	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/21/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	5/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/13/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	5/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/11/2010	***5.3***	3.2	ND	ND	ND	ND	ND	4.6	ND	ND	ND	ND
MW-1	5/25/2011	1.1	1.1	ND	ND	ND	ND	ND	9.3	ND	ND	ND	ND
MW-1	10/17/2011	***3***	1.4	ND	*0.25 J*	ND	ND	ND	9.8	ND	ND	ND	ND
MW-1	5/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1	10/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/27/2004	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/25/2004	3.6	0.17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/26/2005	4.2	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/24/2005	4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/30/2006	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/24/2006	2.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	4/27/2007	2.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/22/2007	4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/29/2008	3.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/21/2008	2.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/22/2009	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/13/2009	1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/18/2010	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/11/2010	3.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	5/25/2011	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/17/2011	1.2	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
MW-2	5/10/2012	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2	10/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-2 DUP	10/10/2012	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	5	70	100	2	5	200	NS	NS	5	7	5	5
Well ID	Sample Date												
MW-3	5/27/2004	***220***	27	0.3	ND	***22***	2.7	ND	9.6	ND	0.24	ND	ND
MW-3	10/25/2004	***72***	***79***	0.32	ND	ND	2	*6.6*	4.5	ND	0.27	ND	ND
MW-3	5/26/2005	***240***	16	ND	ND	***28***	3.8	ND	9.1	ND	ND	ND	ND
MW-3	10/24/2005	***210***	4.1	0.26	ND	***43***	8.9	ND	8.6	ND	ND	ND	ND
MW-3	5/30/2006	***303***	6.1	ND	ND	***52.1***	9.3	ND	10.9	ND	ND	ND	ND
MW-3	10/25/2006	***93***	27	ND	ND	***16***	1.4	ND	3.9	ND	ND	ND	ND
MW-3	4/27/2007	***219***	15	ND	ND	***35.9***	4.8	ND	8.3	ND	ND	ND	ND
MW-3	10/22/2007	***196***	25.3	ND	ND	***21.3***	3.3	ND	5.7	ND	ND	ND	ND
MW-3 DUP	10/22/2007	***208***	25.7	ND	ND	***21.8***	3.7	ND	5.5	ND	ND	ND	ND
MW-3	5/29/2008	***257***	9.7	ND	ND	***39.7***	4.4	ND	8.3	ND	ND	ND	ND
MW-3	10/21/2008	***47.7***	17.7	ND	ND	***8.4***	ND	ND	1.5	ND	ND	ND	ND
MW-3	5/22/2009	***200***	15.5	ND	ND	***26.7***	3.8	ND	7.4	ND	ND	ND	ND
MW-3	10/13/2009	***11.9***	11.9	ND	ND	1	ND	ND	ND	ND	ND	ND	ND
MW-3 DUP	10/13/2009	***12.4***	12	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND
MW-3	5/18/2010	***172***	*56.9*	ND	ND	***19.7***	5.1	ND	9.3	ND	ND	ND	ND
MW-3	10/11/2010	***197***	31.2	ND	ND	***25.5***	7.1	ND	10.7	ND	ND	ND	ND
MW-3	5/25/2011	***258***	5.2	ND	ND	***40.1***	9.8	ND	8.6	ND	ND	ND	ND
MW-3	10/17/2011	***265***	23.6	ND	ND	***26.2***	8.7	ND	11.4	ND	ND	ND	ND
MW-3	5/10/2012	***45.7***	34.4	ND	ND	***2.6***	ND	ND	3.8	ND	ND	ND	ND
MW-3	10/10/2012	***136***	71.6	ND	ND	***6.8***	1.2	ND	7	ND	ND	ND	ND
MW-4	5/27/2004	***10***	1.6	ND	ND	1.7	0.47	ND	0.23	ND	ND	ND	ND
MW-4	10/25/2004	***11***	1.5	0.11	ND	1.6	0.44	ND	0.58	ND	ND	ND	ND
MW-4	5/26/2005	***12***	1.7	ND	ND	1.5	0.44	ND	0.42	ND	ND	ND	ND
MW-4	10/24/2005	***19***	1.3	ND	ND	1.3	0.7	ND	0.61	ND	ND	ND	ND
MW-4	5/30/2006	***10.4***	1.3	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND
MW-4	10/25/2006	***8.8***	1.3	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
MW-4	4/27/2007	***9.8***	1.6	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
MW-4	10/22/2007	***10***	1.3	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
MW-4	5/29/2008	***11***	1.6	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
MW-4	10/21/2008	***9.2***	1.1	ND	ND	1.7	ND	ND	ND	ND	ND	ND	ND
MW-4	5/22/2009	***9.1***	1.1	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND
MW-4 DUP	5/22/2009	***8.1***	1	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
MW-4	10/13/2009	***8.1***	1	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
MW-4	5/18/2010	***8.0***	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
MW-4	10/11/2010	***8.5***	ND	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND
MW-4	5/25/2011	***8.5***	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND
MW-4	10/17/2011	***6***	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND
MW-4	5/10/2012	***6.9***	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND
MW-4 DUP	5/10/2012	***7.2***	ND	ND	ND	1.7	ND	ND	ND	ND	ND	ND	ND
MW-4	10/10/2012	***6.5***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/27/2004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/25/2004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/26/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/24/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/30/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/24/2006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes on Page 9.

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Table 6-10. Summary of Groundwater TCL VOC Analytical Results from Monitoring Wells and Receptor Points from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	PCE	1,1,1-TCA	1,1,2,2-PCA	1,1-DCA	1,2-DCA	1,1-DCE	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	127-18-4	71-55-6	79-34-5	75-34-3	107-06-2	75-35-4	56-23-5	75-09-2
	Health Risk Limit	*5*	*50*	*100*	*0.2*	*5*	*9000*	*2*	*100*	*4*	*200*	*3*	*5*
	Maximum Contaminant Level	**5**	**70**	**100**	**2**	**5**	**200**	**NS**	**NS**	**5**	**7**	**5**	**5**
Well ID	Sample Date												
MW-5	4/27/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/22/2007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/29/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/21/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/22/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/13/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/25/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/17/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	5/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	10/10/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/29/2004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/28/2005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/26/2006	ND.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/26/2007	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MWW	10/24/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/15/2009	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/14/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/19/2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MWW	10/15/2012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Acronyms and Abbreviations:

Italic Result exceeds Minnesota Department of Health Risk Level Water Criteria.
BOLD Result exceeds Federal Maximum Contaminant Level.
J Estimated result.
µg/L = micrograms per liter
MWW = Minneapolis Water Works Intake (MPLS IN)
NA = not available or not analyzed.
ND = not detected
NS = not standard
TCL = target compound list
VOCs = Volatile Organic Compounds
DUP = duplicate sample

1,1-DCA = 1,1-Dichloroethane
1,1-DCE = 1,1-Dichloroethene
1,2-DCA = 1,2-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
1,1,2,2-PCA = 1,1,2,2-Tetrachloroethane
cis-1,2-DCE = cis-1,2-Dichloroethene
CT = carbon tetrachloride
MC = methylene chloride
PCE = Tetrachloroethene
TCE = Trichloroethene
trans-1-2-DCE = trans-1,2-Dichloroethene
VC = vinyl chloride

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Table 6-11. Summary of Groundwater TCL VOC Analytical Results from the Seeps from 2004 through 2012, FMC Corporation Site, Fridley, Minnesota

	VOCs (µg/L)	TCE	cis-1,2-DCE	trans-1,2-DCE	VC	1,1,1-TCA	1,1,2,2-PCA	PCE	1,1-DCA	1,1-DCE	1,2-DCA	CT	MC
	CAS No.	79-01-6	156-59-2	156-60-5	75-01-4	71-55-6	79-34-5	127-18-4	75-34-3	75-35-4	107-06-2	56-23-5	75-09-2
	Health Risk Limit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/L	ug/l	ug/l	ug/l
	Maximum Contaminant Level	*5*	*50*	*100*	*0.2*	*9000*	*2*	*5*	*100*	*200*	*4*	*3*	*5*
Well ID	Sample Date	5	70	100	2	200	NS	5	NS	7	5	5	5
EAST SEEP	10/29/2004	***780***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EAST SEEP	11/22/2004	***780***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EAST SEEP	10/28/2005	***54***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EAST SEEP	12/15/2005	***54***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EAST SEEP	9/28/2006	***210***	7.1	ND	ND	6.9	ND	***64.2***	6.2	1.2	ND	ND	ND
EAST SEEP	10/26/2006	***194***	11.5	ND	ND	6.1	ND	***54.4***	5.5	1.2	ND	ND	ND
EAST SEEP	6/27/2007	***96.8***	7.3	ND	ND	2.5	ND	***39.7***	2.6	ND	ND	ND	ND
EAST SEEP	9/11/2007	***173***	7.6	ND	ND	6.3	ND	***82.1***	4.4	ND	ND	ND	ND
EAST SEEP	11/19/2007	***180***	13.9	ND	ND	20	ND	***60.7***	4.6	1.3	ND	ND	ND
EAST SEEP	8/15/2008	***100***	5	ND	ND	2.4	ND	***38***	2.8	ND	ND	ND	ND
EAST SEEP	10/24/2008	***123***	5	ND	ND	5	ND	***57.6***	2.8	ND	ND	ND	ND
EAST SEEP	6/17/2009	***26.1***	1.5	ND	ND	ND	ND	***7.2***	ND	ND	ND	ND	ND
EAST SEEP	9/16/2009	***147***	12.5	ND	ND	2.7	ND	***83.4***	3.8	ND	ND	ND	ND
EAST SEEP	6/15/2010	***45.2***	10.1	ND	ND	ND	ND	***28.3***	1.3	ND	ND	ND	ND
EAST SEEP	8/31/2011	***17.3***	ND	ND	ND	ND	ND	1.8	ND	ND	ND	ND	ND
EAST SEEP	10/19/2011	***86.3***	2.6	ND	ND	ND	ND	***45.7***	1.6	ND	ND	ND	ND
EAST SEEP	3/28/2012	***75.5***	3	ND	ND	1.6	ND	***54.6***	2.4	ND	ND	ND	ND
EAST SEEP	9/20/2012	***112***	1.6	ND	ND	1.7	ND	***89.2***	3	ND	ND	ND	ND
EAST SEEP	11/14/2012	***67.4***	1	ND	ND	1	ND	***60.5***	1.7	ND	ND	ND	ND
WEST SEEP	9/28/2006	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
WEST SEEP	10/26/2006	4.4	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND
WEST SEEP	6/27/2007	***15.3***	ND	ND	ND	ND	ND	2.5	ND	ND	ND	ND	ND
WEST SEEP	9/11/2007	3.1	ND	ND	ND	ND	ND	1.8	ND	ND	ND	ND	ND
WEST SEEP	11/19/2007	***34.8***	ND	ND	ND	ND	ND	***6.5***	1.6	ND	ND	ND	ND
WEST SEEP	8/15/2008	***26.9***	1.1	ND	ND	ND	ND	***5.8***	1.3	ND	ND	ND	ND
WEST SEEP	10/24/2008	***33.5***	1.2	ND	ND	ND	ND	***9***	1.1	ND	ND	ND	ND
WEST SEEP	6/17/2009	4.3	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND	ND
WEST SEEP	9/16/2009	***10.1***	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND	ND
WEST SEEP	6/15/2010	3.8	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND
WEST SEEP	8/31/2011	***20.6***	ND	ND	ND	ND	ND	4.1	ND	ND	ND	ND	ND
WEST SEEP	10/19/2011	***14.6***	ND	ND	ND	ND	ND	3.8	ND	ND	ND	ND	ND
WEST SEEP	3/28/2012	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
WEST SEEP	9/20/2012	2.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
WEST SEEP	11/14/2012	1.7	ND	ND	ND	ND	ND	0.77 J	ND	ND	ND	ND	ND

Acronyms and Abbreviations:

Italic	Result exceeds Minnesota Department of Health Risk Level Water Criteria.
BOLD	Result exceeds Federal Maximum Contaminant Level.
µg/L	Micrograms per liter.
NA	Not available or not analyzed.
ND	Not detected.
NS	No standard.
TCL	Target Compound List.
VOCs	Volatile Organic Compounds.
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
1,1,1-TCA	1,1,1-Trichloroethane
1,1,2,2-PCA	1,1,2,2-Tetrachloroethane
cis-1,2-DCE	cis-1,2-Dichloroethene.
CT	Carbon Tetrachloride
MC	Methylene Chloride
PCE	Tetrachloroethene
TCE	Trichloroethene
trans-1,2-DCE	trans-1,2-Dichloroethene
VC	Vinyl Chloride

APPENDIX D

SITE INSPECTION CHECKLIST

Site Inspection Checklist

I. SITE INFORMATION	
Site name: FMC corp	**Date of inspection:** 1-16-14
Location and Region:	**EPA ID:**
Agency, office, or company leading the five-year review:	**Weather/temperature:**

Remedy Includes: (Check all that apply)

- Landfill cover/containment
- Access controls
- X Institutional controls
- X Groundwater pump and treatment
- Surface water collection and treatment
- Other_ Pre-ROD Excavation
- Monitored natural attenuation
- X Groundwater containment
- Vertical barrier walls

Attachments: X Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; _____

2. **O&M staff** Tim Ruda - BAE _____ 1-16-14
   Name Title Date
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency MPCA
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; G Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; G Report attached _____

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	**O&M Documents**			
	O&M manual	Readily available	Up to date	N/A
	As-built drawings	Readily available	Up to date	N/A
	Maintenance logs	Readily available	Up to date	N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	Readily available	Up to date	N/A
	Contingency plan/emergency response plan	Readily available	Up to date	N/A
	Remarks			
3.	**O&M and OSHA Training Records**	Readily available	Up to date	N/A
	Remarks			
4.	**Permits and Service Agreements**			
	Air discharge permit	Readily available	Up to date	N/A
	Effluent discharge	Readily available	Up to date	N/A
	Waste disposal, POTW	Readily available	Up to date	N/A
	Other permits	Readily available	Up to date	N/A
	Remarks			
5.	**Gas Generation Records**	Readily available	Up to date	N/A
	Remarks			
6.	**Settlement Monument Records**	Readily available	Up to date	N/A
	Remarks			
7.	**Groundwater Monitoring Records**	Readily available	Up to date	N/A
	Remarks			
8.	**Leachate Extraction Records**	Readily available	Up to date	N/A
	Remarks			
9.	**Discharge Compliance Records**			
	Air	Readily available	Up to date	N/A
	Water (effluent)	Readily available	Up to date	N/A
	Remarks also on line (NPDES)			
10.	**Daily Access/Security Logs**	Readily available	Up to date	N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP
Federal Facility in-house — Contractor for Federal Facility
Other _____

2. **O&M Cost Records**

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate _____ Breakdown attached

Total annual cost by year for review period if available

From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost
From _____ To _____ _____ Breakdown attached
Date — Date — Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A

Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A

Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	Yes	No	N/A
Site conditions imply ICs not being fully enforced	Yes	No	N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date	Yes	No	N/A
Reports are verified by the lead agency	Yes	No	N/A
Specific requirements in deed or decision documents have been met	Yes	No	N/A
Violations have been reported	Yes	No	N/A

Other problems or suggestions:
_____
_____
_____
_____

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks_____
_____
_____

2. **Land use changes on site** N/A
Remarks_____
_____

3. **Land use changes off site** N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks_____
_____

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** Location shown on site map Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   G Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks_____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
   Wet areas Location shown on site map Areal extent_____
   Ponding Location shown on site map Areal extent_____
   Seeps Location shown on site map Areal extent_____
   Soft subgrade Location shown on site map Areal extent_____
   Remarks_____

9.	**Slope Instability** Slides Areal extent_____ Remarks_____	Location shown on site map	No evidence of slope instability

B. Benches Applicable N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench** Remarks_____	Location shown on site map	N/A or okay
2.	**Bench Breached** Remarks_____	Location shown on site map	N/A or okay
3.	**Bench Overtopped** Remarks_____	Location shown on site map	N/A or okay

C. Letdown Channels Applicable N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement** Areal extent_____ Depth_____ Remarks_____	Location shown on site map	No evidence of settlement
2.	**Material Degradation** Material type_____ Areal extent_____ Remarks_____	Location shown on site map	No evidence of degradation
3.	**Erosion** Areal extent_____ Depth_____ Remarks_____	Location shown on site map	No evidence of erosion

4. **Undercutting** Location shown on site map No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ No obstructions
G Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
Vegetation in channels does not obstruct flow
Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance
N/A
Remarks_____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks_____

5. **Settlement Monuments** Located Routinely surveyed N/A
Remarks_____

E. Gas Collection and Treatment	Applicable N/A	
1.	**Gas Treatment Facilities** Flaring Thermal destruction Collection for reuse Good condition Needs Maintenance Remarks_____	
2.	**Gas Collection Wells, Manifolds and Piping** Good condition Needs Maintenance Remarks_____	
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) Good condition Needs Maintenance N/A Remarks_____	
F. Cover Drainage Layer	Applicable N/A	
1.	**Outlet Pipes Inspected** Functioning N/A Remarks_____	
2.	**Outlet Rock Inspected** Functioning N/A Remarks_____	
G. Detention/Sedimentation Ponds	Applicable N/A	
1.	**Siltation** Areal extent_____ Depth_____ N/A Siltation not evident Remarks_____	
2.	**Erosion** Areal extent_____ Depth_____ Erosion not evident Remarks_____	
3.	**Outlet Works** Functioning N/A Remarks_____	
4.	**Dam** Functioning N/A Remarks_____	

H. Retaining Walls	Applicable	N/A	
1.	**Deformations**	Location shown on site map	Deformation not evident
	Horizontal displacement_____	Vertical displacement_____	
	Rotational displacement_____		
	Remarks_____		
2.	**Degradation**	Location shown on site map	Degradation not evident
	Remarks_____		
I. Perimeter Ditches/Off-Site Discharge	Applicable	N/A	
1.	**Siltation**	Location shown on site map	Siltation not evident
	Areal extent_____	Depth_____	
	Remarks_____		
2.	**Vegetative Growth**	Location shown on site map	N/A
	Vegetation does not impede flow		
	Areal extent_____	Type_____	
	Remarks_____		
3.	**Erosion**	Location shown on site map	Erosion not evident
	Areal extent_____	Depth_____	
	Remarks_____		
4.	**Discharge Structure**	Functioning	N/A
	Remarks_____		
VIII. VERTICAL BARRIER WALLS	Applicable	N/A	
1.	**Settlement**	Location shown on site map	Settlement not evident
	Areal extent_____	Depth_____	
	Remarks_____		
2.	**Performance Monitoring**	Type of monitoring_____	
	Performance not monitored		
	Frequency_____	Evidence of breaching	
	Head differential_____		
	Remarks_____		

IX. GROUNDWATER/SURFACE WATER REMEDIES	Applicable	N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks Obtained as necessary

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks

C. Treatment System	Applicable	N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters _____
   Additive (*e.g.*, chelation agent, flocculent) _____
   Others _____
   Good condition Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually _____
   Quantity of surface water treated annually _____
   Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A Good condition Needs Maintenance
   Remarks _____

3. **Tanks, Vaults, Storage Vessels**
   N/A Good condition Proper secondary containment Needs Maintenance
   Remarks _____

4. **Discharge Structure and Appurtenances**
   N/A Good condition Needs Maintenance
   Remarks _____

5. **Treatment Building(s)**
   N/A Good condition (esp. roof and doorways) Needs repair
   Chemicals and equipment properly stored
   Remarks _____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks _____

D. Monitoring Data

1. Monitoring Data
   Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

_____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

_____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

FMC 5 YR Review Inspection

Jacob Knapp	Antea Group
Bryan Zinda	ARCADIS
Denice Nelson	ARCADIS
Tim Rudy	BAE Systems
PAUL LUCAS	ANTEA GROUP
Patricia Krause	EPA Krause.patricia@epa.gov
Sheila Desai	EPA
Shanna Schmitt	MPCA

APPENDIX E

PHOTOGRAPHIC LOG

Photo ID	Description: Mississippi River and Seep Area	Direction
1	Date: 1/16/14	SW

Photo ID	Description: MWW and Pilot Study Area	Direction
2	Date: 1/16/14	SW

Photo ID	Description: RW-2 (background) and Pilot study area	Direction
3	Date: 1/16/14	SE

Photo ID	Description: FMC-48 and MWW in the background	Direction
4	Date: 1/16/14	SE

Photo ID	Description: Monitoring well network on BNSF property	Direction
5	Date: 1/16/14	S

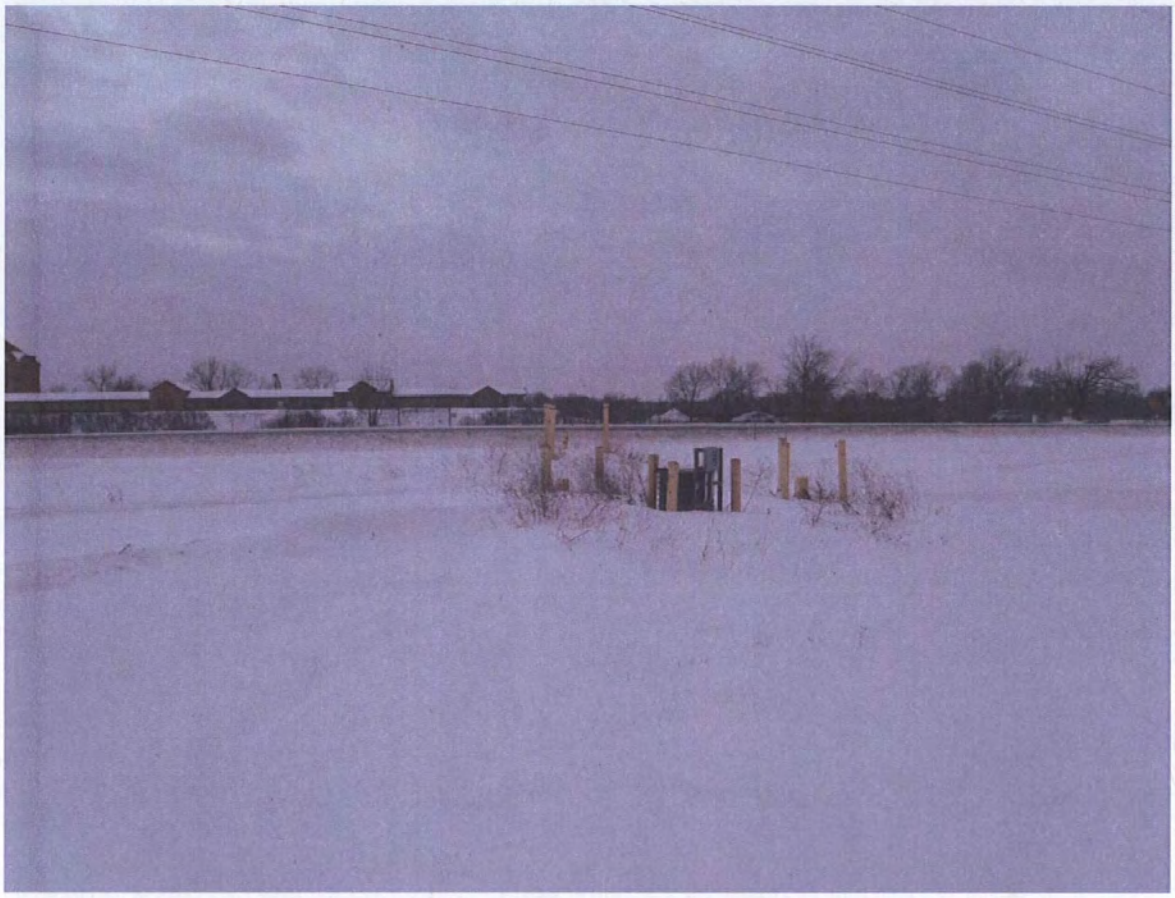

Photo ID	Description: RW-3	Direction
6	Date: 1/16/14	NW

Photo ID	Description: Inside the Air Stripper Building	Direction
7	Date: 1/16/14	NA

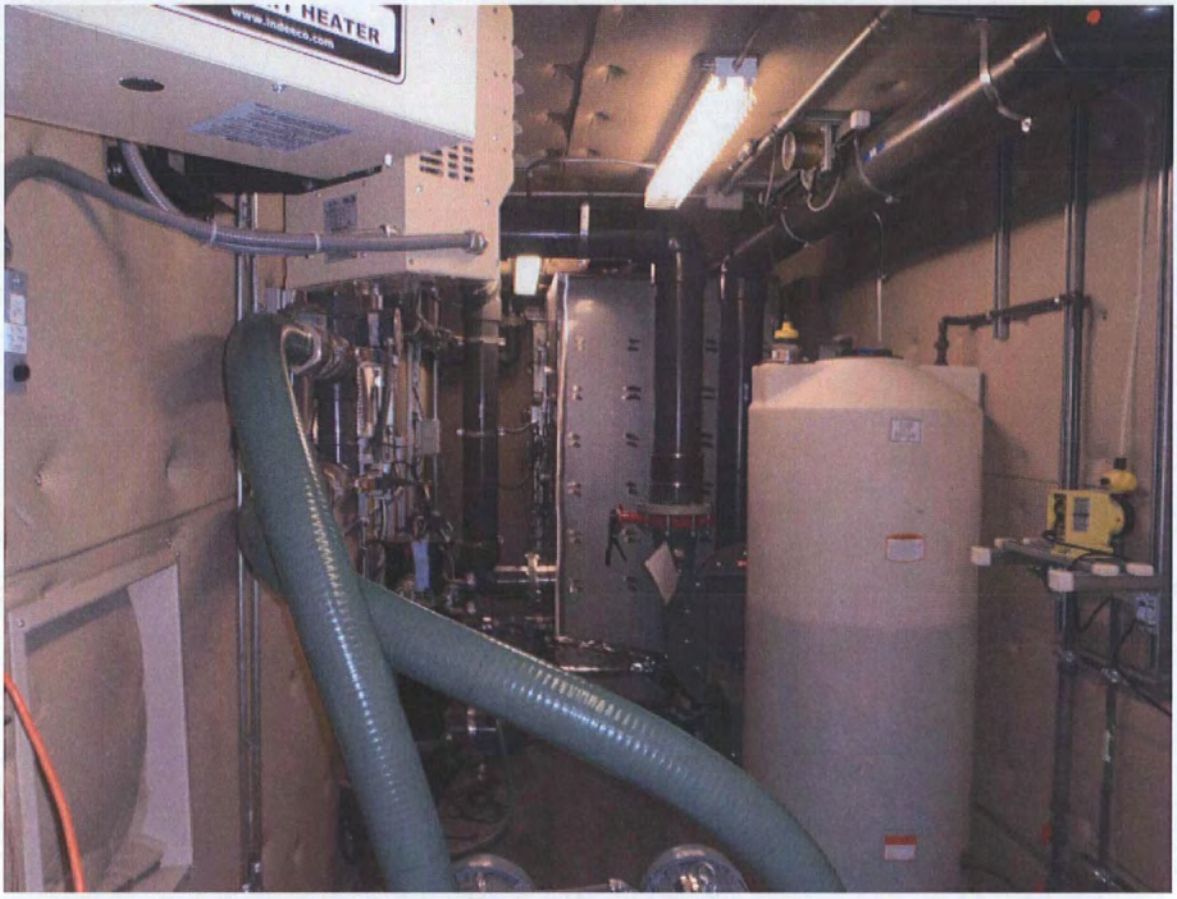

Photo ID	Description: Inside the air stripper building	Direction
8	Date: 1/16/14	NA

Photo ID	Description: Outside the air stripper building	Direction
9	Date: 1/16/14	SE

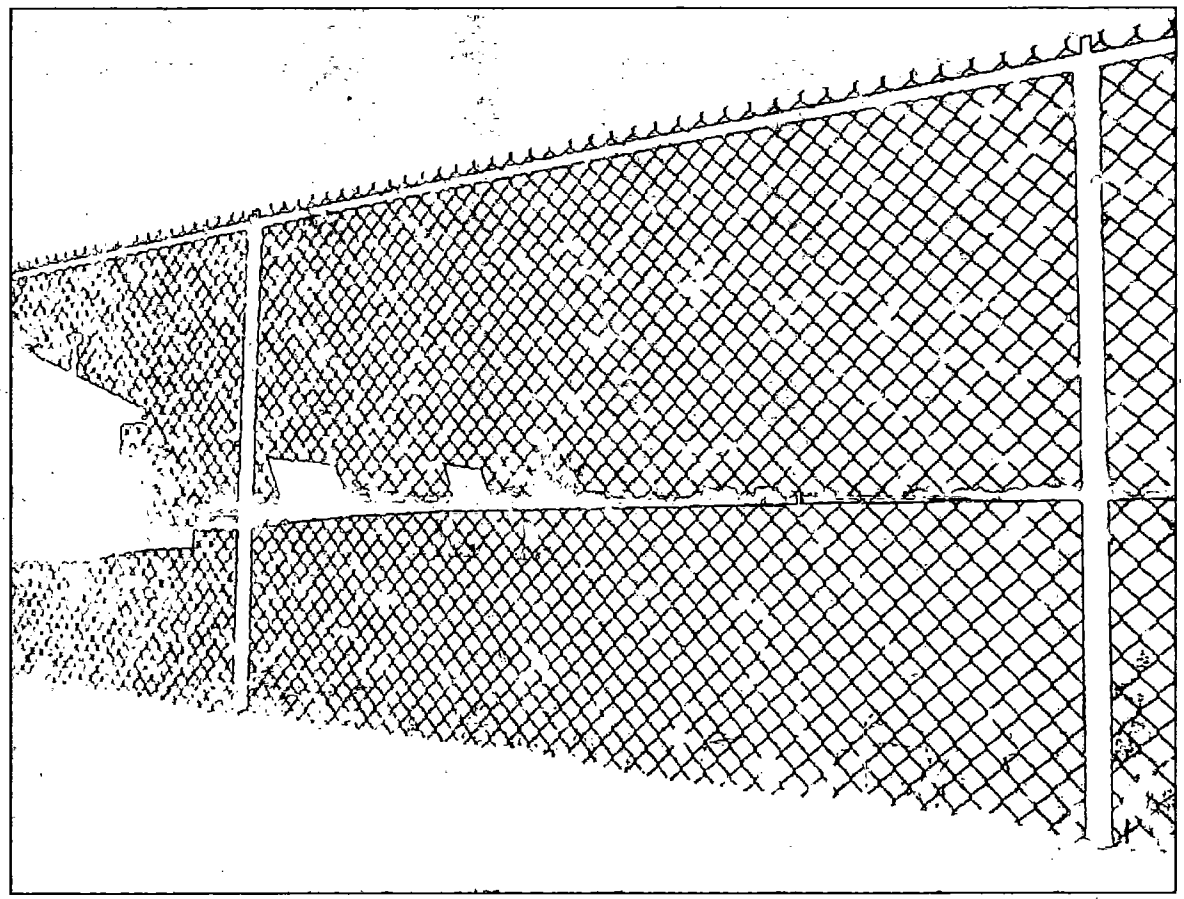

Photo ID	Description: CTF fencing and MW-4	Direction
10	Date: 1/16/14	NE

Photo ID	Description: Through the fence of MWW	Direction
11	Date: 1/16/14	S

Photo ID	Description: Through the fence at the MWW	Direction
12	Date: 1/16/14	SW

Photo ID	Description: Reconstructed Riverbank	Direction
13	Date: 1/16/14	W

APPENDIX F

PUBLIC NOTICE

AFFIDAVIT OF PUBLICATION

STATE OF MINNESOTA)
COUNTY OF ANOKA) ss

Charlene Vold being duly sworn on an oath, states or affirms that they are the Authorized Agent of the newspaper(s) known as:

SF Columbia Heights/Fridley

and has full knowledge of the facts stated below:

(A) The newspaper has complied with all of the requirements constituting qualification as a qualified newspaper as provided by Minn. Stat. §331A.02, §331A.07, and other applicable laws as amended.

(B) This Public Notice was printed and published in said newspaper(s) for 1 successive issues; the first insertion being on 02/21/2014 and the last insertion being on 02/21/2014.

By: Charlene Vold
Authorized Agent

Subscribed and sworn to or affirmed before me on 02/21/2014.

Darlene M MacPherson
Notary Public

DARLENE MARIE MACPHERSON
Notary Public-Minnesota
My Commission Expires Jan 31, 2019

Rate Information:
(1) Lowest classified rate paid by commercial users for comparable space:
$25.40 per column inch

Ad ID 176416

Public Notice

(Official Publication)
Announcement of a Five-Year Review For the FMC Corporation Superfund Site

The Minnesota Pollution Control Agency (MPCA) is beginning a fifth Five-year Review of the FMC Corporation Superfund site. Superfund law requires a review of sites where the cleanup is in progress or cleanup is completed with hazardous waste being managed on site. Five-year Reviews ensure that cleanup efforts protect human health and the environment. The United States Environmental Protection Agency (EPA) is participating in the Five-year Review.

The 18 acre site is located south of 4800 East River Road in Fridley, Minnesota. The site consists of two properties, both formerly owned by FMC. The southern five acre parcel is owned by Burlington Northern/Sante Fe Railroad. The Northern 13 acre parcel is currently owned by BAE Systems Land and Armaments L.P., a successor to FMC.

The FMC Corporation Superfund Site (the Site) was utilized as a disposal site of solvents, paint sludge and plating wastes from manufacturing processes between 1941 and 1969. Contaminated soil at the Site was addressed in 1983. Contaminated soil was placed into an on-site, permitted, storage and treatment facility. In 1983 the site was placed on the EPA National Priorities List (NPL). In 1986 FMC and the MPCA signed a Response Order by Consent that provided a detailed plan for remedial action to be implemented at the Site. The EPA issued a Record of Decision (ROD) for the site documenting the EPA's requirements of the remedial action selected for the site in 1987. The selected remedy for the site includes a groundwater extraction and treatment system, groundwater monitoring, and monitoring of the Minneapolis water intake located in the Mississippi River downstream of the site. The selected remedy is for groundwater extraction and treatment utilizing five pumping wells to remove and discharge groundwater impacted with volatile organic compounds (VOC) into the municipal sanitary sewer. Groundwater monitoring wells are in place at the Site and between the Site and the nearby Mississippi River to evaluate groundwater impacts leaving the Site as the groundwater flows to the river.

In 2013, an Explanation of Significant Difference (ESD) was issued to document changes to the remedy, including: discontinued operation of one extraction well, and treatment of groundwater through an on-site air stripper and discharge of treated water to the Mississippi River under a National Pollutant Discharge Elimination System (NPDES) permit.

The purpose of the five-year review is to ensure cleanup efforts continue to protect human health and the environment. This five year review will also evaluate whether cleanup goals outlined in the 1987 Record of Decision for the Site remain protective of human health and the environment.

A formal meeting or public comment period is not required for this review. The MPCA invites public opinion and comments. Comments should be submitted no later than March 21, 2014 and be directed to the site Project Leader listed below. Local citizens are encouraged to participate by bringing information or any concerns related to this site or requests for more information to the attention of:

Ms. Shanna Schmitt
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155
651.757.2697
shanna.schmitt@state.mn.us

The site MPCA and EPA fact sheets are located at:

- http://www.pca.state.mn.us/index.php/view-document.html?gid=17722
- http://www.epa.gov/region5/superfund/npl/minnesota/MND006481543.html

Site documents are available for review at the St. Paul MPCA office, 520 Lafayette Road North, St. Paul, MN 55155. Please call the MPCA at 651.296.6300 or 1.800.657.3864 to request a file review for the FMC Corporation Superfund Site. These documents will provide more detail on site cleanup history and remedies in place.

2/21/14, 3SF2, FMC Corp Superfund Site, 176416

From: Schmitt, Shanna (MPCA)
To: Jacob Knapp; Paul Lucas
Subject: FW: FMC Superfund & MWW - May data?
Date: Thursday, August 21, 2014 11:29:42 AM

Annika missed the comment period...they only get the Star Tribune there. FYI, Shanna

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From: Bankston, Annika M. [mailto:Annika.Bankston@minneapolismn.gov]
Sent: Wednesday, August 20, 2014 5:03 PM
To: Schmitt, Shanna (MPCA); Sheila Desai (desai.sheila@epa.gov)
Subject: RE: FMC Superfund & MWW - May data?

I will frame my comments based on the interview questions in Appendix B of the 2009 5-Year Review:

Are you aware of any complaints or Incidents that may have affected the Site?
ANSWER: No.

Do you feel well informed about the Site?
ANSWER: No. To my knowledge, Minneapolis has not received reports or updates of remediation activities or assessments. Minneapolis Water has not been part of any multi-party discussions between MPCA and BAE Systems to address potential vapor intrusion risks at our facilities. Nor have we received any communications or recommendations regarding limiting access to the seep along the property. Monitoring data was made available from MPCA once we requested.

Do you have any comments or concerns about the Site?
ANSWER: Yes - Minneapolis Water remains concerned about the issues identified in the Section VIII of the previous 5-Year review (2009) and also concurs with MPCA's position on short term protectiveness in that report. Our own sampling conducted in 2014 indicates presence of TCE and PCE in the sub slabs of multiple treatment buildings which lead to concerns regarding possible vapor intrusion into our treatment buildings and processes.

Have any city policies changed that may affect the Site protectiveness?
ANSWER: No

Do you know of any planned future policy changes that could affect the Site?
ANSWER: No

Do you know of any planned future land use changes that could affect the Site?
ANSWER: Yes - Additional below-ground clearwells are planned south of Fridley Filter Plant as part of upcoming (2015 - 2019) filter rehabilitation project. Dewatering will likely be needed for construction of those clearwells. Further, we are evaluating installation of a dewatering pump system around our Fridley Softening Plant in order to reduce or eliminate the flooding and uplift in the plant that occurs during times of high groundwater levels.

How many people are serviced by operations at the MWW?
Minneapolis Water provides the full supply of drinking water to the cities of Minneapolis, Crystal,

Golden Valley, New Hope, Columbia Heights, Hilltop, and the Morningside area of Edina. Approximate residential population is 478,000. In addition, Minneapolis provides a portion of the supply for the City of Bloomington (population 85,600), meaning a total affected population of approximately 563,000

Thank you for the opportunity to comment. Do you know how Minneapolis Water would have (should have) been aware of the public comment period back in January? I'd like to keep it on my and others' radar.

Annika M. Bankston, P.E.
Superintendent of Water Plant Operations & Maintenance

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