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Five-Year Review Report
Fourth Five-Year Review Report
For
FMC Corporation (Fridley Plant)
Fridley
Anoka County, Minnesota

September, 2009

PREPARED BY:

Minnesota Pollution Control Agency
St. Paul, Minnesota

As Modified by
The United States Environmental Protection Agency
Region 5
Chicago, Illinois

Approved by:

Date:

Richard C. Karl
Director
Superfund Division

9/30/09

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List of Acronyms

ACL	Alternate Concentration Levels
AMR	Annual Monitoring Reports
ARAR	Applicable or Relevant and Appropriate Requirements
BAE	BAE Systems Land and Armaments L. P.
BGS	Below Ground Surface
BNR	Burlington Northern Railroad
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
COC	Contaminants of Concern
CTF	Containment and Treatment Facility
FS	Feasibility Study
HRL	Health Risk Levels
ICs	Institutional Controls
LLC	Limited Liability Company
LMCL	Listed Maximum Concentration Levels
MCES	Metropolitan Council Environmental Services
MCL	Maximum Contaminant Level
MDH	Minnesota Department of Health
MERLA	Minnesota Environmental Liability and Response Act
mg/l	Milligrams per liter
MPCA	Minnesota Pollution Control Agency
MWW	Minneapolis Water Works
NCP	National Contingency Plan
NIROP	Naval Industrial Reserve Ordinance Plant
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OU	Operating Unit
OU1	Operating Unit 1
PCE	Tetrachloroethene
POTW	Publicly Owned Treatment Works
PPM	Parts Per Million
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAI	Recommended Allowable Limits
RAOs	Remedial Action Objectives
RAP	Response Action Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation

ROD	Record of Decision
RP	Responsible Party
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
TBC	To Be Considered
TBE	To Be Evaluated
TCE	Trichloroethene
UDLP	United Defense Limited Partnership
ug/l	micrograms per liter
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UU/UE	Unrestricted Use/ Unlimited Exposure
VOC	Volatile Organic Compound
VFD	Variable Frequency Drive
WasteLAN	Regional Database related to CERCLIS

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Executive Summary

On behalf of the United States Environmental Protection Agency (US EPA), the Minnesota Pollution Control Agency (MPCA) has completed a five-year review of the remedial action (RA) implemented at the FMC Site (Site) located in Fridley, Minnesota. This is the fourth five-year review for the Site which evaluates the effectiveness of the RA to date.

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 remedial actions included construction of an on-site containment and treatment facility (CTF) to treat and contain soils contaminated with volatile organic compounds (VOCs) in 1983. 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 down gradient of the Site.

Protectiveness Statement(s):

The protectiveness of the current remedy as concluded by this five-year review is as follows:

Groundwater

The remedy selected to address groundwater contamination is currently protective of human health and the environment in the short term^a. 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;
- MCLs 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 institutional controls are 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, additional institutional controls on BAE property and nearby property will be evaluated.
- Remedial action addressing exposure at the seep must be completed (if

^a See Appendix A for MPCA's position on the short term protectiveness.

- 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 Report to be made.

Soil

Soil removal actions were conducted prior to implementation of the ROD and decision documents for the Site. The US 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 institutional controls 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.

Site Wide

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 in the groundwater and recommendations section of this five-year review must be implemented. The soil removal actions and CTF have been identified by the MPCA and US EPA as protective, although institutional controls are may be needed to assure long-term protectiveness.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): FMC Corporation; (from CERCLIS); FMC Corp. (Fridley Site)		
EPA ID (from WasteLAN): MND006481543		
Region: 5	State: MN	City/County: City of Fridley/Anoka County
SITE STATUS		
NPL status: Final		
Remediation status (choose all that apply): Operating		
Multiple OUs?* NO	Construction completion date: 12 / 15 /1987	
Has site been put into reuse? NO		
REVIEW STATUS		
Lead agency: Minnesota Pollution Control Agency		
Author name: Deepa de Alwis		
Author title: Project Leader	Author affiliation: MPCA	
Review period:** 9 / 15 /2008 to 3 / 1 7/ 09		
Date(s) of site inspection: 11 / 12 / 2008		
Type of review: Post-SARA		
Review number: 4 (fourth)		
Triggering action: Previous Five-Year Review Report		
Triggering action date (from WasteLAN): 3 /17 /2004		
Due date (five years after triggering action date): 3 /17 /2009		

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form cont'd.

Issues:

Issues identified by this five-year review are summarized below:

- Remedial Action Objectives (RAOs) from the previous decision documents are unclear.
- MCL or health based cleanup values have not been achieved at the site boundary as required by the ROD.
- Data reviewed related to groundwater capture is inconsistent and/or not up to date. Additional evaluation of the capture zones of the groundwater extraction system is necessary. At the time of this review, data was not available to review the effect the Variable Frequency Drive (VFD) installed at RW2 has on the capture zone.
- A seep downgradient of the site provides a potential exposure pathway for VOC impacted groundwater.
- The monitoring well network at the Site is not adequate to provide data representative of current groundwater conditions. The existing monitoring wells in place do not provide adequate plume delineation downgradient of the Site.
- Institutional controls must be evaluated to ensure protectiveness. If these institutional controls are found to be inadequate, additional institutional controls will be needed to ensure all activities at the site are protective.

Recommendations and Follow-up Actions:

Recommendations identified by this five-year review are necessary to assure long-term protectiveness at the Site. Recommendations identified by this report include:

- Further development and clarification of RAOs stated in the ROD.
- Further evaluation of the extraction system capture zones;
- Update system capture zone information;
- Evaluate options to control potential exposure at the seep;

- Enhance existing monitoring well network and improve data presentation and trend analysis in Site monitoring reports.
- Evaluate existing institutional controls and implement additional ICs as necessary.

Recommendations and follow-up actions are detailed in Section IX of this five-year review. If the ROD is determined to be inadequate to ensure implementation of the recommendations and follow up actions, the ROD may be revised by an Explanation of Significant Differences (ESD) or a ROD Amendment.

Protectiveness Statement(s):

The protectiveness of the current remedy as concluded by this five-year review is as follows:

Groundwater

The remedy selected to address groundwater contamination is currently protective of human health and the environment in the short term^b. In order for the remedy to be protective in the long-term the actions need to be completed as listed in the Executive summary on page 9.

Soil

Soil removal actions were conducted prior to implementation of the ROD and decision documents for the Site. The US 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 institutional controls should be implemented and monitored to assure the CTF remains protective in the long-term.

Site Wide

The selected remedy to address groundwater contamination at the site is protective of human health and the environment in the short term^b. 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 five-year review should be implemented. The soil removal actions and CTF have been identified by the MPCA and US EPA as protective, although institutional controls are necessary to assure long-term protectiveness.

^b See Appendix A for MPCA's position on the short term protectiveness.

Five-Year Review Report

I. Introduction

The Purpose of the Review

The purpose of the five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Five-Year Review

The Minnesota Pollution Control Agency (MPCA) is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §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.

The MPCA interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §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 action no less often than every five years after the initiation of the selected remedial action.

Who Conducted the Five-Year Review

The MPCA, in consultation with the United States Environmental Protection Agency (US EPA)

Region 5, has conducted a five-year review of the remedial actions implemented at the FMC Site in Fridley, Minnesota. The MPCA conducted the review from September 2008 through September 2009. This report documents the results of the review conducted with the assistance of MPCA contractor, Delta Consultants of St. Paul, Minnesota. The MPCA is the lead environmental regulatory agency for the implementation and oversight of response actions at the FMC Site.

Other Review Characteristics

This is the fourth five-year review for the FMC Site. The triggering action for this statutory review is the date of the previous five-year review, as shown in the US EPA WasteLAN database: March 17, 2004. This five-year review was conducted by the MPCA following US EPA requirements as stated in the Superfund Amendments and Reauthorization Act (SARA) of 1986. US EPA statutory review is required for sites where hazardous substances will remain on-site upon completion of the remedial action and the Record of Decision (ROD) was signed after October 17, 1986. The ROD for the FMC Site was signed on September 30, 1987, and based on performance criteria established by the ROD it is likely that hazardous materials will remain on-site preventing unlimited use and unrestricted exposure.

II. Site Chronology

Table 1: Chronology of Site Events

Event	Date
Former FMC employee informed the MPCA of the disposal of industrial and hazardous waste from the 1940's 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	June 8, 1983
The FMC Site was place on the National Priorities List (NPL)	September 8,1983

Table 1: Chronology of Site Events

Event	Date
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 Minnesota Environmental Liability and Response Act (MERLA) for the implementation of the RA.	October 28, 1986
FMC Site ROD is signed, which documented the US 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 Report.	September 30, 1992
Completion of the Second Five-Year Review Report.	March 30, 1999
Extraction Well Capture Zone Analysis	June 2003 and June 2004
Completion of the Third Five-Year Review Report	March 17, 2005
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 preformed.	August 2007

III. Background

Physical Characteristics

The FMC Site is located on East River Road within the City of Fridley in Anoka County, Minnesota (Figure 1). The FMC Site consists of 18 acres including 5 acres purchased by Burlington Northern Railroad (BNR) from FMC 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 2 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 storm water retention pond and an above ground storage tank (AST). 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 discussed further in the Initial Response portion of this review.

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 MWW property to the south west; and commercial/light industrial 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 supply. At the time of this five-year review 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 are 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 1980's and 1990's. This five-year review report addresses only the FMC Site.

Disposal of waste generated by the naval ordnance manufacturing facility occurred on portions of the FMC Site between the 1940's and 1969. Wastes disposed of on the FMC Site included:

plating wastes, paint, paint sludges, oils, bottom ash, chlorinated and non-chlorinated solvents.

In 1980, MPCA staff received information regarding the past disposal practices at the Site and requested FMC initiate an investigation to determine the extent of contamination. The investigation revealed that soil in the disposal areas were contaminated with Volatile Organic Compounds (VOCs). During the investigation, 44 drums containing hazardous materials were discovered and disposed of 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 Minneapolis Water Works (MWW) raw water intake. Additional investigation of the surface water in the Mississippi River 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, an Administrative Order and Interim Response Order by Consent (Consent Order) regarding impacted soil at the Site were executed by FMC, the MPCA and the US EPA. Soil identified as having a VOC concentration of one part per million (ppm) or greater was excavated if above the groundwater table. The 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 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 FMC Site annual monitoring reports (AMR). The location of the CTF and excavated areas are shown on Figure 3.

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.

The ROD for the site was signed on September 30, 1987 and identifies the selected remedy to address VOC contaminated groundwater at the Site. Groundwater is the only operable unit identified by the ROD. In December 1987, construction of the groundwater extraction system was completed. The system consists of five extraction wells discharging to the municipal sanitary sewer. Groundwater is discharged under permit to a publicly owned treatment works (POTW) operated by the Metropolitan Council Environmental Services (MCES). Three of the groundwater extraction wells (RW3, RW4, and RW5) are completed in the confined aquifer. Two of the groundwater extraction wells (RW1, RW2) are completed in the shallow unconfined aquifer. The groundwater extraction system has been in operation since December 7, 1987. However, operation of RW1 was discontinued shortly after system startup due to the well pumping dry.

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 Administrative Order by Consent. The soil removal and containment successfully controlled risk to human health and the environment associated with soil contamination at the Site.

Groundwater

Contaminants of concern (COC) 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 south west 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 COC entering the river.

IV. 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 selected remedy described in the ROD includes three parts:

- 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;
- 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 maximum contamination levels (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.

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 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 RW2 and RW3 quarterly for VOC concentrations.
- Sample RW4 and RW5 semi-annually for VOC concentrations.
- Monitor extracted groundwater for the duration of system operation.

The groundwater extraction and containment remedy utilizes five groundwater extraction wells that discharge to the municipal sanitary sewer for treatment at the Pigs Eye Waste Water Treatment Facility, a POTW, operated by the Metropolitan Council Environmental Services (MCES). 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 and unconfined aquifers annually for VOC concentrations.
- Wells are selected for sampling prior to each sampling event.
- Annual monitoring reports are submitted.
- The confined and unconfined 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, the US EPA adopted this selected remedy as described in the ROD. The groundwater extraction system consists of five 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 discharged to the sanitary sewer. The purpose of the spray nozzle is to allow VOCs to volatilize.

Construction of the groundwater extraction system was completed on December 7, 1987. RW1 was found to continually run dry and has not operated since December 15, 1987. The groundwater extraction system construction is complete and its operation is ongoing.

Extraction wells RW1 and RW2 are completed in the unconfined aquifer in the BNR portion of the Site. RW2 is the only extraction well completed in the unconfined aquifer currently operating at the Site. The 2007 AMR identifies RW2 as the most effective extraction well with regards to VOC removal.

Extraction wells RW3, RW4 and RW5 are completed in the confined 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 RW3 and RW4. In October 2002 the performance of extraction wells RW3 and RW4 was enhanced by installing larger pumps.

Capture zone analysis of the extraction system conducted in 2002 and 2003 evaluated the ability of the groundwater extraction system to prevent off-site migration of VOC impacted groundwater. The results of the capture zone analyses are discussed in Sections V, VII and VIII of this report.

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 previously in the Remedy Selection portion of this report. Groundwater monitoring is conducted at the Site in accordance with the QAPP. All samples collected are analyzed for VOCs.

- Groundwater samples are collected from 20 monitoring wells annually in October for laboratory analysis of selected VOCs.
- Groundwater elevation measurements are obtained on a quarterly basis to determine groundwater flow and influence of the extraction well system.
- Samples are collected for analysis of selected VOCs from the MWW intake, FMC-21A and FMC-21B as required by the receptor monitoring portion of the ROD.
- Samples are collected from RW2 and RW3 on a quarterly basis (February, May, August, and November).
- Samples are collected from RW4 semi-annually (February, August).
- Samples are collected from RW5 semi-annually (May, November).

Adjustments to the monitoring well network have been made since the previous five-year review. These include: well replacement, well modifications and installation of additional wells. The changes to the monitoring well network were made at the request of the MPCA. 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.

Institutional Controls

Institutional controls are required to ensure the protectiveness of the remedy. ICs are non-engineered instruments, such as administrative and legal controls that help to minimize the potential for human exposure to contamination and that protect the integrity of the remedy. ICs are required to assure the long-term protectiveness for any areas which do not allow for unlimited use or unrestricted exposure (UU/UE), and are required also to maintain the integrity of the remedy. ICs are required at the Site because the remedy has not yet achieved full protectiveness necessary for UU/UE.

Institutional controls (ICs) limiting the use of groundwater and construction of new groundwater production wells at and adjacent to the FMC Site are identified in the ROD as a part of the selected remedy for the Site. Institutional controls identified by the ROD include: 1) the

Minnesota Department of Health (MDH) approval authority over well construction and placement and 2) a City of Fridley ordinance prohibiting installation of a potable water supply well where municipal service is reasonably available. Institutional controls described by the ROD are considered to be complete, although more evaluation is necessary to ensure that institutional controls are providing long term protection.

Currently, the Site is subject to the institutional controls listed in the table below:

Table 2: Current Institutional Controls in Place

Areas that Do Not Support UU/UE Based on Current Conditions	IC Objective in Decision Document	Physical Area covered by Implemented IC
Groundwater	Limit groundwater use through existing State and City ordinances and regulations.	MDH well approval authority applies to wells constructed throughout the State (Minnesota Rule 4725.1830). City of Fridley Ordinance requiring municipal water supply applies throughout the City of Fridley.

Interviews with the MDH and the City of Fridley confirmed that institutional controls identified in the ROD remain in place. The MDH indicated that their policy for well notification and installation is in place and that the City of Minneapolis has a similar notification process that applies to the area downgradient of the Site as well. The City of Fridley requires water users to connect to the existing municipal water supply.

Summary of IC Evaluation Activities and Need for Additional Work

A map which depicts the current conditions of the Site and areas which do not allow for UU/UE will be developed in the IC plan discussed below.

Table 3: Future Institutional Controls

Media, Engineered controls and areas that do not support UU/UE	IC Objective	IC Instrument Implemented or To Be Evaluated (TBE)
Groundwater	To Limit well construction	Minnesota Rule 4725 (Implemented)
Groundwater	Requirement for municipal water supply use	City of Fridley (Implemented)

Media, Engineered controls and areas that do not support UU/UE	IC Objective	IC Instrument Implemented or To Be Evaluated (TBE)
BAE property and groundwater	Prohibit construction, excavation or other access to soil and groundwater within areas identified as non-UU/UE.	Restrictive Covenant(TBE)
BNR property and groundwater	Prohibit construction, excavation or other areas to soil and groundwater within areas identified as non-UU/UE	Restrictive Covenant (TBE)
MWW property and groundwater	Prohibit access to groundwater by methods other than well construction for areas identified as non-UU/UE	IC options to be evaluated (TBE)
Anoka County Park and groundwater	Prohibit access to groundwater by methods other than well construction for areas identified as non-UU/UE	IC options to be evaluated (TBE)

At this time, although all ICs required by the ROD have been implemented, additional ICs may be needed to ensure the protection of the remedy is necessary to ensure effective long-term stewardship for all non-UU/UE areas of the Site. The ICs currently in place at the Site address specific activities and practices (well construction, municipal water connection). The evaluation of existing ICs indicate that additional ICs maybe needed beyond those identified in the ROD to ensure the remedy is protective of human health and the environment in the long-term. The evaluation of additional ICs will be done in an IC plan.

The IC plan will look at the development of additional ICs and an IC monitoring and evaluation program to ensure long-term protectiveness at the Site. Additional ICs in the form of restrictive covenants for all areas on-site where UU/UE has not or will not likely be achieved will be developed. The process of implementing additional ICs should include review of the legal descriptions and confirmation of property ownership of affected properties to assure that all non-UU/UE areas are addressed and covered by ICs developed. The restrictive covenants developed should include detailed descriptions of areas where UU/UE has not or will not be achieved. Review of available institutional control methods for off-site properties should be conducted to evaluate the most appropriate control method(s) for affected areas. To determine the need for additional institutional controls, an IC plan for the Site should be developed to review, implement, maintain, monitor and enforce the institutional controls for the Site.

Current Compliance

There are currently no known IC compliance issues at the Site. The ICs identified in the ROD appears to be functioning as intended based on the interviews and Site inspections. The MDH indicated that their policy for well notification and installation is in place and that the City of Minneapolis has a similar process that applies to the area downgradient of the Site as well. The City of Fridley stated they require water users to connect to the existing municipal water supply.

While the existing ICs are protective for preventing use of contaminated groundwater, additional development of ICs and IC evaluation activities are needed to assure long-term protectiveness. Those additional activities include: enacting deed restrictions to assure that all required objectives are effectively addressed by the instruments; reviewing the legal descriptions to assure that all non-UU/UE areas are addressed; and assuring that effective ICs cover all areas which do not allow for UU/UE. This IC review should also include mapping activities: performance of a title search to confirm ownership and note any possible inconsistent encumbrances; and, assuring long-term stewardship at the Site.

Long-Term Stewardship

Compliance with ICs is necessary to assure long-term protectiveness of the remedy. Planning for long-term stewardship is required to assure the remedy functions as intended.

Long-term stewardship involves assuring effective procedures are in place to properly maintain and monitor the Site. Long-term stewardship will ensure that the Site remedy including effective ICs are maintained and monitored so that the remedy continues to function as intended. Future Site monitoring plans should include regular IC monitoring and evaluations to ensure ICs remain protective. Future monitoring reports should include progress/protectiveness reports evaluating ICs currently in place, in progress or developed for the Site.

System Operations/O&M

During this review period the groundwater extraction system was operated by BAE. Unscheduled downtime due to power supply interruption, equipment malfunction or failure was addressed as necessary. As stated in the 2007 AMR and by BAE during the Site visit, anticipated maintenance including extraction system cleaning occurred as necessary when flow rates were determined to be approximately 65 to 75 percent of flow capacity. Actual flow capacity was not identified in the documents reviewed for this five-year review.

Annual operation and maintenance at the Site includes: monitoring flow rates at each extraction well, monitoring total system flow and discharge rates, quarterly monitoring of groundwater elevations at selected monitoring wells, maintenance and repair to the groundwater extraction system (as necessary) and weekly operational and equipment inspections. Extraction well monitoring includes quarterly or semi-annual sample collection for laboratory analysis of VOCs from each well. Additionally samples of the system effluent are collected monthly as required

by the MCES permit.

Data collected from Site investigation activities documented in the 2004 Arcadis report entitled Results of Vertical Aquifer Profiling and Seep Assessment indicate a hydraulic connection between wells FMC 14 (located near RW4) and USGS-6 located near the seep on the river bank. The report recommended elevating the pump at RW4 to attempt to limit groundwater travel through this suspected preferential pathway and increase TCE removal from the confined aquifer. In August 2004, the pump in RW4 was elevated 14 feet within the well and remained in that position until August 2005. A March 2005 report by Arcadis, Results of Monitoring Well Installation and Extraction Well Modification, concluded that significant changes in TCE concentrations were not observed at RW4 while the pump was elevated. The 2005 report concluded that RW4 was hydraulically connected to FMC-14.

Monitoring reports have indicated groundwater recovery rates at RW2 have required occasional shut down of this extraction well. In October 2008 BAE installed a variable frequency drive (VFD) to control pumping rates of RW2 and eliminate the need for pump shut down by maintaining a constant water table elevation. The VFD adjusts the pumping rate of RW2 to maintain the water level in the well at approximately 43 feet below ground surface (bgs) according to BAE during the Site visit. BAE indicated that the VFD was installed to control the pumping rate at RW2 and minimize downtime for this well.

During the Site inspection, BAE also indicated that annual operations and maintenance costs over this review period are approximately \$300,000 per year. BAE indicated that the majority of the annual cost is for water discharge to the sanitary sewer. They also indicated that the cost for water disposal is anticipated to increase in the near future, due to anticipated rate increases by MCES.

Table 4: Annual System Operations/O&M Costs

Dates: 2003-2008		Total Cost rounded to nearest \$100,000
Approximate annual O&M costs during this review period		
		\$300,000 per year (According to Doug Hildre during Site visit)

V. Progress Since The Last Review

The protectiveness statement from the last five-year review dated March 17, 2004 is as follows:

“The remedy is functioning as intended and is protective of human health and the environment in the short term. Long term protectiveness needs to be verified based on the follow up actions and recommendations. The remedy would be confirmed to be fully

protective if recommendations and performance standards cited in Section IX are implemented and met.”

Table 5 describes issues and recommendations from the last five-year review, follow up actions, outcomes and relevant dates.

Table 5: Issues, Recommendations and Actions from the Last Five-Year Review

Issue or Recommendation from Previous Review	Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Inadequate data to determine if the revisions to the pumping rate have increased the efficiency of the capture zone.	Arcadis completed an evaluation of increased pumping rates on behalf of UDLP. The results of the evaluation are documented in a memorandum included as Appendix F, in the June 2004 Monitoring Report.	BAE	None Stated	Capture zones of extraction wells were evaluated and found to be inadequate to completely capture groundwater migrating off-site in the confined aquifer.	June 2004

Issue or Recommendation from Previous Review	Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
<p>Inadequate monitoring network to evaluate the off-site migration of the plume in the confined and unconfined aquifers.</p>	<p>Arcadis performed multiple aquifer profile investigations at the Site. While on-site, modifications to the monitoring well network were performed. Modifications are documented in various reports and discussed below.</p>	<p>BAE</p>	<p>None Stated</p>	<p>Modifications to the monitoring well network were implemented at the request of the MPCA. Further modifications are necessary to completely delineate the Site's plume.</p>	<p>Various</p>
<p>A further definition of the lateral and vertical extent and magnitude of the contaminant plume in the unconfined and confined aquifers is necessary as outlined in the MPCA letter dated June 2, 2003.</p>	<p>Arcadis performed multiple aquifer profile investigations at the Site.</p>	<p>BAE</p>	<p>None Stated</p>	<p>Vertical aquifer profiling and Site assessments improved vertical and horizontal delineation of the groundwater plume. However, comprehensive delineation is still incomplete.</p>	<p>Various</p>

Issue or Recommendation from Previous Review	Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Further evaluation of the effectiveness of the increased pumping rate at RW3 and RW4.	Arcadis completed an evaluation of increased pumping rates on behalf of UDLP. The results are documented in a memorandum included as Appendix F, in the June 2004 Monitoring Report.	BAE	None Stated	Capture zones of extraction wells were evaluated and found to be inadequate to completely capture groundwater migrating off-site in the confined aquifer.	June 2004
An evaluation should be performed to determine if the existing remedial system is capturing contamination at and downgradient of RW1.	Arcadis completed an evaluation of extraction well capture zones on behalf of UDLP. The results are documented in a memorandum included as Appendix F, in the June 2004 Monitoring Report.	BAE	None Stated	The confining clay layer was determined to limit the migration of groundwater in the unconfined aquifer in the area of RW1 and RW2. Additional information and groundwater elevation data provided in the June 2008 AMR does not support this claim.	June 30, 2003 and June 30, 2004

Issue or Recommendation from Previous Review	Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Annual monitoring reports should be more concise. Detailed data presentation and interpretation should be included in the AMR.	Submitted AMRs since the previous five-year review have consistently included additional information recommended by the previous five-year review.	BAE	None Stated	Additional information has been included in AMRs submitted to the MPCA during this review period. Further improvements should be included in future AMRs.	Continuing
If data from the modified monitoring well network indicates protectiveness is not achieved, modifications to the current remedy or alternative remedial actions should be proposed and implemented.	Review of available data indicates long-term protectiveness has not yet been achieved.	BAE MPCA US EPA	None Stated	Documents reviewed did not indicate consideration or proposal of alternative remedial actions to address groundwater contamination associated with the Site.	None

Issue or Recommendation from Previous Review	Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Recommendations listed above should be addressed as soon as possible and certainly soon enough that the effectiveness of the implemented recommendations can be evaluated in the next five-year review.	Most of the recommendations from the previous five-year review have been addressed. Further action to fulfill incomplete recommendations should be addressed as soon as possible.	BAE MPCA US EPA	None Stated	Various	Various

Recommendations from the previous five-year review and actions taken to address issues described in the previous five-year review are detailed below.

Previous Recommendation #1:

A further definition of the lateral and vertical extent and magnitude of the contaminant plume in the unconfined and confined aquifers is necessary as outlined in the MPCA letter dated June 2, 2003.

Additional assessment of the vertical and horizontal extent of contaminated ground water at the Site was completed through multiple subsurface investigations conducted at the Site since the previous five-year review. The following reports detail Site activities and conclusions regarding the extent of contamination at the Site:

- Results of Vertical Aquifer Profiling and Seep Assessment, Arcadis, August 19, 2004;
- Results of Monitoring Well installation and Extraction Well Modification, Arcadis, March 1, 2005;
- Results of Vertical Aquifer Profiling and Seep Assessment, Arcadis, February 15, 2006;
- Results of the Dye Tracer Study, Arcadis, August 22, 2007.

These reports concluded:

- 1) The horizontal extent and magnitude have been defined on the MWW property based on data collected during annual groundwater sampling

- events and modifications made to the monitoring well network.
- 2) On-site investigations also provided evidence of hydraulic connection and a possible preferential pathway in the subsurface between wells FMC-14, USGS-6 and the seep on the riverbank.
 - 3) Vertical aquifer analysis identified that VOC concentrations decreased with distance from the confining clay layer.

The data reviewed during this five-year review does not support the first and second conclusions of these reports:

- 1) Information identifying the extent and magnitude of groundwater conditions in the confined aquifer on the southern portion of the BNR property is unavailable due to the absence of monitoring wells completed within the confined aquifer.

Data related to the extent and magnitude of the plume within the unconfined aquifer downgradient of the BNR property can not be collected utilizing the current monitoring well network on the MWW property. All monitoring wells downgradient of the BNR portion of the Site are completed in the confined aquifer. Additional data from the unconfined aquifer downgradient of the BNR portion of the Site is necessary. Recent data, as discussed in Section VII, Question C, has indicated TCE concentrations exceeding MCL or health based cleanup levels are present within the BNR portion of the Site in an area outside the capture zone of RW2.

- 2) Additional investigation including the dye tracer study listed above has not been able to confirm the presence of a preferential pathway in the area between FMC-3 and USGS-6 and the seep on the riverbank.

The data reviewed during this five-year review supports conclusion 3 of these reports.

- 3) Samples collected during the vertical aquifer profiling studies from the confined aquifer at greater depths below the clay layer had lower VOC concentrations than samples collected closer to the clay layer.

Previous Recommendation #2:

The off-site monitoring network should be evaluated after the lateral and vertical extent and magnitude of the contaminant plumes have been defined. Modifications to the monitoring well network should be proposed and implemented. The well network should monitor the lateral and vertical extent and magnitude of the off-site plumes, the effectiveness of the groundwater capture system in preventing the off-site migration of contaminant plumes, the progress of the groundwater cleanup in achieving

cleanup goals and should evaluate potential exceedances of the surface water standards prior to plume discharge to the Mississippi River.

Modifications to the monitoring well network have been implemented throughout this review period. The following monitoring well network modifications were implemented during this review period as documented in the submitted AMRs:

- 2004: Replaced wells FMC-53 and FMC-54;
Installed FMC-54A, FMC-21A, FMC-21B and FMC-35A;
- 2005: Installed FMC-70;
Abandoned FMC-39;
Modified screen lengths of FMC-37, FMC-45, FMC-53 and FMC-54.
(Monitoring wells FMC-53 and FMC-54 were reported to have been replaced in Section 2 of the Groundwater Extraction System Annual Monitoring Report for 2004, submitted in 2005.)
- 2006: Installed FMC-71;
- 2007: No documented changes to the monitoring well network.

The monitoring well network modifications were generally implemented on the MWW property to the south and west of the Site. Wells FMC-53, FMC-54, FMC-54A, FMC-21B, FMC-35A and FMC-71 were completed in the confined aquifer. Wells FMC-21A and FMC-70 were completed in the unconfined aquifer.

The monitoring well network is still not sufficient to monitor the groundwater plume at and downgradient of the Site. Groundwater within the unconfined aquifer downgradient of the BNR property can not be monitored due to the absence of downgradient, unconfined aquifer monitoring wells. Additionally, groundwater within the confined aquifer in the southern portion of the BNR property can not be monitored due to the absence of confined aquifer monitoring wells in this portion of the Site.

Previous Recommendation #3:

A further evaluation of the effectiveness of the increased pumping rate at RW3 and RW4 on the capture zone and plume migration is needed.

Evaluation of the increased pumping rates in RW3 and RW4 was discussed in a 2003 Arcadis technical memorandum submitted as Appendix F to the 2004 AMR. The technical memorandum found that the capture zones of RW3 and RW4 with increased pumping rates continued to be inadequate to prevent contaminated groundwater from migrating off-site.

Evaluation of groundwater elevation contour figures supports this conclusion (Figure 3). Groundwater contour figures submitted in AMRs over this review period identify the approximate area of influence for wells RW3 and RW4.

Previous Recommendation #4:

An evaluation should be performed to determine if the existing remedial system is capturing contamination at and downgradient of RW1.

Evaluation of the capture zone of the extraction system was discussed in the 2003 Arcadis technical memorandum submitted as Appendix F to the 2004 AMR. The technical memorandum found the underlying clay confining layer was enhancing the performance of the capture zone of RW2 in the unconfined aquifer and limiting plume migration in this area. The technical memorandum also concluded that the clay layer was promoting the effectiveness of the capture zone near RW1 and RW2 and prohibiting plume migration in the unconfined aquifer in the area of RW2.

This claim can not be verified as recent data indicates plume migration may be occurring to the south of the RW2 capture zone. Groundwater elevation data presented in the 2007 AMR (Figure 4) indicates groundwater flow is to the south in the area of FMC-50. Additionally this evaluation was completed prior to the addition of the VFD which affects the pumping rate and therefore the capture zone of RW2.

Previous Recommendation #5:

The ROD specifies that “the effectiveness of the groundwater pump-out and treatment system will be assessed through monitoring of receptors, groundwater levels, groundwater contaminant concentrations and discharge to the sanitary sewer.” Utilizing the data from the modified monitoring well network, a more detailed data presentation and interpretation should be included in the AMR, to assist in the evaluation of the effectiveness of the remedy. The additional data presentation should include, but not be limited to, concise and legible tables, tables with all of the detected VOCs with their respective HRL and MCL, isoconcentration maps for the two aquifers, equipotential maps, capture zone maps, etc. In addition to additional data presentation, the AMR should include a concise and informative interpretation of the data to assist the reader in evaluation the effectiveness of the remedy.

Recently submitted AMRs have included additional information when compared to reports submitted prior to the last five-year review. However, as discussed in Section IX of this report further improvements are required.

Previous Recommendation #6:

If data from the modified monitoring well network indicates the current remedy does not meet cleanup goals, or if data indicates that protectiveness is not achieved, modifications to the current remedy or alternative remedial actions should be proposed and implemented conditional on regulatory approval of such changes.

Data submitted over this review period suggests that remedial action performance criteria required for termination of the groundwater extraction system operation described in the ROD have not been met at the Site boundary. Additional remedial action suggestions or modifications to the selected remedy have not been documented at the time of this review. Therefore this recommendation from the previous five-year review is not complete and will be addressed in Section IX of this review.

Previous Recommendation #7:

The recommendations listed above should be addressed as soon as possible and certainly soon enough that the effectiveness of the implemented recommendations can be evaluated in the next five-year review.

Some of the recommendations suggested in the previous five-year review have not been met. The recommendations that have been addressed during this review period are evaluated in this section of the five-year review. Recommendations that have not been satisfied are included in the Section IX of this review.

VI. Five-Year Review Process

Administrative components of the Five-year review Process

The responsible party (RP) was notified and given the opportunity to contribute to the content of this report. A public notice was published in the Fridley/Columbia Heights Sun-Focus on October 16, 2008. This document was initially drafted by Delta Consultants on behalf of the MPCA and submitted to the MPCA for finalization.

Components associated with this review include:

September 19, 2008	File review at MPCA
October 16, 2008	Public Notice Published
October – November 2008	Interviews with MCES, MWW, MDH, City of Fridley
November 12, 2008	Site Visit
January 8, 2009	Draft Review Submitted to MPCA
June 12, 2009	Second Draft Submitted to MPCA Incorporating Comments from MPCA and US EPA

Community Involvement

Representatives from MWW, MDH and the City of Fridley were notified by a telephone interview that a five-year review was being performed. BAE representatives were interviewed in person during the Site inspection on November 12, 2008.

Interviews with representatives from the City of Fridley were conducted by telephone and/or by email with Jim Kosuchar, Public Works Director and Scott Hickok, Community Development

Director. The representatives from the City of Fridley stated that the City had a well head protection program for the nearby Fridley municipal wells 1 and 13. They indicated that the city now utilizes these wells for emergency purposes only. Scott Hickok also indicated that the current property owner of the NIROP Site (ELT Minneapolis LLC) had indicated an intent to further subdivide the property and that the City of Fridley staff would alert the property owner to any city requirements that would need to be met prior to subdivision of the Site.

Michael Convery, Hydrologist Supervisor, and David Rindal, Senior Engineer, with the MDH were also interviewed by telephone during the five-year review process. The MDH indicated that there were no concerns regarding the protectiveness of the selected remedy at the Site.

In addition, Rick Malmberg from the MWW was interviewed by telephone during the five-year review process. The MWW did not express concern for the protectiveness of the selected remedy at the FMC Site. They did indicate plans to build chlorine handling facility and a new filtration facility on the MWW property in the near future.

Doug Hildre and Timothy Ruda of BAE were interviewed during the Site inspection. BAE indicated they believed the selected remedy was protective of human health and the environment. BAE also acknowledged differences with MPCA staff regarding the performance of the selected remedy. BAE addressed the City of Fridley statement regarding additional development of the Site and indicated that future development to the north of the site was possible, but at this time was only in preliminary planning stages. At the time of the Site inspection, Mr. Hildre indicated that the system was operating under an expired MCES discharge permit and that a new permit was expected to be issued by MCES in the near future. Timothy Ruda was contacted on January 15, 2009 to verify the status of the discharge permit. He indicated that permit 2020 had been reissued effective from November 1st 2008 through October 31, 2011. He also indicated that there were no changes to the discharge permit.

Interview questions were submitted by email to Mr. Tom Flaherty of the MCES on November 18, 2008. Mr. Flaherty indicated that MCES did not have any concerns or issues related to discharge from the FMC Site and that the site has operated in compliance with their permit requirements.

Interview documentation is provided in Appendix B.

A public notice announcing this five-year review was published in the Fridley/Columbia Heights Sun-Focus on October 16, 2008. A copy of the notice is included in Appendix C. No comments or concerns were received from the public concerning the FMC Site.

Document Review

All relevant documents associated with the Site were reviewed during this five-year review period. A complete list of documents reviewed is included in Appendix D. Documents reviewed include Site decision documents, annual monitoring reports, previous five-year

reviews, MPCA correspondence letters and additional assessment reports.

Data Review

Groundwater analytical data from AMRs and other assessment reports submitted to the MPCA were reviewed and are included in Appendix E.

Groundwater Extraction System

The groundwater extraction system has been operating at the Site since 1987. Since system start up over 983 million gallons of groundwater has been extracted, removing approximately 18,970 pounds of total VOCs and approximately 15,969 pounds of TCE from the Site. Over this review period, volumes of groundwater extracted ranged from 63 million gallons in 2003 to 49.3 million gallons in 2007. Estimated VOCs removed over this review period ranged from 598 pounds in 2003 to 261 pounds in 2005, with TCE comprising, 471 pounds and 196 pounds, respectively.

Data reviewed indicates extraction well RW2 was the most effective extraction well and removed 95 percent of the contaminant mass in 2007. The higher removal rate of this well has been identified as being linked to higher contaminant concentrations detected in the unconfined aquifer than those detected in the confined aquifer.

Mass removal rates for the individual groundwater extraction wells were not provided for comparison in the submitted AMRs. Total mass removal rates and trend analysis should be included in future AMRs as discussed in Section IX of this report.

Reporting inconsistencies were also identified in the 2003 and 2007 AMRs. Differences were identified in the amount of VOC and TCE extracted and the amount of VOC and TCE discharged to the sanitary sewer. In each of these reports, TCE volatilized within the system was reported to be greater than total VOC volatilized. Since TCE is included as a component of total VOCs, volatilization of more TCE than total VOCs is not possible and there is likely an error in the mass removal calculations.

- The 2007 AMR reported 307 pounds of total VOC extracted and 247 pounds total VOC discharged to the sanitary sewer, indicating a total VOC volatilization loss of 60 pounds. In contrast, 255 pounds of TCE were extracted while 185 pounds of TCE was discharged to the sanitary sewer, indicating a total TCE volatilization loss of 70 pounds. This discrepancy is 10 more pounds of TCE volatilized than total VOCs.
- The 2003 AMR reported 598 pounds of VOC extracted and 346 pounds discharged to the sanitary sewer, indicating a total VOC volatilization loss of 252 pounds. In contrast, 471 pounds of TCE were extracted while 206 pounds of TCE was discharged to the sanitary sewer, indicating a total TCE volatilization loss of 265 pounds. This discrepancy is 13 more pounds of TCE volatilized than total

VOCs.

The inconsistencies identified above could lead to inaccurate mass removal rates and conclusions regarding the systems performance. The data reviewed and discussed above regarding the groundwater extraction system was collected by requirements described in Part one of the groundwater monitoring plan.

Groundwater Monitoring

During this five-year review period groundwater sampling and analysis was performed annually at selected monitoring wells located on-site and off-site and at wells completed in the confined and unconfined aquifers. Modifications to the monitoring well network were implemented during this review period. Modifications are previously discussed in Section V of this review.

Groundwater monitoring activities at the Site followed the four part plan identified by the ROD and previously discussed in Section IV of this review. Data reviewed for part one of the groundwater monitoring plan is discussed above. Data reviewed for parts two through four are discussed below.

Part 2: Hydraulic Containment Monitoring

Groundwater elevations were gauged quarterly to identify groundwater flow and monitor performance of the groundwater extraction system. Groundwater elevations during this reporting period indicated groundwater flow was typically to the west and southwest toward the Mississippi River. Groundwater elevation contour maps from the 2007 AMR indicated that the increased pumping rates at RW3 and RW4 did not completely capture groundwater between these two wells (Figures 3 and 4).

Part 3: Aquifer Monitoring

The 20 monitoring wells sampled during this review period varied from year to year. Typically monitoring wells sampled on-site were located within or near extraction well capture zones. TCE concentrations were detected above MCL or health based values beyond the Site boundaries in all sampling events during this review period. Cumulative TCE concentration data is included in Appendix E. Evaluation of concentration trends for VOCs other than TCE is difficult due to the absence of historic VOC concentrations presented in a cumulative format.

Monitoring wells FMC-14, FMC-15 and FMC-36 had the highest TCE concentrations of on-site monitoring wells during the 2007 sampling event. FMC-14, FMC-15 and FMC-36 are located near or within the estimated groundwater capture zone of the nearest extraction well, as identified by groundwater elevation data collected in 2007. The highest concentrations

observed on-site in 2007 exceed MCL or health based cleanup levels and were collected at FMC-14 (564 ug/l), FMC-15 (580 ug/l) and FMC-36 (4,520 ug/l).

Samples collected in 2007 from monitoring wells identified in the ROD as representing the Site boundary have TCE concentrations exceeding MCL or health based cleanup levels. FMC-45 had a TCE concentration of 18.5 ug/l. FMC-54 had a TCE concentration of 544 ug/l. FMC-51 was not sampled during 2007; however the most recent sample collected from this location was 25 ug/l, collected in 2006.

Samples collected from off-site monitoring wells also contained TCE concentrations exceeding MCL or health based cleanup levels. The highest concentrations observed off-site in 2007 were at FMC-54A (94.2 ug/l), FMC-21B (178 ug/l) and FMC-53 (73.8 ug/l).

Overall contaminant concentrations detected in monitoring wells since system start up have declined as identified in Table 3-9 of the 2007 AMR and provided in Appendix E. Fluctuations in TCE concentrations in all Site associated monitoring wells have occurred during this review period and over the life of the Site. Monitoring and reporting inconsistencies have made specific trend analysis difficult for individual wells or individual areas of the Site. Additionally the monitoring well network does not provide for adequate data collection to evaluate the extent and magnitude of the plume, specifically downgradient of the BNR portion of the Site.

Part 4: Receptor Monitoring

Receptor monitoring as required by the ROD consisted of collecting samples from the MWW raw water intake, FMC-21, FMC-21A and FMC-21B. Samples were also collected from the groundwater seep located on the river bank when the seep was exposed, although the seep is not identified as receptor in the ROD, RAP or QAPP.

MWW Raw Water Intake

VOC concentrations in samples collected from the MWW raw water intake were not detected above MCL or health based cleanup levels during this review period. Only samples collected during 2003 had detectable concentrations of VOCs, including 1,1-dichloroethane and cis-1,2-dichloroethene. Both of these compounds were detected below regulatory action levels.

Receptor Monitoring Wells

Samples collected from FMC-21A and FMC-21B are reported as part of the

receptor monitoring program as required by the ROD. FMC-21A and FMC-21B are completed in the confined and unconfined aquifer, respectively, prior to the point groundwater discharges to the Mississippi River. Wells FMC-21A and FMC-21B were installed in 2004 to replace well FMC-21 due to low groundwater yield.

- FMC-21 was sampled in 2003 prior to being abandoned, there were no compounds detected above MCL or health based cleanup levels.
- FMC-21A is completed in the unconfined aquifer. Laboratory analysis of samples collected from FMC-21A has indicated TCE is present above MCL or health based cleanup levels. TCE concentrations detected in FMC-21A have ranged from 50.1 ug/l (2004) to 105 ug/l (2005) during this reporting period.
- FMC-21B is completed in the confined aquifer. Laboratory analysis of samples collected from FMC-21B has indicated TCE is present above MCL or health based cleanup levels. TCE concentrations detected in FMC-21B have ranged from 22.8 ug/l (2004) to 178 ug/l (2007) and have been increasing since this well was constructed.
- Other VOC detected in FMC-21A and FMC-21B include cis-1,2-dichloroethene, trans-1,2-dichloroethene, PCE, and 1,1-dichloroethene; all detections of these compounds were below MCL or health based clean up values.

Seep

The seep located on the MWW property is visible periodically throughout the year depending on river flow. Samples were collected at the seep when possible. Additional exposure risks to potential receptors exist while the seep is exposed. Direct contact with VOC contaminated water is possible by humans, plants and animals. The seep was sampled during the 2004 through 2007 monitoring events.

- Samples were collected from the seep at one point in 2004 and 2005 and at two points (east and west) in 2006 and 2007.
- TCE concentrations detected in samples collected ranged from 4.4 ug/l (west sample 2006) to 780 ug/l (2004).
- Samples collected from the east side of the seep indicated higher concentrations than samples collected from the west side of the seep.
- TCE and PCE were detected exceeding MCL or health based cleanup values at one sampling location during each sampling event. The MCL for PCE is 5 ug/l.
- Other VOC compounds detected include: cis-1,2-dichloroethene, 1,1,1-trichloroethane, 1,1-dichloroethene and 1,1-dichloroethane, all were

detected below MCL or health based values.

Site Inspection

A Site inspection was conducted on November 12, 2008 at the FMC Site by Deepa de Alwis, MPCA Project Leader, John Estes, Catherine Stott and Jacob Knapp of Delta Consultants; and Doug Hildre and Timothy Ruda of BAE Systems. A site inspection checklist is included in Appendix G and photographs from the site inspection are included in Appendix H. During the Site inspection access to the MWW property was not available due to MWW security procedures. Monitoring wells on the MWW property were observed through the fence and appeared to be in good condition. Monitoring and extraction wells observed on the BAE and BNR properties also appeared to be in good condition.

VII. Technical Assessment

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

Yes, the remedy is functioning as intended by the decision documents. The intent of the selected remedy as described in the ROD is “to reduce contamination source areas and to reduce general offsite migration of elevated contaminant levels”. Remedy performance is monitored through groundwater and receptor monitoring at and downgradient of the Site.

Groundwater Extraction System

The groundwater extraction system is currently operating and continues to contain a portion of the contaminant plume at the FMC Site as identified by the 2003 and 2004 technical memorandums of capture zone analysis by Arcadis. The extraction system continues to remove VOCs from groundwater at the Site satisfying the ROD requirement to “reduce contamination source areas”. The identified partial capture of the groundwater plume may not meet the qualitative ROD requirements to “reduce general offsite migration of elevated contaminant levels”.

At the time of this review the groundwater plume continues to exceed MCL or health based cleanup values at the Site boundary. The selected remedy continues to function at the Site as designed; however, the groundwater extraction system may be only partially containing the groundwater plume. The current monitoring well network does not adequately define the horizontal and vertical extent of the plume in either the confined or unconfined aquifers at or downgradient of the Site. The ROD will be reviewed to verify the appropriateness of the performance standards and RAOs of the ROD. If it is determined that the performance standards and the RAOs stipulated in the ROD are inadequate to address the long term protectiveness of the human health and the environment, an evaluation will be performed to amend or modify the ROD through an ESD or ROD Amendment.

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

Yes, exposure assumptions at the Site have not changed since ROD implementation and most RAOs identified by the ROD are protective of human health and the environment. Toxicity data and cleanup levels described in the decision documents are still valid. Most of the applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) established in the ROD have not changed during this reporting period. However, an additional point of possible exposure and contaminant contact with humans, plants, animals and aquatic life has been identified at the groundwater seep downgradient of the Site. Samples collected at the Seep have consistently demonstrated exceedence of MCL or health based cleanup values.

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

Yes, a potential exposure pathway not identified in the Site decision documents exists downgradient of the Site. The short term protectiveness is not affected by the seep. The ROD will be reviewed to ensure the current appropriate performance standards are protective of human health and the environment.

Groundwater Extraction System Capture Zone Analysis

Information identified by the capture zone analysis and additional Site investigations identify possible locations where the selected remedy may not be protective of human health and the environment in the long term. However, based on conflicting information provided and the installation of the VFD, the extent of extraction well capture is unclear at this time.

Confined Aquifer

Analysis of the extraction well capture zones was conducted in 2002 and again in 2003 and submitted as Appendix F to the 2003 and 2004 AMRs. Capture zone analysis in each technical memorandum concluded that spacing between RW3 and RW4 was inadequate to completely capture the groundwater plume in this area of the Site. Monitoring well FMC-29A is the only monitoring well located between RW3 and RW4 and has had recent TCE concentrations slightly above MCL or health based cleanup levels. RW3, RW4 and FMC-29A are completed in the confined aquifer. Although TCE concentrations in FMC-29A have historically been near MCL or health based cleanup levels, data collected from downgradient, off-site, monitoring wells FMC-35a and FMC-53 have recently indicated groundwater in this area contains much higher concentrations of TCE than what is represented in FMC-29A. The increased downgradient concentrations indicate additional data is necessary to assess groundwater contaminant concentrations and groundwater flow conditions between RW3 and RW4.

Unconfined Aquifer

Conclusions in the 2002 and 2003 capture zone analysis differed on the estimated southern extent of the capture zone for RW2. The 2002 technical memorandum identified RW1 as the southern most extent of the capture zone, while the 2003 technical memorandum indicated the capture zone extended further to the south to FMC-50. Groundwater elevation contours identified in the most recent AMR indicate the southern most extent of the RW2 capture zone at

RW1 as indicated in the 2002 capture zone analysis.

Monitoring Well Network

Confined Aquifer

There are no monitoring wells on-site to the south of RW2 completed in the confined aquifer. There are two monitoring wells completed in the confined aquifer downgradient of this area. Data is not available regarding the on-site TCE concentrations or groundwater elevation data in the confined aquifer to the south of RW2. Additional information regarding the confined aquifer is necessary in this portion of the Site for plume delineation and groundwater flow analysis.

Unconfined Aquifer

The groundwater monitoring well network is not adequate to define plume extent or stability in the southern portion of the Site. Several groundwater monitoring wells are completed to the south of RW2 in the unconfined aquifer; however, many of these wells are consistently dry. Additionally there are no monitoring wells completed in the unconfined aquifer downgradient of the Site boundary.

Recent subsurface investigations on the BNR portion of the Site have indicated the presence of TCE concentrations exceeding MCL or health based cleanup levels in groundwater to the south of RW1 near FMC-50. An unrelated subsurface investigation was conducted in 2008 on behalf of CenterPoint Energy on the FMC Site. Results of groundwater samples collected near FMC-50 identified concentrations of TCE at 1,100 ug/l. FMC-50 is to the south west of RW1. Groundwater elevations in the southern portion of the BNR property have not allowed consistent monitoring in this portion of the Site. For example FMC-50 is reportedly completed at a depth of 30 feet bgs. Groundwater was observed at a depth of 35 feet bgs in the 2008 soil boring near FMC-50, below the screened interval of FMC-50. Additionally, monitoring well FMC-46 in this portion of the Site has been dry for the majority of this reporting period.

Groundwater Extraction System

During the Site investigation portion of this five-year review BAE indicated that a VFD had been installed at RW2. The VFD was set to adjust the RW2 pumping rate to maintain a constant groundwater elevation and avoid pumping the well dry and pump shut down. However, changing pumping rates will cause changes to the capture zone of RW2 and could allow for contaminated groundwater to migrate downgradient of the Site.

Seep

Potential exposure to humans and actual exposure to terrestrial and aquatic plants and animals may exist at the seep on the MWW property. A fence surrounding the MWW property limits public access to the seep; however, the fence does not completely prevent access in the area of the seep. The seep is located in a difficult to access area at the bottom of a steep wooded bank; however access to this area by humans is possible. Photographs taken during the site visit (Appendix H) indicate the fence may not extend to the bottom of the embankment and may also

have gaps where access could be obtained; furthermore the fence does not restrict human access via the river. Access to the seep 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 MCL and health based cleanup values is discharged to the Mississippi River at all flow stages.

Institutional Controls

The City of Fridley and BAE have indicated that ELT Minneapolis LLC has expressed interest in property development directly to the north of the Site. Development of the Site and properties immediately adjacent to the Site could create potential exposure risks to human health and the environment. Additional institutional controls are necessary to prevent future exposure risks associated with property development. Additionally, institutional controls identified by the ROD are not enforceable by the MPCA or US EPA under the current Site decision documents. Institutional controls currently in place are only applicable to specific activities and would not provide protection in all circumstances where exposure potential would exist.

VIII. Issues

Site conditions that may not be protective of human health and the environment in the long-term are discussed below.

Groundwater Extraction System Capture Zone Analysis

Information identified by the capture zone analysis and additional Site investigations identify possible locations where the selected remedy may not be protective of human health and the environment in the long term. The extent of extraction well capture zones need to be further evaluated.

Confined Aquifer

Analysis of the extraction well capture zones was conducted in 2002 and 2003 and submitted as Appendix F to the 2003 and 2004 AMRs respectively. Capture zone analysis in each technical memorandum concluded that spacing between RW3 and RW4 was too great to completely capture the groundwater plume between these extraction wells. As discussed in Section VI of this review, groundwater samples collected from monitoring wells downgradient of this area have identified the presence of TCE concentrations exceeding MCL or health based cleanup levels.

Unconfined Aquifer

The 2002 technical memorandum for capture zone analysis of RW2 indicated that the capture zone extended to RW1. Groundwater elevation data presented in the most recent AMR indicates that RW1 is the approximate southerly extent of the RW2 capture zone. This conclusion conflicts with capture zone analysis for RW2 provided in the 2003 technical memorandum which states FMC-50 as the southern most extent of the RW2 capture zone. The recent installation of a

VFD in RW2 will affect the pumping rate and therefore the capture zone of RW2. At this time the extent of capture for the groundwater extraction system is unclear.

Recent groundwater samples collected during the Center Point Energy investigation indicate the presence of TCE impacted groundwater near the Site boundary to the south possibly beyond the capture zone of RW2. Groundwater elevation data indicates groundwater flow in this portion of the Site is to the South. Groundwater contaminant trend analysis in this area is inconclusive due to periods of low groundwater elevations and limited data availability.

Monitoring Well Network

The monitoring well network at the Site does not provide adequate information to define the horizontal and vertical extent of the contaminant plume in the confined and unconfined aquifers.

Confined Aquifer

Monitoring wells in the confined aquifer in the area near FMC-29A may not adequately represent groundwater migrating from the Site in an area between the estimated capture zones of RW3 and RW4. Concentrations at FMC-29A have historically been near the MCL or health based cleanup levels for TCE, however downgradient off-site monitoring wells FMC-35A and FMC-53 have shown concentrations that exceed the MCL or health based cleanup levels for TCE during each sampling event conducted during this review period. The presence of elevated TCE levels downgradient of FMC-29A indicates additional data collection representative of the area between capture zones of RW3 and RW4 is necessary.

Monitoring wells completed in the confined aquifer are absent from the area south of RW2. Groundwater data for the confined aquifer is not available due to the absence of confined aquifer monitoring wells in this area of the BNR property.

Unconfined Aquifer

Monitoring wells completed within the unconfined aquifer are not present down gradient of the BNR portion of the Site. The groundwater monitoring well network to be further evaluated to provide plume delineation or stability data for the southern portion of the Site. Groundwater monitoring wells to the south of RW2 are completed in the unconfined aquifer and many of these wells are consistently dry. Additionally there are no monitoring wells completed in the unconfined aquifer downgradient of the Site boundary. Recent sampling events have indicated that monitoring wells completed in the unconfined aquifer in the BNR portion of the Site are not yielding enough groundwater for water level measurements or sample collection. Boring logs completed during the Center Point Energy investigation in this portion of the Site indicate groundwater is present at 35 feet bgs while most monitoring wells in this area are completed at 30 feet bgs. Boring logs from the Energy investigation also indicate that the clay layer is deeper than 40 feet bgs in the area of FMC-50. Information regarding monitoring well construction and groundwater elevations indicates the monitoring well network in the unconfined aquifer in this

portion of the Site may not be adequate to define or monitor plume conditions. The absence of the clay layer at a depth of 40 feet bgs indicates that additional wells could be completed deeper within the unconfined aquifer than those currently in place and would provide more consistent groundwater data.

Groundwater Monitoring

VOC concentrations exceeding MCL or health based cleanup levels are present beyond the Site boundary. TCE concentrations exceeding MCL or health based cleanup levels are present at off-site monitoring wells downgradient of the Site boundary. Groundwater samples collected identified TCE concentrations exceeding MCL or health based cleanup levels at twelve of seventeen downgradient monitoring wells. TCE concentrations exceeding MCL or health based cleanup levels were also detected in water collected from the seep on the Mississippi River bank.

Migration Pathways

Cross sections provided in the 2007 AMR were reviewed during this five-year review (Figures 7 through 11). Cross section B-B' extends from FMC-30 through FMC-15 on the FMC Site. This cross section should be updated to include data from the BNR portion of the Site. The cross section should also include information identifying the depth and extent of previously excavated areas. The depth and extent of the excavations relative to the confining clay layer and water table should be evaluated to identify the presence of possible contaminant migration pathways between the confined and unconfined aquifers.

Future development at the MWW could also provide soil vapor intrusion risk to MWW personnel. Possible exposure to impacted soil vapor downgradient of the Site may be possible based on the location of the identified groundwater plume and the location of MWW buildings. Additionally documents reviewed during this five-year review did not indicate soil vapor intrusion assessments had been previously conducted.

Seep

Current conditions at the Site have identified a potential exposure point exceeding MCL or health based cleanup levels beyond the Site boundary at the seepage point along the Mississippi River. The seep is visible periodically throughout the year and groundwater is discharged directly to the river from the seep. The seep, when exposed during periods of low flow provides a pathway for potential human exposure to water containing TCE concentrations exceeding MCL or health based cleanup levels. Fencing present on the MWW property limits public access to the seep; however, the fencing does not completely prevent access and exposure to humans. The fencing does not prevent access and exposure to VOC impacted water by plants, animals and humans utilizing the Mississippi River and therefore can not be considered adequate to protect human health and the environment in the long-term.

Institutional Controls

Possible development of the Site and properties immediately adjacent to the Site could create potential exposure risks to human health and the environment. Additional institutional controls are necessary to prevent future exposure risks associated with property development. Additionally, institutional controls identified by the ROD are not inclusive of all activities that may cause exposure risk. Institutional controls currently in place are not specific to Site conditions and do not protect human health and the environment from potential exposure in all instances.

Issues as described in this and other sections of this document are summarized in Table 7.

Table 9: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Inadequate monitoring well network to evaluate the off-site migration of the plume in the confined and unconfined aquifers.	N	Y
The groundwater extraction system may not completely capture VOC impacted groundwater leaving the Site	N	Y
MCL or health based cleanup levels are not being met at the Site boundary	N	Y
Additional evaluation of the effects of the VFD installed at RW2 is necessary	N	Y
The seep provides a potential exposure pathway and puts human health and the environment at risk	N	Y
Additional Institutional controls may be needed to ensure long term protectiveness.	N	Y

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Possible development in the area could create additional exposure risk	N	Y

IX. Recommendations and Follow-up Actions

Groundwater Extraction System

The groundwater extraction system is functioning to remove VOC and specifically TCE from groundwater at the Site. At the time of this review, the groundwater extraction system is also functioning to meet RAOs identified in the ROD. Continued operation of the four operating extraction wells on-site is recommended at this time.

However, further evaluation of the groundwater extraction system capture zones should be completed. Conflicting information was provided in documents reviewed during this five-year review with regards to the extent of groundwater capture zones of the extraction wells. Further evaluation should follow US EPA guidance entitled, A Systematic Approach for Evaluation of Capture Zones at Pump and Treat System, dated January 2008.

Additional Investigation

Additional investigation may be necessary upon completion of further capture zone analysis. Should further evaluation of groundwater extraction well capture zones indicate the groundwater plume is migrating beyond the site boundary additional investigations, to identify appropriate remedial actions, should be conducted.

Unconfined Aquifer

Additional subsurface investigation is recommended in the BNR portion of the Site. TCE concentrations in groundwater exceeding MCL or health based cleanup levels have been identified during a 2008 subsurface investigation on the southern portion of the BNR parcel of the Site. Impacted groundwater was identified in the area to the south of the estimated capture zone of RW2 near FMC-50. Results of additional subsurface investigation should be utilized to determine if additional monitoring and/or extraction wells are necessary in the southern portion of the Site.

Monitoring Well Network

Figures 5 and 6 identify Site associated monitoring and extraction wells and 2007 TCE concentrations in the confined and unconfined aquifers.

Confined Aquifer

Monitoring wells in the confined aquifer are absent in the area of the Site south of RW2. Due to the incomplete monitoring well network, the extent and magnitude of VOC contamination at and downgradient of this portion of the Site can not be thoroughly evaluated. Additional monitoring wells should be completed in the confined aquifer on the BNR portion of the Site.

Unconfined Aquifer

The monitoring well network is inadequate to define the horizontal and vertical extent of groundwater conditions at the Site. Additional monitoring wells should be installed in the unconfined aquifer downgradient of the BNR portion of the Site. Monitoring wells completed in the unconfined aquifer are not present downgradient of the BNR portion of the Site. TCE concentrations at the Site boundary of the BNR parcel have been detected above MCL or health based cleanup levels; plume evaluation of the unconfined aquifer is not possible downgradient of the BNR parcel without additional monitoring wells.

Monitoring Plan

Groundwater Monitoring

Additional monitoring wells are recommended to provide adequate representation of groundwater conditions at and downgradient of the Site. Upon completion of additional monitoring wells the groundwater monitoring plan and QAPP should be revised to incorporate the new wells. Additionally the current groundwater monitoring plan identified in the QAPP indicates 20 monitoring wells are to be sampled annually. However, the QAPP does not identify specific monitoring wells to be sampled each year. The QAPP should be revised to identify specific wells to be sampled each sampling event and the purpose of each well sampled should be identified. Increased monitoring frequency should also be considered at key monitoring wells to expedite contaminant trend analysis. The revised QAPP should incorporate all changes to the monitoring well network and monitoring plan.

Receptor Monitoring

The receptor monitoring plan should be revised to include the seep located on the MWW property. The seep has been sampled during previous sampling events. However, the seep is not included in the QAPP as a receptor monitoring point. The seep is an exposure pathway and should be included in the receptor monitoring plan.

Seep

Current conditions at the Site have identified a potential exposure point exceeding MCL or health based cleanup levels beyond the Site boundary at the seepage point along the Mississippi River.

The seep may also create additional risk to human health and the environment by providing a potential exposure pathway to humans, plants and animals. At the time of this five-year review a complete risk assessment of the seep has not been conducted and human exposure and environmental risks, with regard to the seep, are unclear. A complete risk assessment should be conducted to evaluate what risks or effects, if any, are occurring as a result of the discharge of VOC impacted water at the Seep.

If the risk assessment determines additional action to reduce risk of contact with VOC impacted water at the seep is necessary, institutional controls and/or engineered remedies limiting exposure should be evaluated, proposed and implemented following recommendations of the risk assessment.

Site Wide

Remedial Action Objectives

The intent and/or objective of some RAOs identified within the ROD require definition and in some instances further development. Further definition of Site objectives is necessary for the Site to achieve long-term protectiveness.

Selected Remedy

Information from additional subsurface investigations and monitoring wells should be utilized to evaluate the selected remedy. Groundwater exceeding MCL or health based cleanup levels is present at and downgradient of the Site boundary and capture zone effectiveness is unclear at the time of this review. Additional remedial action should be considered upon evaluation of data collected from further investigation and capture zone evaluation.

ARARs

Minnesota Rules 7050 and 7060 should be evaluated as future ARARs for the Site. These Rules are applicable to “waters of the state” including groundwater and surface water and may provide additional protectiveness to human health and the environment.

Institutional Controls

Further institutional controls are necessary to provide long-term protectiveness at the Site. Institutional controls in the form of restrictive covenants should be implemented for the Site associated properties. Restrictive covenants are institutional controls that ride with the land and would provide long term protectiveness of human health and the environment. Additional institutional controls should be evaluated for Site adjacent properties. Interest in future development has been expressed for properties in the area of the Site and current institutional controls are not enforceable by the MPCA or US EPA and do not protect against all activities where exposure risk may be encountered.

Future monitoring reports should also provide protectiveness evaluations and compliance reports for institutional controls associated with the Site.

Annual Monitoring Reports

Evaluation of data presented in AMRs over this review period concluded that discrepancies and inaccuracies within the AMRs made data evaluation difficult. Cumulative data should be included in future reports. Trend analysis for extraction and monitoring wells should be provided in graphic format and discussed within the reports. Discussion and trend analysis of the

CTF monitoring program should also be provided. Attention should be given to the data presented in the text, figures and tables to ensure data is current and accurate.

Cross section B-B' from the 2007 AMR should be expanded to include information from the BNR portion of the site. Detail should also be provided to identify the depths and location of previously excavated areas of the Site relative to groundwater elevations. Possible contaminant migration pathways through the confining clay layer may be present in the previously excavated areas. An accurate cross section could identify possible areas where these migration pathways may be present.

Table 10: Recommendations and Follow-up Actions

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Evaluate additional ARARs for inclusion in revised decision documents, if applicable	MPCA US EPA	MPCA US EPA	March 2010	N	Y
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 US EPA	MPCA US EPA	July 2010	N	Y
Further investigation of extraction well capture zones following US EPA document entitled: A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems	BAE	MPCA	July 2010	N	Y
Additional subsurface investigation on the BNR portion of the Site	BAE	MPCA	May 2010	N	Y
Evaluate the need to better define RAOs	MPCA US EPA	MPCA US EPA	December 2010	N	Y

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Improve the monitoring well network in the confined aquifer in the BNR portion of the Site	BAE	MPCA	October 2010	N	Y
Improve the monitoring well network in the unconfined aquifer downgradient of the BNR portion of the Site	BAE	MPCA	October 2010	N	Y
Update the Site groundwater monitoring plan	BAE	MPCA	December 2009, and as necessary.	N	Y
Update the Site receptor monitoring plan	BAE	MPCA	December 2009	N	Y
Evaluate additional groundwater ARARs for points downgradient of the Site	MPCA US EPA	MPCA US EPA	February 2010	N	Y
Evaluate exposure/risk and options to control exposure/risk to human health and the environment at the Seep	BAE MPCA	MPCA	July 2010	N	Y
Evaluate information obtained from additional investigation to identify other potential remedies	BAE MPCA US EPA	MPCA USEPA	July 2010	N	Y
Evaluate institutional controls for the Site and adjacent properties by preparing IC plan	BAE MPCA	MPCA	December 2010	N	Y
Evaluate the need to better define RAOs	MPCA US EPA	MPCA US EPA	December 2010	N	Y

Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Implement recommendations from IC plan	BAE MPCA	MPCA	December 2011	N	Y
Improve data presentation and trend analysis in Site monitoring reports	BAE	MPCA	June 2010	N	Y

If the ROD is determined to be inadequate to ensure implementation of the recommendations and follow up actions, the ROD may be revised by an Explanation of Significant Differences (ESD) or a ROD Amendment.

X. Protectiveness Statement(s)

The protectiveness of the current remedy as concluded by this five-year review is as follows:

Groundwater

The remedy selected to address groundwater contamination is currently protective of human health and the environment in the short term^c. 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;
- 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 institutional controls are to be in place at and near the site that are protective in the short 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);

^c See Appendix A for MPCA's position on the short term protectiveness.

- Further evaluation needs to be conducted for additional remedial action utilizing data collected from additional investigations
- Improvements to data evaluation and presentation within AMRs to be made.

Soil

Soil removal actions were conducted prior to implementation of the ROD and decision documents for the Site. The US 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, institutional controls may be needed be implemented and monitored 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.

Site Wide

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 five-year review must be implemented. The soil removal actions and CTF have been identified by the MPCA and US EPA as protective, although institutional controls may be needed to assure long-term protectiveness

XI. Next Review

Hazardous substances or contaminants will remain at the Site and will not allow for unlimited use or unrestricted exposure. The presence of hazardous substances will require additional five-year reviews of the Site. The next five-year review is scheduled for completion five years from the signature date of this review.

Figures

Figure 1	Site Location Map (Figure 2 from QAPP)
Figure 2	Site Map (Figure 1-1 from 2007 AMR)
Figure 3	Confined Aquifer Groundwater Elevation Contour Map (Figure 3-8 from 2007 AMR)
Figure 4	Unconfined Aquifer Groundwater Elevation Contour Maps (Figure 3-10 from 2007 AMR)
Figure 5	Unconfined Aquifer TCE Concentration Map (Figure 3-5 from 2007 AMR)
Figure 6	Confined Aquifer TCE Concentration Map (Figure 3-6 from 2007 AMR)
Figure 7	Geologic Cross Section Locations (Figure 1-4 from 2007 AMR)
Figure 8	Cross Section A-A' (Figure 1-5 from 2007 AMR)
Figure 9	Cross Section B-B' (Figure 1-6 From 2007 AMR)
Figure 10	Cross Section C-C' (Figure 1-7 From 2007 AMR)
Figure 11	Cross Section D-D' (Figure 1-8 From 2007 AMR)

Appendices

Appendix A	MPCA Position on Short Term Protectiveness
Appendix B	Interview Documentation
Appendix C	Public Notice Documentation
Appendix D	List of Documents Reviewed
Appendix E	Groundwater Data From 2007 AMR
Appendix F	U.S. EPA Memorandum
Appendix G	Site Inspection Checklist
Appendix H	Site Photos

FIGURES

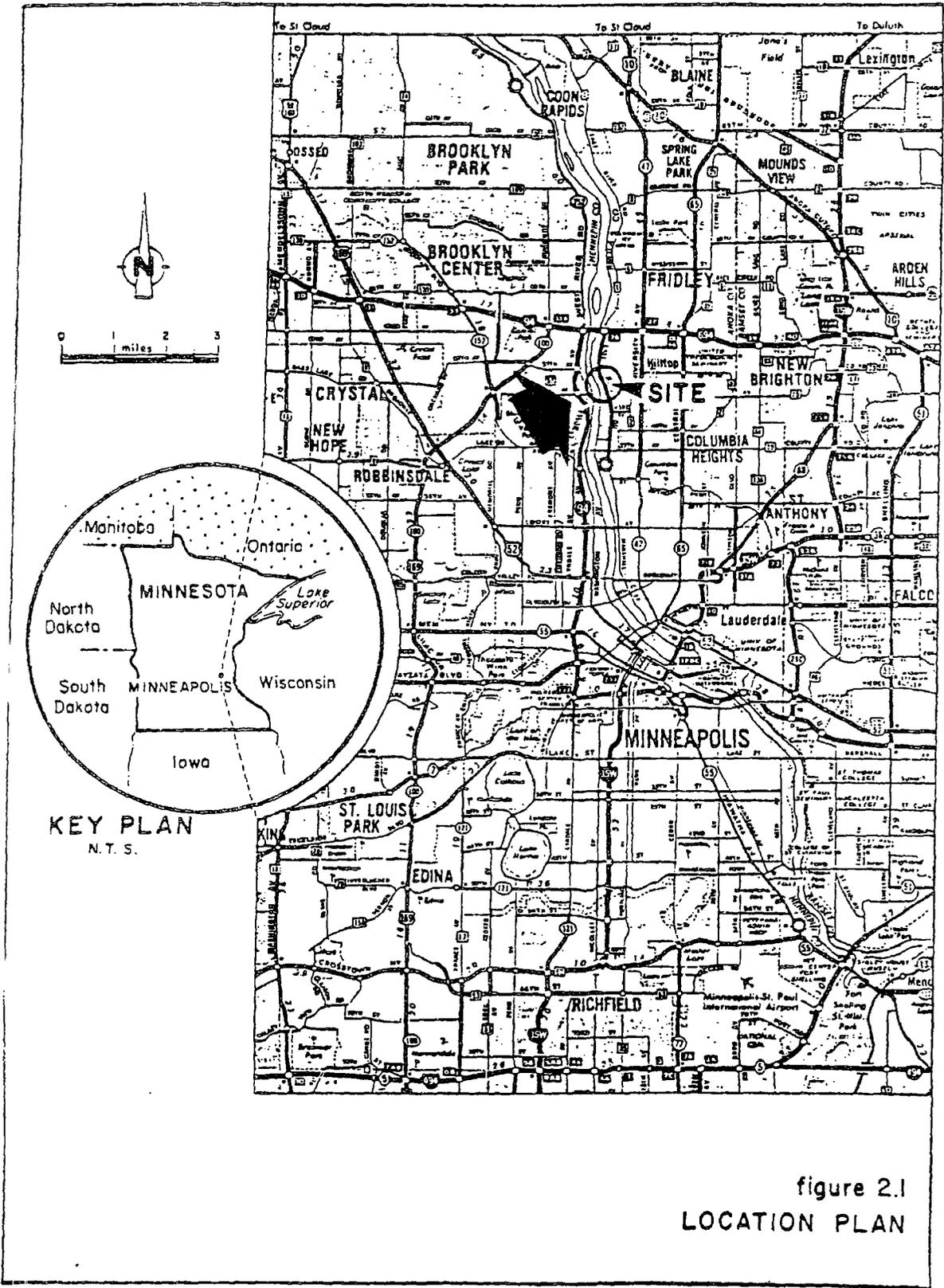
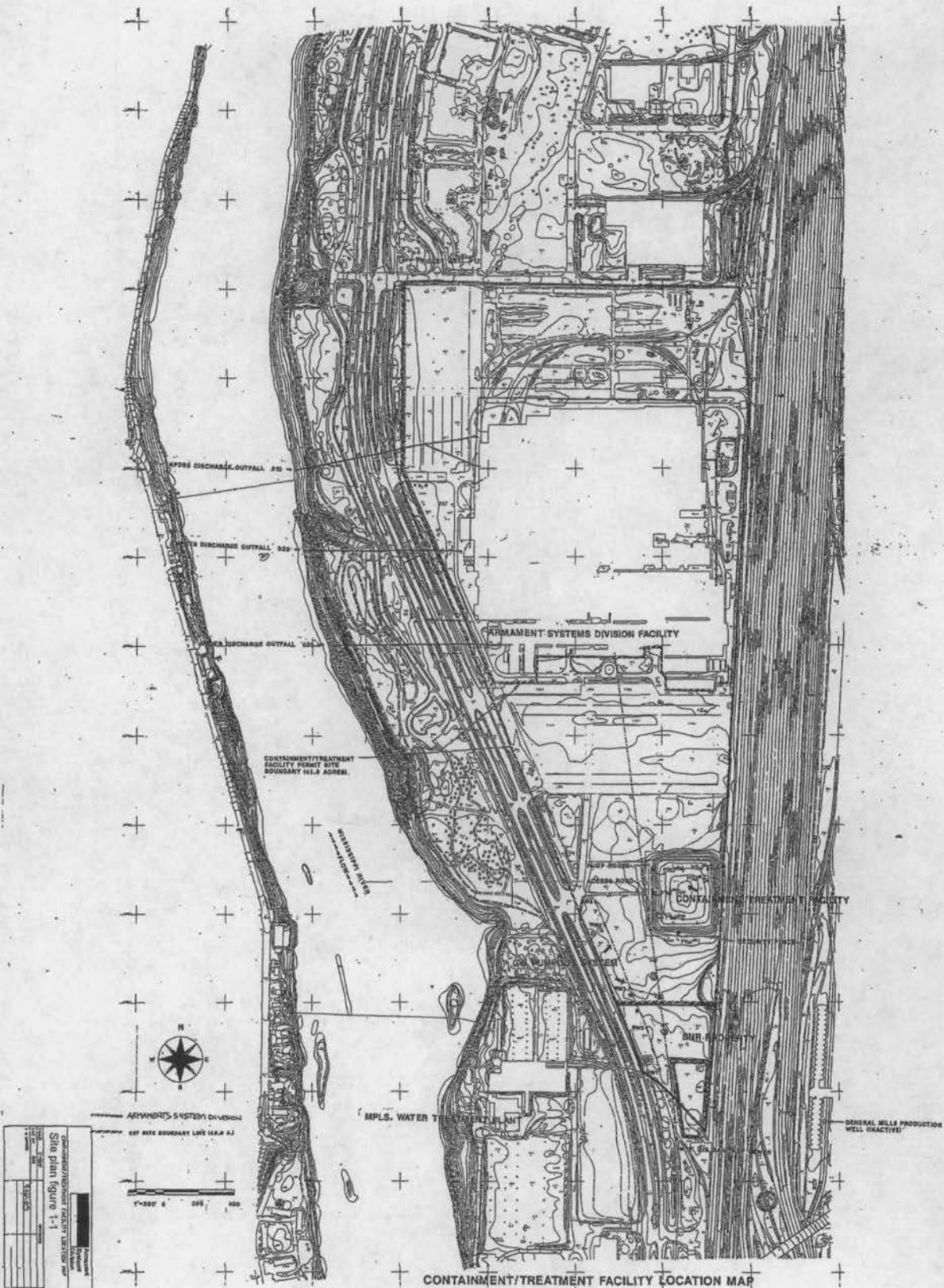
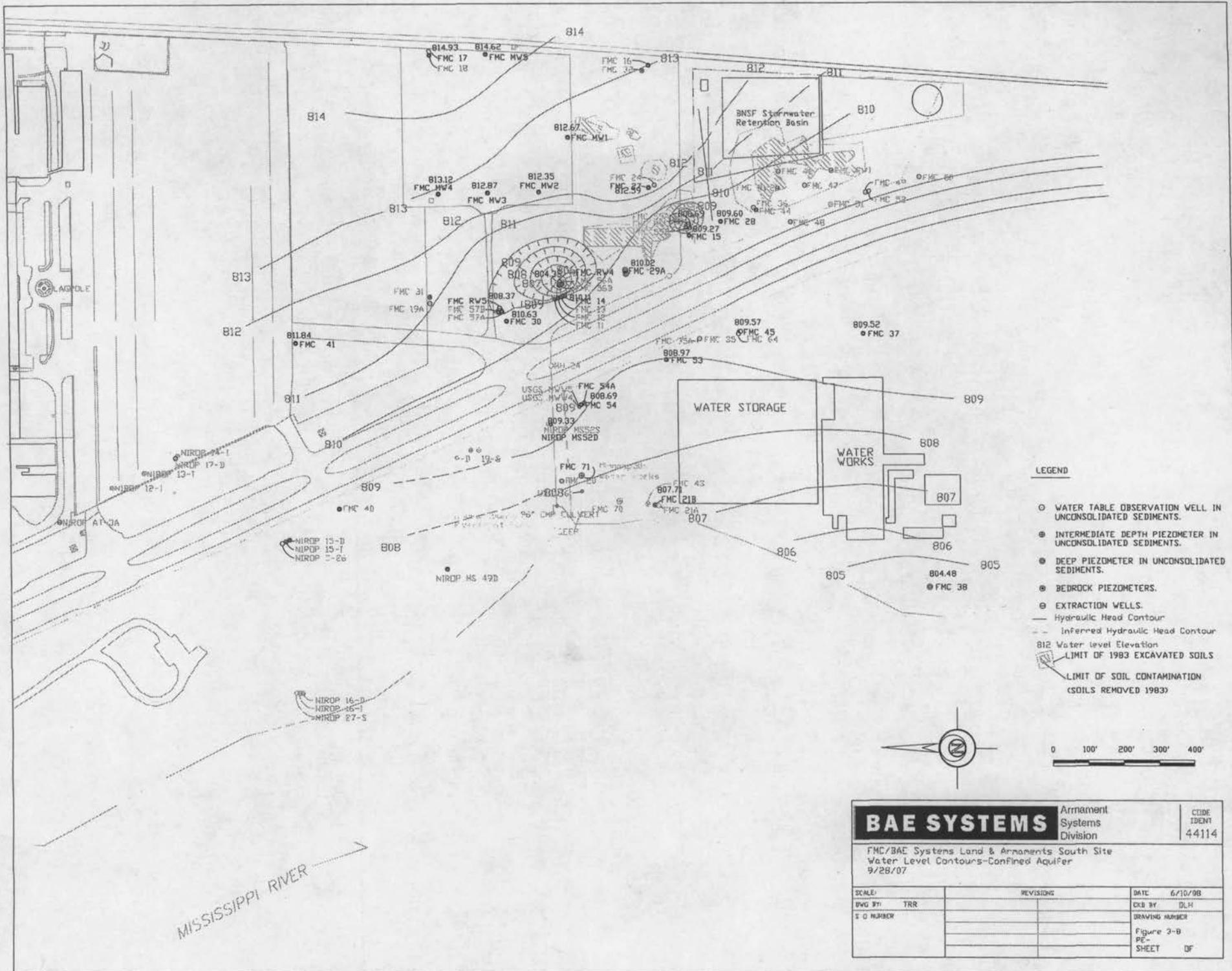


figure 2.1
LOCATION PLAN

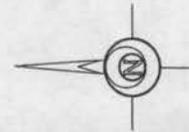


CONTAINMENT/TREATMENT FACILITY LOCATION MAP Site plan figure 1-1	
Project Name Containment/Treatment Facility Location Map	Date 4/11/81
Drawing No. 1-1	Scale 1"=200' @ 250' 800'
Author J. M. ...	Check J. M. ...
Designer J. M. ...	Engineer J. M. ...
Draftsman J. M. ...	Title Containment/Treatment Facility Location Map

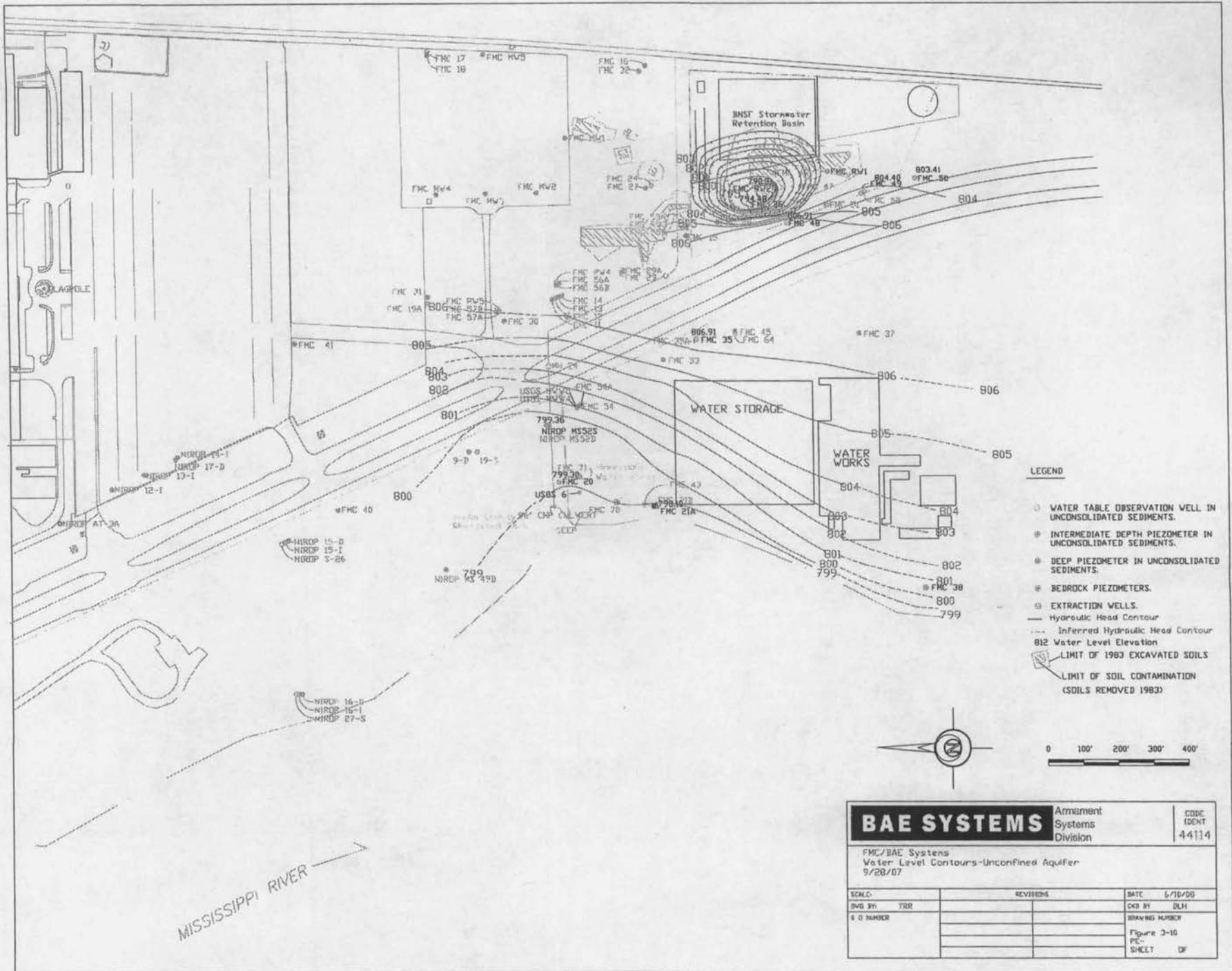
JUNE 1987 R



- LEGEND**
- WATER TABLE OBSERVATION WELL IN UNCONSOLIDATED SEDIMENTS.
 - INTERMEDIATE DEPTH PIEZOMETER IN UNCONSOLIDATED SEDIMENTS.
 - DEEP PIEZOMETER IN UNCONSOLIDATED SEDIMENTS.
 - BEDROCK PIEZOMETERS.
 - EXTRACTION WELLS.
 - Hydraulic Head Contour
 - - - Inferred Hydraulic Head Contour
 - 812 Water level Elevation
 - ▭ LIMIT OF 1983 EXCAVATED SOILS
 - ▭ LIMIT OF SOIL CONTAMINATION (SOILS REMOVED 1983)

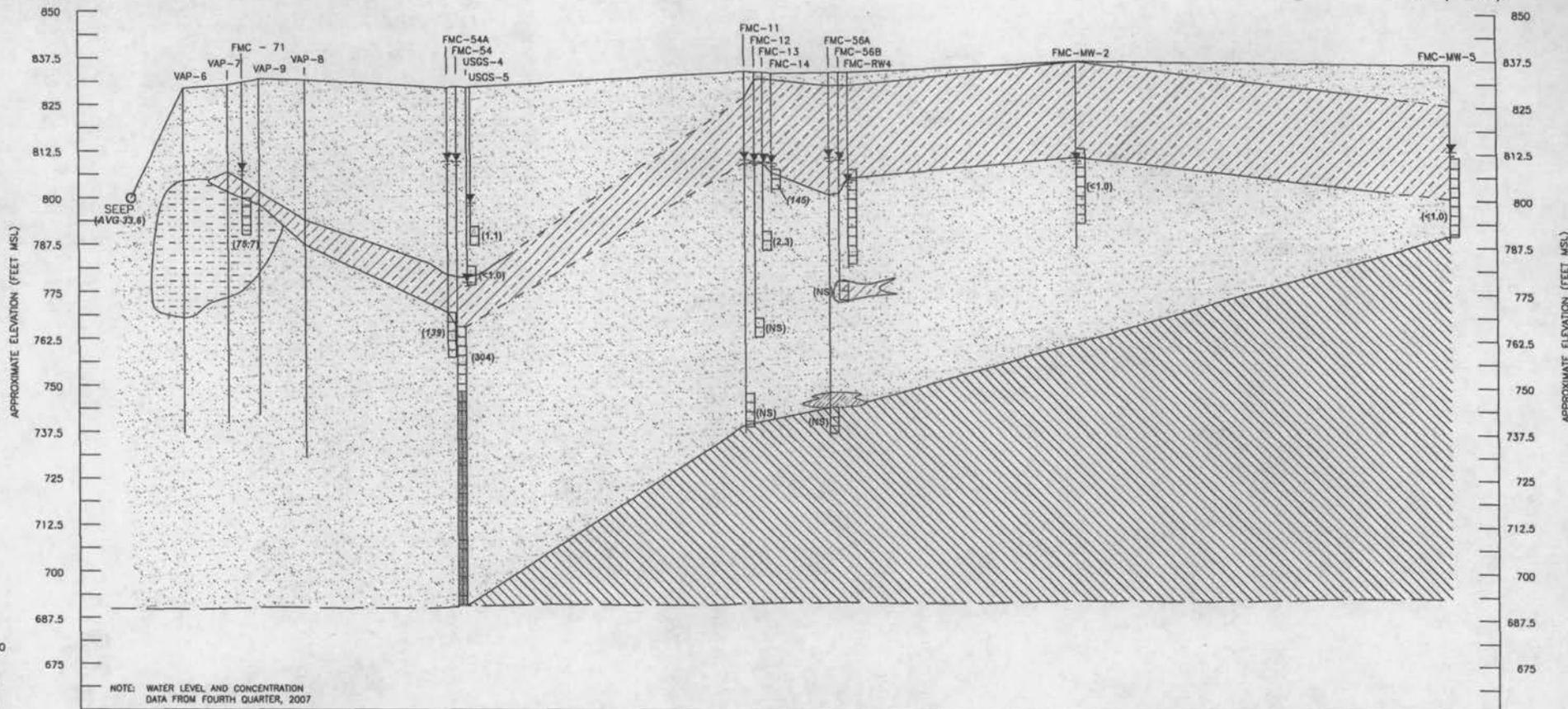


BAE SYSTEMS		Armament Systems Division	CODE IDENT 44114
FMC/BAC Systems Land & Armaments South Site Water Level Contours-Confined Aquifer 9/28/07			
SCALE:	REVISING:	DATE:	6/10/98
DWG BY: TRR		CHK BY: DLH	
SHEET NUMBER:		DRAWING NUMBER:	Figure 3-B
			PE-SHEET OF



A (WEST)

A' (EAST)



NOTE: WATER LEVEL AND CONCENTRATION DATA FROM FOURTH QUARTER, 2007



VERTICAL SCALE APPROXIMATE SCALE IN FEET



HORIZONTAL SCALE APPROXIMATE SCALE IN FEET

VERTICAL EXAGGERATION 3.5X

LEGEND:

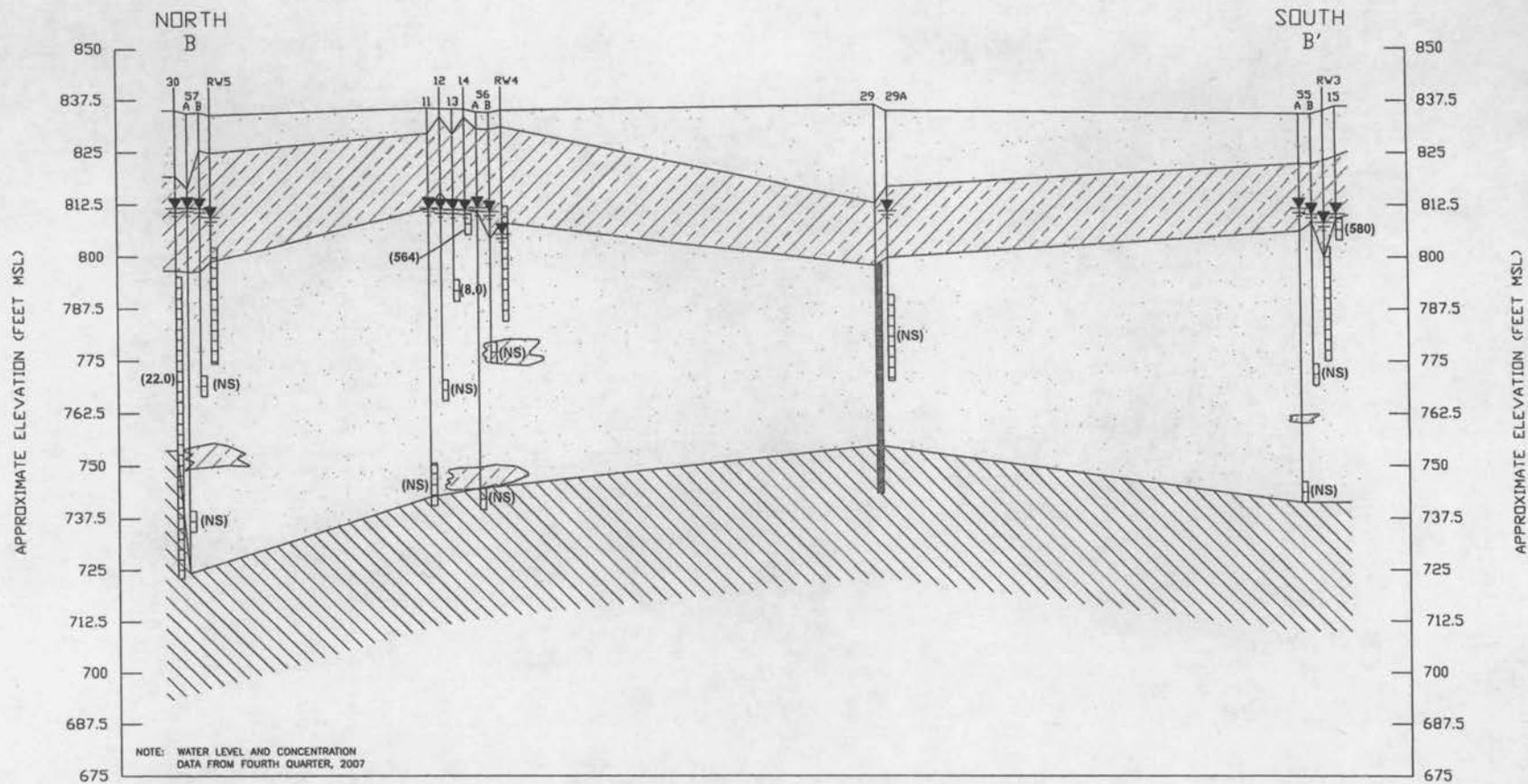
- SCREEN INTERVAL
- MODIFIED WELL SCREEN (GROUTED)
- CLAY / SILTY CLAY
- INFERRED BOUNDARY
- GROUNDWATER TABLE
- SAND
- ST. PETER SANDSTONE
- SILTY SAND AND/OR SANDY SILT
- (NS) NOT SAMPLED

ARCADIS



Cross Section A-A'
2007 Tetrachloroethene Concentrations
Former FMC Site
Fridley, Minnesota

DRAWN	DATE	PROJECT MANAGER	DRAWING NAME
RD	8/20/08	DN	VAP_Knsgl_A-A' 062008
		LEAD DESIGN PRG	CHECKED
		AF	DN
		PROJECT NUMBER	FIGURE NUMBER
		MN00553.003	1-5



0
VERTICAL SCALE
APPROXIMATE SCALE
IN FEET
25
50

HORIZONTAL SCALE
APPROXIMATE SCALE IN FEET
VERTICAL EXAGGERATION = 2X

LEGEND

SAND

CLAY / SILTY CLAY

ST. PETER SANDSTONE

(37.4) TCE CONCENTRATION, ug/l

SCREENED INTERVAL

(NS) NOT SAMPLED

ABANDONED WELL

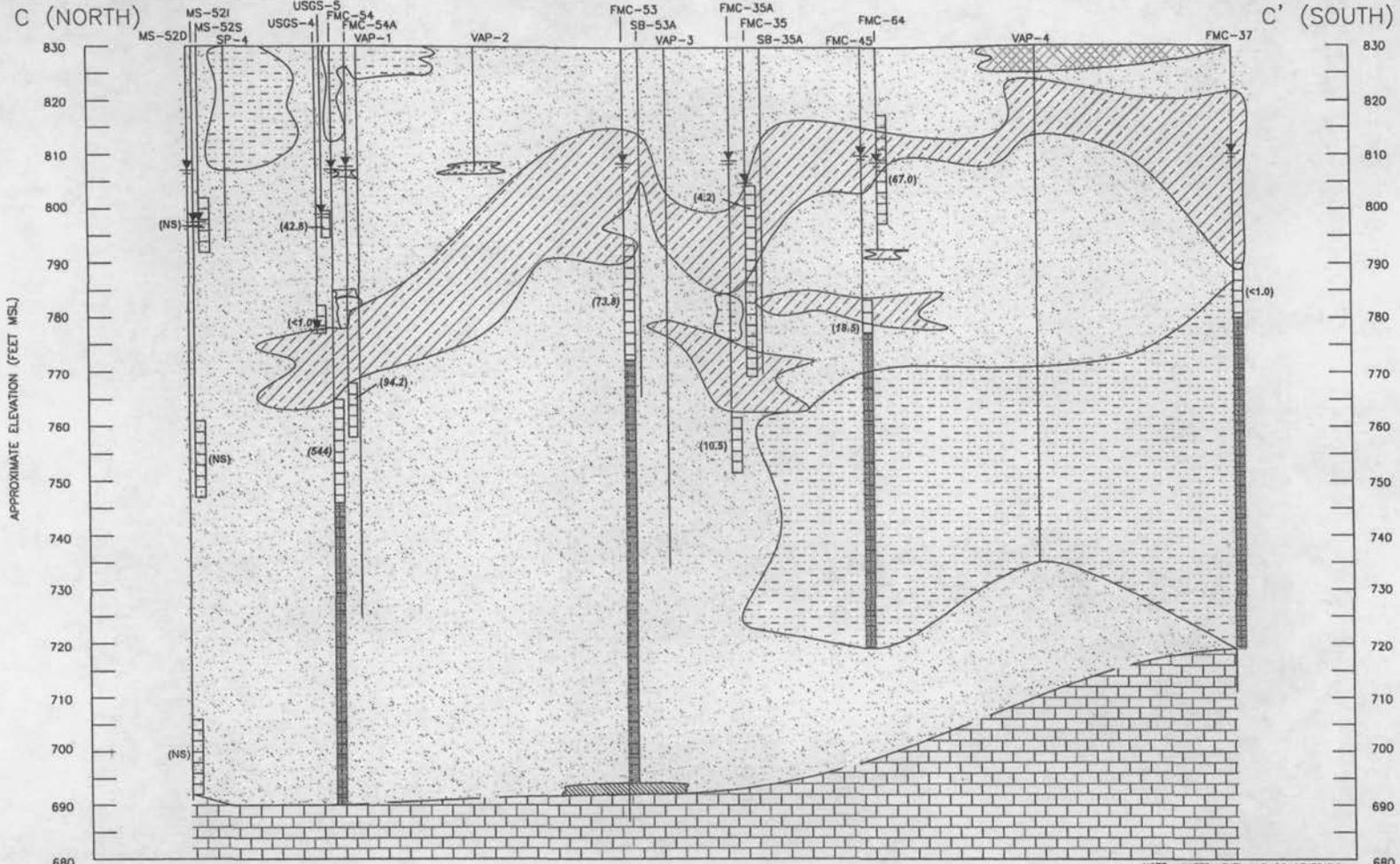
GROUNDWATER TABLE

ARCADIS



Cross Section B-B'
2007 Trichloroethene Concentrations
Former FMC Site
Fridley, Minnesota

DRAWN RO	DATE 6/20/08	PROJECT MANAGER DH	DRAWING NAME VAP Xsect B-B' 062008
		LEAD DESIGN PRGF. AF	CHECKED DH
		PROJECT NUMBER MN00553.003	FIGURE NUMBER 1-6



NOTE: WATER LEVEL AND CONCENTRATION DATA FROM FOURTH QUARTER, 2007

VERTICAL SCALE
APPROXIMATE SCALE IN FEET

HORIZONTAL SCALE
APPROXIMATE SCALE IN FEET

VERTICAL EXAGGERATION 5X

LEGEND:

- SCREEN INTERVAL
- GROUNDWATER TABLE
- MODIFIED SCREEN WELL (GROUTED)
- SAND
- CLAY / SILTY CLAY
- FILL
- GRAVEL
- BEDROCK
- SILT AND SAND
- ST. PETER SANDSTONE

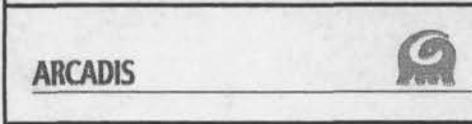
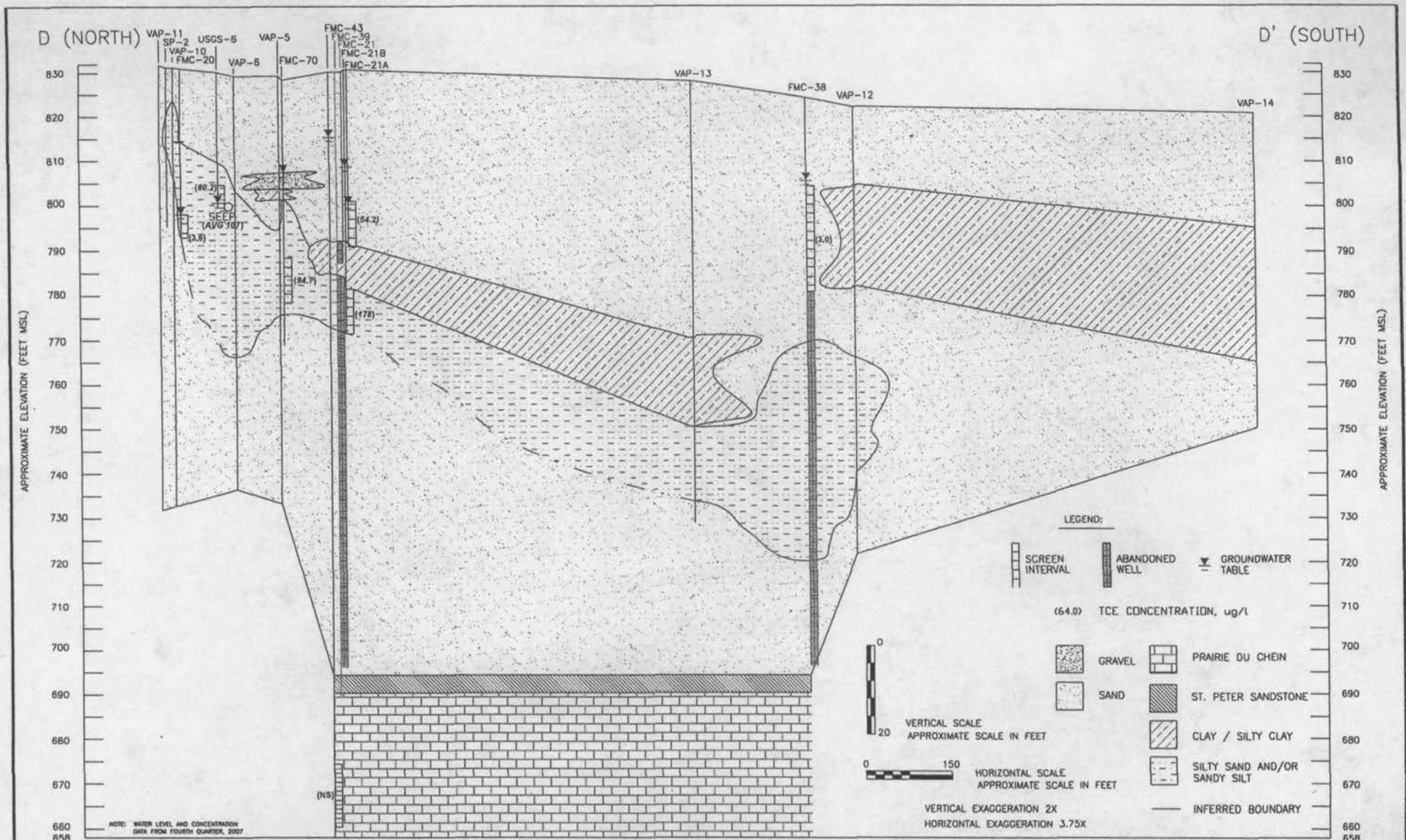
(18) TCE CONCENTRATION, ug/l
(NS) NOT SAMPLED
--- INFERRED BOUNDARY

Cross Section C-C'
2007 Trichloroethene Concentrations
Former FMC Site
Fridley, Minnesota

ARCADIS



DRAWN RD	DATE 8/20/08	PROJECT MANAGER DN	DRAWING NAME VAP Sect C-C' 082008
		LEAD DESIGN PROF. MF	CHECKED DN
		PROJECT NUMBER MN0553.003	FIGURE NUMBER 1-7



Cross Section D-D'
 2007 Trichloroethene Concentrations
 Former FMC Site
 Fridley, Minnesota

DRAWN	RD	DATE	6/20/08	PROJECT MANAGER	DN	DRAWING NAME	VAP Xsect D-D' 082008
				LEAD DESIGN PROF.	AF	CHECKED	DN
				PROJECT NUMBER	MN00553.003	FIGURE NUMBER	1-8

APPENDIX A
(MPCA Position on Short Term Protectiveness)

APPENDIX A

Minnesota Pollution Control Agency's Position Regarding the Short Term Protectiveness of the Remedy at FMC Corp. Site

It is the Minnesota Pollution Control Agency's (MPCA's) position that the remedy to address groundwater contamination at the above referenced site (Site) is currently not protective of human health and the environment in the short-term. This determination, which differs from the United States Environmental Protection Agency's (US 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 U.S. 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 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. 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

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.

APPENDIX B
(Interview Documentation)

From: Flaherty, Mike [michael.flaherty@metc.state.mn.us]
Sent: Tuesday, November 18, 2008 10:43 AM
To: Jacob Knapp
Subject: Interview Responses for FMC 5 Year Review_MCES.doc

Attachments: Interview Responses for FMC 5 Year Review_MCES.doc
Please review and let me know if this is adequate.

Sincerely,
Mike
Michael V Flaherty, P.E.
Senior Engineer

Metropolitan Council Environmental Services
390 N Robert St
St Paul, MN 55101-1805
phone: 651-602-4715
fax: 651-602-4730
email: michael.flaherty@metc.state.mn.us
internet: <http://www.metrocouncil.org/environment/>

Interview Questions for FMC 5 Year Review
Metropolitan Council Environmental Services (POTW)

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: Yes. Discharge reports and site changes are provided in a timely manner.

Do you have any comments or concerns about the Site?

ANSWER: No.

Are you aware of any changes related to the six factors listed below?

Potential of pollutants to cause pass through or interference, including health hazards to employees at the POTW,

The ability of the POTW to ensure compliance with applicable treatment standards and requirements,

The POTW record of compliance with the NPDES permit and pretreatment program requirements,

The potential for volatilization of the wastewater and its impact upon air quality,

The potential for groundwater contamination from transport of CERCLA wastewater to the POTW and the need for groundwater monitoring,

The potential effect of the CERCLA wastewaters upon the POTW discharge into receiving waters.

ANSWER: I'm not aware of any changes or significant concerns related to the above factors.

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

Has discharge from the Site met permit requirements?
ANSWER: Yes. Discharge from this site has not resulted in a violation.

varr 1511261

10-24-08

1:20 p

Interview Questions for FMC 5 Year Review

Minnesota Department Of Health

Are you aware of any complaints or incidents that may have affected the Site?

None

Do you feel well informed about the Site?

*Site is not part of his area
His involvement is with MWW*

Do you have any comments or concerns about the Site?

*no concerns regarding FMC site or TCE
concentrations @ MWW*

Have any department policies changed that could affect the protectiveness of the Site?

Do you know of any planned future policy changes that could affect the Site?

received contact information from Rick @ MWW

Michael Convery
10-24-08
11:00am

Interview Questions for FMC 5 Year Review

Minnesota Department Of Health

Are you aware of any complaints or incidents that may have affected the Site?

no

Do you feel well informed about the Site?

yes

Do you have any comments or concerns about the Site?

Have any department policies changed that could affect the protectiveness of the Site?

no Policy changes that could affect protectiveness of the site

Do you know of any planned future policy changes that could affect the Site?

planning on special well construction area
north to G94

minneapolis has its own permits for well construction

MWW
10-24-08
1:10 PM

Interview Questions for FMC 5 Year Review

Minneapolis Water Works

Are you aware of any complaints or incidents that may have affected the Site?

no complaints or incidents

Do you feel well informed about the Site?

none

Do you have any comments or concerns about the Site?

none

Have any city policies changed that may affect the Site protectiveness?

none

Do you know of any planned future policy changes that could affect the Site?

none

Do you know of any planned future land use changes that could affect the Site?

building a new building on MWW property
chlorine handling facility - also constructing a filtration facility

How many people are serviced by operations at the MWW?

500,000 people

MDH samples River for VOC netto intake
David Rindal 651 201 4660

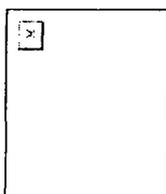
From: Kosluchar, Jim [KoslucharJ@ci.fridley.mn.us]
Sent: Monday, December 08, 2008 3:59 PM
To: Jacob Knapp
Subject: RE: Interview questions for FMC 5 year review
Jacob:

We have had limited use over the last year; I believe well 13 was only used to keep in a "ready" operational condition. While we would use this well to augment water supplies due to high summer use, scheduled maintenance, loss of service of one or more other wells, or other requirements, we would not expect its use on an annual basis. This spring we will have it in standby mode due to a filter project at one of our water plants. Other than this project, we are not planning withdrawals from this well in 2009.

I hope this answers your questions. Let me know if you require more information.

Regards,

James Kosluchar, P.E.
Public Works Director/City Engineer



City of Fridley
6431 University Ave. NE
Fridley, MN 55432
(763) 572-3552
(763) 571-1287 fax
koslucharj@ci.fridley.mn.us

From: Jacob Knapp [mailto:JKnapp@deltaenv.com]
Sent: Monday, December 08, 2008 3:48 PM
To: Kosluchar, Jim
Subject: RE: Interview questions for FMC 5 year review

Jim,

I have a follow up question. I apologize for the delay. During our initial discussion you indicated that Municipal Wells 1 and 13 were utilized for emergency use only.

How often is well 13 utilized, and what are the emergency situations that would constitute its use (i.e. high summer use periods, system maintenance, other).

Please let me know if you have any questions.

Thanks,

Jake

From: Kosluchar, Jim [mailto:KoslucharJ@ci.fridley.mn.us]
Sent: Tuesday, November 04, 2008 9:23 AM
To: Jacob Knapp

Cc: Hickok, Scott

Subject: RE: Interview questions for FMC 5 year review

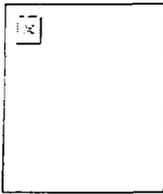
Jacob:

Our Community Development Director, Scott Hickok, added the comments below in red text.

Please let me know if you require any follow-up information.

Regards,

James Kosluchar, P.E.
Public Works Director/City Engineer



City of Fridley
6431 University Ave. NE
Fridley, MN 55432
(763) 572-3552
(763) 571-1287 fax
koslucharj@ci.fridley.mn.us

From: Jacob Knapp [mailto:JKnapp@deltaenv.com]

Sent: Monday, November 03, 2008 2:50 PM

To: Kosluchar, Jim

Subject: Interview questions for FMC 5 year review

Jim.

Thank you for taking the time to answer my questions this afternoon. I have attached a copy of the questions we discussed for your reference.

The following is a brief description to the interview questions and answers from our conversation this afternoon.

Are you aware of any complaints or incidents that may have affected the Site?

You responded that you are not aware of any complaints or incidents related to the FMC Site.

No, I am not aware of any incidents that have occurred on this site, nor have there been any complaints.

Do you feel well informed about the Site?

You indicated that you were new to the position and knew of the Site and the current groundwater pumping but did not have specific knowledge of site activities.

Yes, the original data from the study has been helpful as folks have discussed future uses for the site.

Do you have any comments or concerns about the Site?

You expressed concern for the City wellhead protection plan for the nearby municipal wells 1 and 13.

Is there a similar follow-up another 5 years out?

Have any City policies changed that may affect the site protectiveness?

You identified that municipal wells 1 and 13 are now currently used for emergency purposes only. You also confirmed the City policy requiring water users within the City to utilize the existing municipal water supply is still in place.

No

Do you know of any planned future policy changes that could affect the Site?

You indicated you were not aware of any known policy changes.

The current owner of the site would like to further subdivide the property. They will need to be cognizant of the requirements. To the extent that we can at our staff level, we will alert them to the requirements.

Do you know of any planned future land use changes that could affect the Site?

You indicated you were not aware of any known land use changes.

No

Please let me know if you have any additional information that could be helpful related to this Site or if any of the above information is incorrect. If you would like to pass the attached questions on to someone within your department that may have additional knowledge of changes or concerns affecting the Site please do so. I can be contacted at the number listed below.

Thanks again,

Jacob Knapp
Staff Geologist
Delta Consultants
Direct: 651.697.5253
Fax: 651.639.9473

KOSLUCHARS DCI, Fridley, mn. vs - PW Director

11-3-08 by phone

SCOTT HICKOK

Interview Questions for FMC 5 Year Review

by Email

City of Fridley

Community Development Director

Are you aware of any complaints or incidents that may have affected the Site?

NO COMPLAINTS OR INCIDENTS

Do you feel well informed about the Site?

NEW TO POSITION - KNOWS OF SITE AND THAT GROUNDWATER IS PUMPED - NOT SPECIFIC KNOWLEDGE

Do you have any comments or concerns about the Site?

~~NO~~ CONCERN FOR WELL HEAD PROTECTION PLAN AT FRIDLEY WELLS NEARBY.

Have any city policies changed that may affect the Site protectiveness?

UTILIZING CITY WELLS 1+13 FOR EMERGENCY USE

Do you know of any planned future policy changes that could affect the Site?

NO KNOWN CHANGES

Do you know of any planned future land use changes that could affect the Site?

NO KNOWN

Jacob Knapp

From: Kosluchar, Jim [KoslucharJ@ci.fridley.mn.us]
Sent: Tuesday, November 04, 2008 9:23 AM
To: Jacob Knapp
Cc: Hickok, Scott
Subject: RE: Interview questions for FMC 5 year review
Attachments: image001.jpg

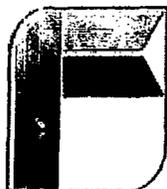
Jacob:

Our Community Development Director, Scott Hickok, added the comments below in red text.

Please let me know if you require any follow-up information.

Regards,

Jarnes Kosluchar, P.E.
Public Works Director/City Engineer



City of Fridley
6431 University Ave. NE
Fridley, MN 55432
(763) 572-3552
(763) 571-1287 fax
koslucharj@ci.fridley.mn.us

From: Jacob Knapp [mailto:JKnapp@deltaenv.com]
Sent: Monday, November 03, 2008 2:50 PM
To: Kosluchar, Jim
Subject: Interview questions for FMC 5 year review

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Do you feel well informed about the Site?

You indicated that you were new to the position and knew of the Site and the current groundwater pumping but did not have specific knowledge of site activities.

Yes, the original data from the study has been helpful as folks have discussed future uses for the site.

Do you have any comments or concerns about the Site?

11/5/2008

13. You expressed concern for the City wellhead protection plan for the nearby municipal wells 1 and

Is there a similar follow-up another 5 years out?

Have any City policies changed that may affect the site protectiveness?

You identified that municipal wells 1 and 13 are now currently used for emergency purposes only. You also confirmed the City policy requiring water users within the City to utilize the existing municipal water supply is still in place.

No

Do you know of any planned future policy changes that could affect the Site?

You indicated you were not aware of any known policy changes.

The current owner of the site would like to further subdivide the property. They will need to be cognizant of the requirements. To the extent that we can at our staff level, we will alert them to the requirements.

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No

Please let me know if you have any additional information that could be helpful related to this Site or if any of the above information is incorrect. If you would like to pass the attached questions on to someone within your department that may have additional knowledge of changes or concerns affecting the Site please do so. I can be contacted at the number listed below.

Thanks again,

Jacob Knapp
Staff Geologist
Deiza Consultants
Direct: 651.697.5253
Fax: 651.639.9473

11/5/2008

APPENDIX C
(Public Notice Documentation)

**Announcement of a Five-Year Review
For the
FMC Superfund Site**

The Minnesota Pollution Control Agency (MPCA) is beginning a fourth Five-year Review of the FMC 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.

The FMC 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 onsite, 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 extraction and treatment system utilizes four pumping wells to 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 groundwater flows to the river.

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 sites 1987 Record of Decision remain protective of human health and the environment.

In the most recent Five-year Review conducted in 2004 the MPCA found that remedial actions at the site provided short term protection to human health and the environment. The previous Five-year Review concluded that long term protectiveness would be achieved once performance requirements identified in the ROD have been achieved.

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 November 21, 2008 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:

Mr. Hans Neve
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155

The site EPA fact sheet is located at www.epa.gov/region5/superfund/npl/minnesota/index.html. Site documents are available for review at the St. Paul MPCA office, 520 Lafayette Road North, St. Paul, MN 55155. These documents will provide more detail on site cleanup history and remedies in place.



AFFIDAVIT OF PUBLICATION

STATE OF MINNESOTA)
) ss.
COUNTY OF HENNEPIN)

Richard Hendrickson, being duly sworn on an oath, states or affirms that he is the Chief Financial Officer of the newspaper known as Fridley / Columbia Hts

Sun-Focus and has full knowledge of the facts stated below:

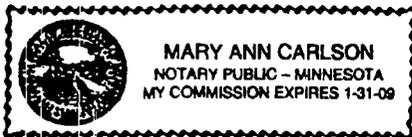
- (A) The newspaper has complied with all of the requirements constituting qualification as a qualified newspaper as provided by Minn. Stat. §331A.02, §331A.07, and other applicable laws as amended.
- (B) The printed public notice that is attached was published in the newspaper once each week, for one successive week(s); it was first published on Thursday, the 16 day of October, 2008, and was thereafter printed and published on every Thursday to and including Thursday, the _____ day of _____, 2008; and printed below is a copy of the lower case alphabet from A to Z, both inclusive, which is hereby acknowledged as being the size and kind of type used in the composition and publication of the notice:

abcdefghijklmnopqrstuvwxyz

BY [Signature]
CFO

Subscribed and sworn to or affirmed before me on this 16 day of October, 2008.

[Signature]
Notary Public



MN Pollution Control Agency

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

The Minnesota Pollution Control Agency (MPCA) is beginning a fourth Five-year Review of the FMC 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.

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St. Paul, MN 55155

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APPENDIX D
(List of Documents Reviewed)

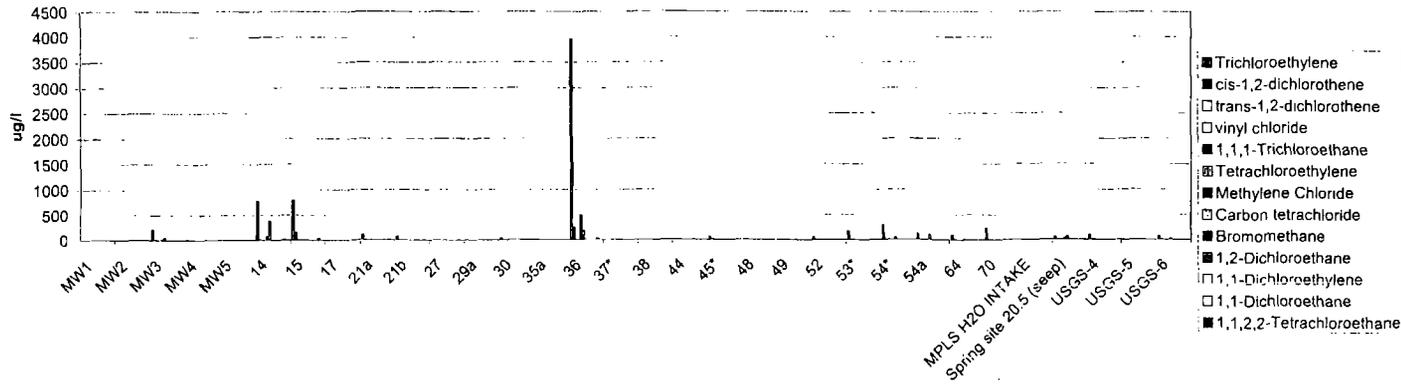
Five Year Review Bibliography

Date	Title	Site	Author
30-Jun-08	Groundwater Extraction System Annual Monitoring Report for 2007	FMC	BAE Systems
27-Aug-07	Results of the Dye Tracer Study	FMC	Arcadis
27-Aug-08	Seep Report	FMC	BAE Systems
13-Jul-08	RE FMC Corporation Superfund Site	FMC	MPCA
27-Aug-07	FMC	FMC	MPCA
27-Aug-08	FMC Site Dye Tracer Study Report Question	FMC	MPCA
17-Feb-06	Results of Vertical Aquifer Profiling and Seep Assessment	FMC	Arcadis
27-Feb-03	Subject: FMC	FMC	MPCA
30-Sep-87	Superfund Record of Decision: FMC Corp., MN	FMC	EPA
17-Oct-86	Response Order by Consent with FMC	FMC	MPCA
15-May-03	Phase II Investigation Report Response Action Plan	Center Point/BNSF	ProSource Technologies, Inc.
14-Jul-08	Supplement to May 15, 2008 Phase II Investigation Report Center Point Energy Riverside Pipeline Project - BNSF Parcel	CenterPoint/BNSF	ProSource Technologies, Inc.
15-Jan-98	Results of Environmental Investigation at Proposed BNSF Stormwater Retention Pond	FMC - BNSF parcel	ThermRetec
1-May-84	Summary of Analytical Data for FMC Northern Ordnance Plant	FMC	FMC
23-Jul-05	Modifications to Report - Results of Monitoring Well Installation and Extraction Well Modification	FMC	BAE Systems
30-Nov-07	Email reflecting changes to the QAPP	FMC	BAE Systems
27-Feb-07	Hazardous Waste Report - 2006	FMC	BAE Systems
1-Oct-97	Aquifer Test Analysis for United Defense for Armament Systems Division	FMC	Geraghy & Miller
30-Jun-04	Capture Zone Analysis of Groundwater Recovery System	FMC	Arcadis
30-Jun-03	Capture Zone Analysis of Groundwater Recovery System	FMC	Arcadis
1-Sep-96	Capture Zone Modeling and Evaluation of Groundwater Recovery System	FMC	RMT
1-Feb-96	1994 Annual Report Groundwater Remediation Response Action Plan - AMR	FMC	UDLP
9-Nov-01	Results of Site Work Conducted in May 2001	FMC	Arcadis
28-Mar-05	Revised Figures Results of Monitoring Well Installation And Extraction Well Modification Report	FMC	Arcadis
1-Jun-04	2003 Annual Monitoring Report	FMC	BAE Systems
1-Mar-04	Quality Assurance Project Plan (QAPP)	FMC	UDLP
1-Jun-03	Annual Monitoring Report for 2002	FMC	UDLP
30-Jun-06	Annual Monitoring Report for 2005	FMC	BAE Systems
1-Jun-05	Annual Monitoring Report for 2004	FMC	BAE Systems
1-Sep-96	Capture Zone Modeling and Evaluation of Groundwater Recovery System - ModFlow Model Disks	FMC	RMT
17-Aug-04	Results of Vertical Aquifer Profiling and Seep Assessment	FMC	Arcadis

APPENDIX E
(Groundwater Data from 2007 AMR)

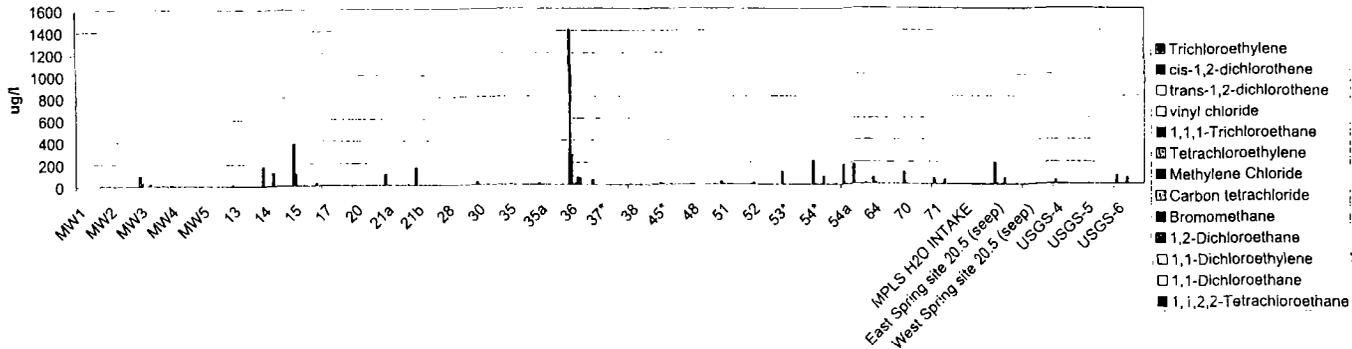
Date	WELL	Trichloroethylene	cis-1,2-dichloroethane	trans-1,2-dichloroethane	vinyl chloride	1,1,1-Trichloroethane	Tetrachloroethylene	Methylene Chloride	Carbon tetrachloride	Bromomethane	1,2-Dichloroethane	1,1-Dichloroethylene	1,1-Dichloroethane	1,1,2,2-Tetrachloroethane	Note
		78-01-8	156-59-2	108-80-05	75-01-4	71-55-6	127-18-4	75-09-2	55-23-5	74-83-9	107-06-2	75-34-4	75-34-3	75-34-5	
		30	70	100	0.2	800	7	50	3	10	5	8	70	2	
		6	70	100	2	200	6	2	5	Not listed	4	7	Not listed	Not listed	
	MW1	0.28	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND method 801/802 GC FID
	MW2	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND method 801/802 GC FID
	MW3	210	8.3	0.36	ND	5.9	43	ND	ND	ND	ND	ND	ND	8.8	ND method 801/802 GC FID
	MW4	18	1.3	ND	ND	0.7	1.3	ND	ND	ND	ND	ND	ND	0.81	ND method 801/802 GC FID
	MW5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND method 801/802 GC FID
	14	773	2.7	ND	ND	88.5	375	ND	ND	ND	ND	ND	1.4	10	ND
	15	784	15.1	3.7	3.61	1.1	4.0	ND	ND	ND	ND	ND	1.8	28.7	ND
	17	0.23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	21a	105	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.8	ND
	21b	84	2.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND
	27	ND	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	29a	6.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	30	37.4	3.0	ND	ND	2.8	ND	ND	ND	ND	ND	ND	ND	1.8	ND
	35a	10.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	36	3960	258	2.8	0.83	496	190	ND	ND	ND	1.8	8.0	28.8	ND	ND
	37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	screen made shallow 2005, sampled 12/15/05
	38	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	44	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	45	81.7	12.4	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND	screen made shallow 2005
	48	7.8	10.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	49	4.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	52	44.7	8.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	53	184	2.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	screen made shallow 2005, sampled 12/15/05
	54	288	6.5	ND	ND	ND	45.1	ND	ND	ND	ND	ND	ND	6.5	screen made shallow 2005, sampled 12/15/05
	54a	121	3.4	ND	ND	3.2	11.9	ND	ND	ND	ND	ND	1.8	4.4	ND
	56	88.3	2.0	ND	ND	ND	3.1	ND	ND	ND	ND	ND	ND	ND	ND
	70	226	8.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND
	MPLS H2O INTAKE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Spring site 20.5 (seep)	64	3.3	ND	ND	23.4	59.5	ND	ND	ND	ND	1.9	6.8	ND	sampled 9/3/05
	USGS-4	88	2.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	USGS-5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	USGS-6	88	2.5	ND	ND	1.9	24.5	ND	ND	ND	ND	ND	1.9	ND	ND
	Concentration ug/l														
	Method detection limit ug/l	0.5	0.5	0.5	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	Reporting limit	1	1	1	0.40	1	1	1	1	1	1	1	1	1	
	ND= Not Detected														
	N/A= Not Analyzed														
	screen mod to shallow														

South Site Groundwater



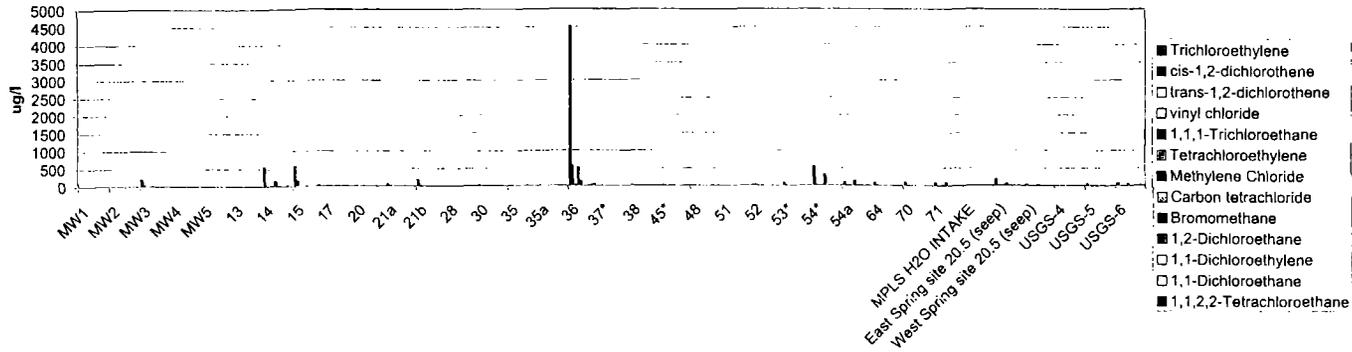
Date	Well	10/25/2005														Note
		Trichloroethylene 79-01-8	cis-1,2-dichloroethene 156-59-2	trans-1,2-dichloroethene 156-60-04	vinyl chloride 74-47-4	1,1,1-Trichloroethane 71-55-8	1,1,2-Dichloroethane 127-18-4	Methylene Chloride 75-00-2	Carbon tetrachloride 56-23-5	Bromomethane 74-83-8	1,2-Dichloroethane 107-06-2	1,1-Dichloroethene 75-34-4	1,1-Dichloroethane 75-34-3	1,1,2,2-Tetrachloroethane 79-34-5		
	CASF	79-01-8	156-59-2	156-60-04	74-47-4	71-55-8	75-00-2	56-23-5	74-83-8	107-06-2	75-34-4	75-34-3	79-34-5			
	HPLA	30	70	100	0.2	800	30	3	10	5	6	70	2			
	MCL	5	70	100	2	200	5	5	Not listed	4	7	Not listed	Not listed			
	MW1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4			
	MW2	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	MW3	8.1	2.1	ND	ND	1.4	1.8	ND	ND	ND	ND	ND	3.8			
	MW4	8.8	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	MW5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	13	8.1	ND	ND	ND	ND	2.7	ND	ND	ND	ND	ND	ND			
	14	17.8	3.8	ND	ND	4.4	120	ND	ND	ND	ND	ND	4.3			
	15	37.8	10.7	3.3	1.1	4.1	4.1	ND	ND	ND	1.1	ND	18.8			
	17	ND	ND	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND			
	20	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	21a	10.1	3.1	ND	ND	ND	1.2	ND	ND	ND	ND	ND	7.1			
	21b	16.5	ND	4.2	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	28	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	30	24.9	1.9	ND	ND	ND	2.7	ND	ND	ND	ND	ND	ND			
	35	ND	3.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	35a	11.8	ND	ND	ND	ND	1.7	ND	ND	ND	ND	ND	ND			
	36	1410	26.5	ND	12.2	85.2	56.1	ND	ND	ND	ND	ND	41.5			
	37*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	38	3.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	45*	14.3	8.4	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND			
	46	4.7	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3			
	51	2.5	3.8	ND	2.5	1.6	2.2	ND	ND	ND	ND	ND	ND			
	52	4.8	ND	ND	ND	ND	13.7	ND	ND	ND	ND	ND	ND			
	53*	11.8	1.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	54*	21.8	5.0	1.1	ND	1.4	72.4	ND	ND	ND	1.3	ND	8.4			
	54a	189	2.8	ND	ND	8.4	176	ND	ND	ND	ND	ND	5.2			
	64	82.1	14.7	ND	ND	ND	3.0	ND	ND	ND	ND	ND	ND			
	70	104	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	71	47.8	1.5	ND	ND	1.8	33.7	ND	ND	ND	ND	ND	1.8			
	MPLS H2O INTAKE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	East Spring site 20.5 (seep)	184	11.5	ND	ND	8.1	54.4	ND	ND	ND	ND	1.2	5.3			
	West Spring site 20.5 (seep)	4.4	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND			
	USGS 4	31.8	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND			
	USGS 5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
	USGS 6	78.3	2.4	ND	ND	2.4	56.4	ND	ND	ND	ND	ND	3.7			
	Concentration in ug/l				0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			
	Method detection limit ug/l	0.5	0.5	0.5	0.40	0.5	1	1	1	1	1	1	1			
	Reporting limit															
	ND= Not Detected															
	NA= Not Analyzed															
	* screen mod. in shallow															

South Site Groundwater



Well	Trichloroethylene	cis-1,2-dichloroethene	trans-1,2-dichloroethene	vinyl chloride	1,1,1-trichloroethane	tetrachloroethylene	Methylene Chloride	Carbon tetrachloride	Bromomethane	1,2-Dichloroethane	1,1-Dichloroethane	1,1-Dichloroethane	1,1,2,2-tetrachloroethane	Note
	78-31-8	156-55-1	158-60-0	75-01-4	71-85-8	127-18-4	104-2	36-22-5	74-83-3	107-06-2	79-31-4	75-31-3	18-36-5	
CA58	3	70	100	0.2	800	7	50	3	10	5	8	30	2	
HPL4	3	70	100	2	200	5	5	5	Not Read	4	7	Not Read	Not Read	
MCL														
MW1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
MW2	4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
MW3	188	25.3	ND	ND	3.3	21.3	ND	ND	ND	ND	ND	ND	5.7	
MW4	10	1.3	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND	
MW5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
13	8	ND	ND	ND	ND	2.3	ND	ND	ND	ND	ND	ND	ND	
14	564	5.7	ND	ND	13.8	145	ND	ND	ND	ND	ND	31.8	ND	
16	380	141	7.8	0.77	ND	5.7	ND	ND	ND	ND	ND	22.7	ND	
17	ND	ND	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND	
20	3.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
21a	34.7	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8	
21b	178	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
28	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
30	22	1.7	ND	ND	ND	2.7	ND	ND	ND	ND	ND	1.2	ND	
35	4.2	9.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
35a	10.5	ND	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND	
36	4326	966	8.2	8.4	522	122	ND	ND	ND	3.8	10.8	37	ND	
37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	screen made shallow 2005
38	3	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND	
45	18.9	7.9	ND	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND	screen made shallow 2005
48	12.8	13.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2	ND	
51	23.8	25.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	
53	73.8	10.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	screen made shallow 2005
54	84.4	11.1	ND	ND	ND	3.04	ND	ND	ND	2.3	14.9	ND	ND	
54a	84.2	2.2	ND	ND	2.2	1.38	ND	ND	ND	ND	ND	4	ND	screen made shallow 2005
64	87	8.9	ND	ND	ND	3.1	ND	ND	ND	ND	ND	ND	ND	
70	84.7	1.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
71	77	1.7	ND	ND	8	75.7	ND	ND	ND	ND	ND	2.7	ND	
MPLS H2O INTAKE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
East Spring site 20.5 (seep)	185	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
West Spring site 20.5 (seep)	34.8	ND	ND	ND	ND	8.5	ND	ND	ND	ND	ND	1.6	ND	
USGS-4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
USGS-5	42.4	1.6	ND	ND	1.2	1.1	ND	ND	ND	ND	ND	ND	ND	
USGS-6	88.2	1.8	ND	ND	2.7	54.9	ND	ND	ND	ND	ND	5.1	ND	
Concentration ug/l														
Method detection limit ug/l	0.3	0.8	0.3	0.2	8.5	0.5	0.8	0.8	0.5	0.3	0.3	0.5	0.3	
Reporting limit	1	1	1	0.40										

South Site Groundwater



APPENDIX F
(U.S. EPA Memorandum)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

JUL 19 2005

OSWER 9200.4-39

MEMORANDUM

SUBJECT: Use of Alternate Concentration Limits (CLs) in Superfund Cleanups

FROM: Michael B. Cook, Director
Office of Superfund Remediation and Technology Innovation

TO: Superfund National Policy Managers, Regions 1 - 10

Purpose

The purpose of this memorandum is to present EPA policy regarding use of Alternate Concentration Limits (ACLs) in remedies selected under the authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). CERCLA section 121 provides authority to use ACLs under certain circumstances.¹ CERCLA section 121 also requires that all Superfund remedies selected, including those based on ACLs, be protective of human health and the environment. Regions are requested to consult with the Office of Superfund Remediation and Technology Innovation (OSRTI) prior to selecting a remedy that includes CERCLA ACLs.

If the Agency, in its discretion, decides an ACL might be appropriate based on site-specific circumstances, CERCLA section 121 sets forth a number of specific requirements that must be met. This memorandum, which is designed to assist Regions in evaluating the potential of ACLs at Superfund sites, is not a regulation itself, nor does it change or substitute for any regulations. It describes national policy and does not impose legally binding requirements on EPA, states, or the regulated community. This policy does not confer legal rights or impose legal obligations upon any member of the public. Interested parties are free to raise questions and objections about the substance of this memorandum and the appropriateness of the application of this policy to a particular situation. EPA and other decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from those described in this memorandum, and may change this policy in the future.

¹The term CERCLA ACLs is used in this memorandum to distinguish this term from alternate concentration limits used in other programs (e.g., RCR ACLs, provided for in 40 CFR Part 264, or state ACLs). Only CERCLA ACLs are addressed in this memorandum.

Background

CERCLA section 121 establishes certain requirements for the Superfund cleanup process.

Section 121(b)(1) requires that remedial actions be protective of human health and the environment. In addition to that independent requirement, Section 121(d) generally provides that remedial actions shall meet applicable or relevant and appropriate requirements (ARARs), unless those requirements are waived pursuant to section §121(d)(4) under appropriate site-specific circumstances.² Section 121(d)(2)(B)(ii) also addresses ACLs and limitations concerning their use, as follows:

(ii) For the purposes of this section, a process for establishing alternate concentration limits to those otherwise applicable for hazardous constituents in groundwater under subparagraph (A) may not be used to establish applicable standards under this paragraph if the process assumes a point of human exposure beyond the boundary of the facility, as defined at the conclusion of the remedial investigation and feasibility study, except where-

- (I) there are known and projected points of entry of such groundwater into surface water; and
- (II) on the basis of measurements or projections, there is or will be no statistically significant increase of such constituents from such groundwater in such surface water at the point of entry or at any point where there is reason to believe accumulation of constituents may occur downstream; and
- (III) the remedial action includes enforceable measures that will preclude human exposure to the contaminated groundwater at any point between the facility boundary and all known and projected points of entry of such groundwater into surface water then the assumed point of human exposure may be at such known and projected points of entry.

The CERCLA ACL provision is directed at standards that are “otherwise applicable for hazardous constituents in groundwater.” Examples of such standards may include state requirements to clean up ground water to background levels (e.g., some state antidegradation requirements) or state requirements for ground water cleanup. Such standards must otherwise qualify as an applicable standard pursuant to section 121(d)(2)(A) (e.g., must be properly promulgated, enforceable, consistently applied).³

²ARAR waivers are also discussed in §300.430(f)(1)(ii)(C) of the 1990 National Oil and Hazardous Substances Pollution Contingency Plan (the NCP).

³Federal or state Maximum Contaminant Levels (MCLs) or non-zero Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act generally are not “applicable” requirements but are considered to be “relevant and appropriate” requirements for aquifers that are current or potential future sources of drinking water. (see, CERCLA section 121(d)(2)(A)(i); and §300.430(e)(2)(i)(B) of the NCP). Similarly, water quality criteria under the Clean Water Act also may be “relevant and appropriate” standards for specific contaminants where a plume discharges to (or threatens) surface water (see, CERCLA section 121(d)(2)(A)(i) and (B)(:); and §300.430(e)(2)(i)(E) of the NCP). Further information concerning environmental standards that may be either applicable or relevant and appropriate to a Superfund cleanup action is available from the EPA web site: <http://www.epa.gov/superfund/action/guidance/remedy/arars.htm>

This provision of the statute also contains several site-specific conditions which must be met in order to establish CERCLA ACLs. Regions have broad discretion under the statute when evaluating whether a CERCLA ACL might be appropriate under site-specific circumstances. Generally, in satisfying the statutory requirements in section 121(d)(2)(B)(ii), Regions should consider a number of factors, including:

1. whether contaminated ground water discharges to surface water;
2. whether all plumes of contaminated ground water are discharging to surface water (e.g., are contaminants present in a deeper aquifer that does not discharge to surface water?);
3. whether significant degradation of the aquifer might occur prior to discharge to surface water (e.g., could the plume spread to uncontaminated portions of the aquifer or to other aquifers that are interconnected?);
4. whether "known and projected" points of entry of the plume (or plumes) into a surface water body have been, or can be, specifically identified;
5. whether the discharge of ground water to surface water would lead to a "statistically significant" increase of contaminant concentrations in the surface water body at those points of entry, at points downstream, or at any point at which contaminants might be expected to accumulate (including accumulation of contaminants that might occur in sediments at or below those points of entry);
6. whether ground water can be restored (e.g., can the program goal of restoring contaminated ground water to its beneficial uses be met in a reasonable time frame?);
7. whether there is the potential for degradation products, particularly those that could represent more of a risk than the parent compounds (e.g., trichloroethene (TCE) can degrade into the more toxic compound, vinyl chloride), within the zone between the source and the points of entry;
8. whether the ACL will lead to a "statistically significant" increase in the concentration of degradation compounds in the surface water, and whether the assessed risk from any potential degradation products in the surface water is within EPA's acceptable risk range;
9. whether enforceable measures can be implemented to preclude human consumption of the contaminated ground water, and ensure that there would be no exposure to contaminants in the ground water above health-based levels (e.g., is it possible to reliably prevent human exposure to the contaminated ground water through the use of institutional controls?); and
10. whether a Total Maximum Daily Load (TMDL) pursuant to Clean Water Act section 303(d) has been (or is being) established for the surface water, and whether an ACL could result in exceedence of a TMDL even though there would be no "statistically significant" increase in the concentration of the contaminant in the surface water body.

Implementation

In general, Regions should consider the factors discussed in this guidance in evaluating whether use of CERCLA ACLs may be appropriate under site-specific circumstances. Where CERCLA ACLs are established as part of a remedy, the Superfund Record of Decision (ROD) should identify the applicable standards for which the CERCLA ACLs have been substituted, and should document specifically how the site meets the specific conditions required by the statute (e.g., point of entry, no statistically significant increase of constituents, enforceable measures that will preclude human exposure). The ROD also should explain the process used to establish the CERCLA ACLs and their numeric values. Finally, the ROD should explain how the ACL meets the independent requirement in CERCLA section 121 that CERCLA response actions be protective of human health and the environment (e.g., selected engineering measures; institutional controls).

For sites not meeting the statutory conditions for use of CERCLA ACLs, Regions should consider other flexibilities provided for in CERCLA and the NCP that may be appropriate. ARAR waivers are an example of the flexibility provided in CERCLA and the NCP (section §121(d)(4) and part §300.430(f)(1)(ii)(C), respectively).⁴

This memorandum provides EPA policy related to the use of CERCLA ACLs in Superfund cleanups and supersedes any previous guidance on this matter. Where the Region contemplates using an ACL, and for questions regarding program flexibilities that may be appropriate to ground water cleanup, including CERCLA ACLs, please have your staff contact Kenneth Lovelace of OSRTI, at (703) 603-8787. For question regarding ARARs compliance, please have your staff contact Robin M. Anderson of OSRTI at (703) 603-8747.

cc: OSRTI Managers
Ed Chu, Land Revitalization Staff
Debbie Deitrich, OEM
Linda Garczynski, OBCR
Matt Hale, OSW
Jim Woolford, FFRRO
Cliff Rothenstein, OUST
Susan Bromm, OSRE
Dave Kling, FFEO
Scott Sherman, OGC
Eric Steinhaus, Superfund Lead Region Coordinator, US EPA Region 8
NARPM Co-Chairs
Joanna Gibson, OSRTI Documents Coordinator

⁴Also, EPA guidance on factors to consider when evaluating the technical impracticability of ground water restoration can be found at: http://www.epa.gov/superfund/resources/gwdocs/tec_imp.htm.

APPENDIX G
(Site Inspection Checklist)

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 _____
Contact _____
Name _____ Title _____ Date _____ Phone no. _____

Problems; suggestions; G Report attached _____

Agency _____
Contact _____
Name _____ Title _____ Date _____ Phone no. _____

Problems; suggestions; G Report attached _____

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) G Report attached.

*Other interviews are documented in Appendix A of the
Five-year review report.*

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	O&M Documents <input type="checkbox"/> O&M manual <input type="checkbox"/> As-built drawings <input type="checkbox"/> Maintenance logs Remarks _____	<input checked="" type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A
2.	Site-Specific Health and Safety Plan <input type="checkbox"/> Contingency plan/emergency response plan Remarks _____	<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
3.	O&M and OSHA Training Records Remarks _____	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
4.	Permits and Service Agreements <input type="checkbox"/> Air discharge permit <input type="checkbox"/> Effluent discharge <input type="checkbox"/> Waste disposal, POTW <input type="checkbox"/> Other permits Remarks <i>Effluent discharge is through permit with POTW. POTW permit expired 10-2008, BAE indicated discharge continues under expired permit requirements until new permit is issued.</i>	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A
5.	Gas Generation Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
6.	Settlement Monument Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
7.	Groundwater Monitoring Records Remarks _____	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
8.	Leachate Extraction Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
9.	Discharge Compliance Records <input type="checkbox"/> Air <input checked="" type="checkbox"/> Water (effluent) Remarks _____	<input type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A <input type="checkbox"/> N/A
10.	Daily Access/Security Logs Remarks _____	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A

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) NA

Frequency NA

Responsible party/agency MDH, City of Fridley, City of Minneapolis

Contact see interview documentation

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: Report attached

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

Remarks ICs are not enforceable by MPCA or USEPA

D. General

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

Remarks _____

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

Remarks none

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

Remarks none

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 *CTF NOT addressed by ROD*

A. Landfill Surface			
1.	Settlement (Low spots) Areal extent _____ Remarks _____	<input type="checkbox"/> Location shown on site map Depth _____	<input type="checkbox"/> Settlement not evident
2.	Cracks Lengths _____ Widths _____ Remarks _____	<input type="checkbox"/> Location shown on site map Depths _____	<input type="checkbox"/> Cracking not evident
3.	Erosion Areal extent _____ Remarks _____	<input type="checkbox"/> Location shown on site map Depth _____	<input type="checkbox"/> Erosion not evident
4.	Holes Areal extent _____ Remarks _____	<input type="checkbox"/> Location shown on site map Depth _____	<input type="checkbox"/> Holes not evident
5.	Vegetative Cover <input type="checkbox"/> Grass <input type="checkbox"/> Cover properly established <input type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram) Remarks _____		<input type="checkbox"/> No signs of stress
6.	Alternative Cover (armored rock, concrete, etc.) Remarks _____	<input type="checkbox"/> N/A	
7.	Bulges Areal extent _____ Remarks _____	<input type="checkbox"/> Location shown on site map Height _____	<input type="checkbox"/> Bulges not evident

8.	Wet Areas/Water Damage <input type="checkbox"/> Wet areas <input type="checkbox"/> Ponding <input type="checkbox"/> Seeps <input type="checkbox"/> Soft subgrade Remarks	<input type="checkbox"/> Wet areas/water damage not evident <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Location shown on site map	Areal extent _____ Areal extent _____ Areal extent _____ Areal extent _____
9.	Slope Instability Areal extent Remarks	<input type="checkbox"/> Slides <input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of slope instability
B. Benches <input type="checkbox"/> Applicable <input type="checkbox"/> 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	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay
2.	Bench Breached Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay
3.	Bench Overtopped Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay
C. Letdown Channels <input type="checkbox"/> Applicable <input type="checkbox"/> 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 Remarks	<input type="checkbox"/> Location shown on site map Depth	<input type="checkbox"/> No evidence of settlement
2.	Material Degradation Material type Remarks	<input type="checkbox"/> Location shown on site map Areal extent	<input type="checkbox"/> No evidence of degradation
3.	Erosion Areal extent Remarks	<input type="checkbox"/> Location shown on site map Depth	<input type="checkbox"/> No evidence of erosion

4.	Undercutting Areal extent _____ Depth _____ Remarks _____	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of undercutting
5.	Obstructions Type _____ <input type="checkbox"/> Location shown on site map Size _____ Remarks _____	<input type="checkbox"/> No obstructions	Areal extent _____
6.	Excessive Vegetative Growth Type _____ <input type="checkbox"/> No evidence of excessive growth <input type="checkbox"/> Vegetation in channels does not obstruct flow <input type="checkbox"/> Location shown on site map Remarks _____	<input type="checkbox"/> Areal extent _____	
D. Cover Penetrations <input type="checkbox"/> Applicable <input type="checkbox"/> N/A			
1.	Gas Vents <input type="checkbox"/> Active <input type="checkbox"/> Passive <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____		
2.	Gas Monitoring Probes <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____		
3.	Monitoring Wells (within surface area of landfill) <input checked="" type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input checked="" type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____		
4.	Leachate Extraction Wells <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____		
5.	Settlement Monuments Remarks _____	<input type="checkbox"/> Located	<input type="checkbox"/> Routinely surveyed <input type="checkbox"/> N/A

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

H. Retaining Walls		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Deformations Horizontal displacement Rotational displacement Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident Vertical displacement _____
2.	Degradation Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident
I. Perimeter Ditches/Off-Site Discharge		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Siltation Areal extent Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident Depth _____
2.	Vegetative Growth <input type="checkbox"/> Vegetation does not impede flow Areal extent Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A Type _____
3.	Erosion Areal extent Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident Depth _____
4.	Discharge Structure Remarks	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
VIII. VERTICAL BARRIER WALLS		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Settlement Areal extent Remarks	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident Depth _____
2.	Performance Monitoring <input type="checkbox"/> Performance not monitored Frequency Head differential Remarks	Type of monitoring _____	<input type="checkbox"/> Evidence of breaching

C. Treatment System		<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A
1.	Treatment Train (Check components that apply)		
	<input type="checkbox"/> Metals removal	<input type="checkbox"/> Oil/water separation	<input type="checkbox"/> Bioremediation
	<input type="checkbox"/> Air stripping	<input type="checkbox"/> Carbon adsorbers	
	<input type="checkbox"/> Filters		
	<input type="checkbox"/> Additive (e.g., chelation agent, flocculent)		
	<input checked="" type="checkbox"/> Others <i>groundwater extraction with discharge to POTW</i>		
	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
	<input checked="" type="checkbox"/> Sampling ports properly marked and functional		
	<input type="checkbox"/> Sampling/maintenance log displayed and up to date		
	<input checked="" type="checkbox"/> Equipment properly identified		
	<input checked="" type="checkbox"/> Quantity of groundwater treated annually <i>~ 50 million gallons/year</i>		
	<input type="checkbox"/> Quantity of surface water treated annually		
	Remarks		
2.	Electrical Enclosures and Panels (properly rated and functional)		
	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
	Remarks		
3.	Tanks, Vaults, Storage Vessels		
	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition	<input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance
	Remarks		
4.	Discharge Structure and Appurtenances		
	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
	Remarks		
5.	Treatment Building(s)		
	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Good condition (esp. roof and doorways)	<input type="checkbox"/> Needs repair
	<input type="checkbox"/> Chemicals and equipment properly stored		
	Remarks <i>site does not utilize treatment building</i>		
6.	Monitoring Wells (pump and treatment remedy)		
	<input checked="" type="checkbox"/> Properly secured/locked	<input checked="" type="checkbox"/> Functioning	<input checked="" type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition
	<input checked="" type="checkbox"/> All required wells located	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A
	Remarks <i>some monitoring wells in BNR portion of the site are routinely dry.</i>		
D. Monitoring Data			
1.	Monitoring Data		
	<input checked="" type="checkbox"/> Is routinely submitted on time	<input type="checkbox"/> Is of acceptable quality	
2.	Monitoring data suggests:		
	<input type="checkbox"/> Groundwater plume is effectively contained	<input type="checkbox"/> Contaminant concentrations are declining	

D. Monitored Natural Attenuation			
1.	Monitoring Wells (natural attenuation remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> 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.). <i>The remedy selected is intended to prevent groundwater migration of VFD impacted groundwater beyond the site boundary. Site conditions observed during the site inspection indicated site O&M was consistent with ROD objectives. Reports and other documents reviewed during the five year review process, however did not indicate the remedy was functioning as intended.</i>			
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. <i>Site conditions observed during the site inspection indicated O&M was conducted on a routine basis and consistent with ROD objectives. More study of the effects of the VFD is is recommended.</i>			

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.

NA

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

NA

APPENDIX H
(Site Photos)

Phase I ESA Photo Log
NIROP



Photo ID	Description: North of RW5 looking south	Direction
1	Date: 11-12-08	S



Photo ID	Description: FMC 30	Direction
2	Date: 11-12-08	E



Photo ID	Description: RW5, FMC-57A and FMC-57B	Direction
3	Date: 11-12-08	N



Photo ID	Description: FMC-11, FMC-12, FMC-13 and FMC-14	Direction
4	Date: 11-12-08	S



Photo ID	Description: RW4, FMC-56A and FMC-56B	Direction
5	Date: 11-12-08	W



Photo ID	Description: Extraction well control access and maintenance points near RW4	Direction
6	Date: 11-12-08	E



Photo ID	Description: Inside extraction well flow control chamber	Direction
7	Date: 11-12-08	NA



Photo ID	Description: Inside extraction well flow control chamber	Direction
8	Date: 11-12-08	NA



Photo ID	Description: Inside flow control chamber near RW4	Direction
9	Date: 11-12-08	NA



Photo ID	Description: RW4 and RW5 air gap back flow preventors	Direction
10	Date: 11-12-08	



Photo ID	Description: Inside flow control chamber	Direction
11	Date: 11-12-08	NA

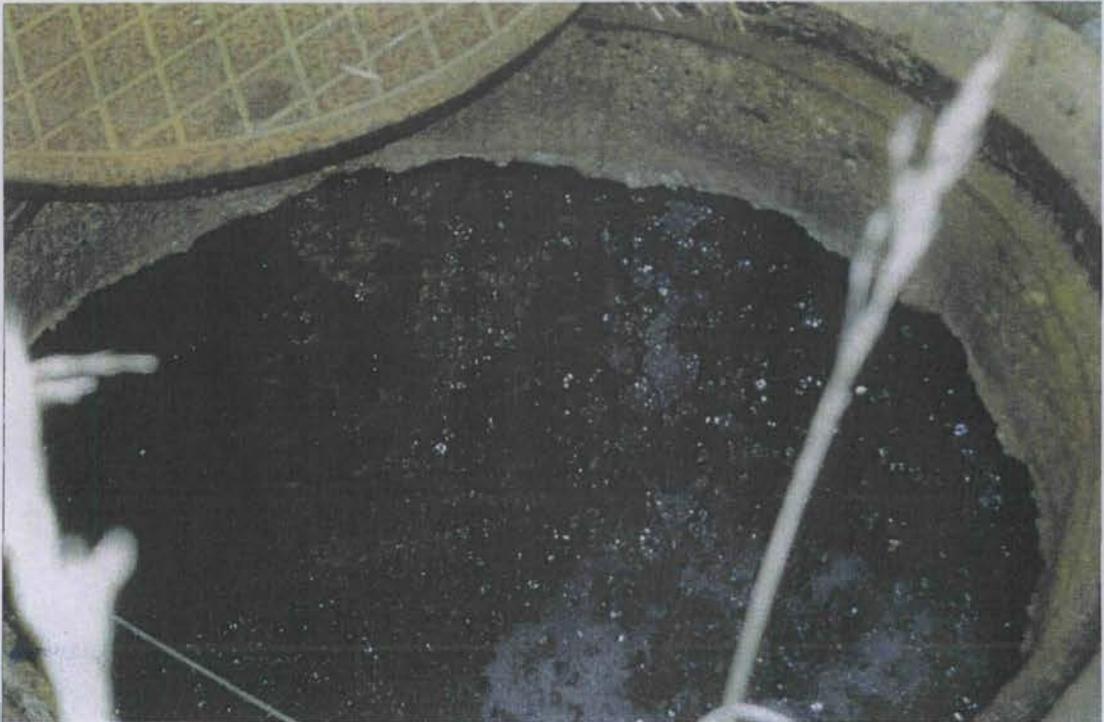


Photo ID	Description: Water cascading into combined piping after air gap backflow preventer	Direction
12	Date: 11-12-08	NA



Photo ID	Description: Bottom of combination chamber	Direction
13	Date: 11-12-08	NA



Photo ID	Description: CTF	Direction
14	Date: 11-12-08	W



Photo ID	Description: FMC-48	Direction
15	Date: 11-12-08	W

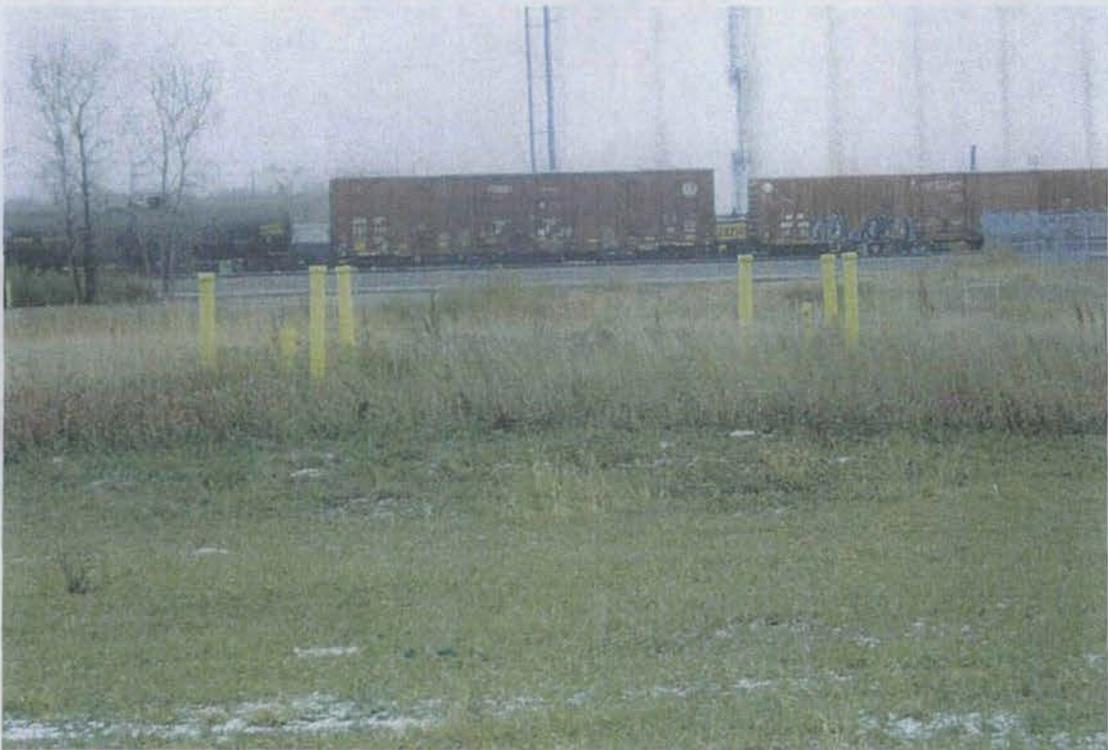


Photo ID	Description: FMC-27 and FMC-24	Direction
16	Date: 11-12-08	E



Photo ID	Description: RW3, FMC-55A, FMC-55B and FMC-15	Direction
17	Date: 11-12-08	SW



Photo ID	Description: Flow control Chamber near RW3	Direction
18	Date: 11-12-08	NA



Photo ID	Description: Point of discharge to sanitary sewer	Direction
19	Date: 11-12-08	NA



Photo ID	Description: VFD in RW2 flow control chamber	Direction
20	Date: 11-12-08	NA



Photo ID	Description: RW2	Direction
21	Date: 11-12-08	W



Photo ID	Description: FMC-47(Right), RW1 (left), FMC-49 and FMC-50 (background)	Direction
22	Date: 11-12-08	S



Photo ID	Description: RW2 air gap back flow preventer and abandoned RW1 piping	Direction
23	Date: 11-12-08	NA



Photo ID	Description: Looking South from RW2	Direction
24	Date: 11-12-08	S



Photo ID	Description: FMC-46	Direction
25	Date: 11-12-08	E



Photo ID	Description: FMC-51	Direction
26	Date: 11-12-08	W



Photo ID	Description: FMC-44 and FMC-36	Direction
27	Date: 11-12-08	E



Photo ID	Description: FMC-28	Direction
28	Date: 11-12-08	NA



Photo ID	Description: Looking East from FMC-15 towards BNR stormwater retention pond	Direction
29	Date: 11-12-08	E



Photo ID	Description: FMC-54A, FMC-54, USGS- 4 and USGS-5	Direction
30	Date: 11-12-08	E

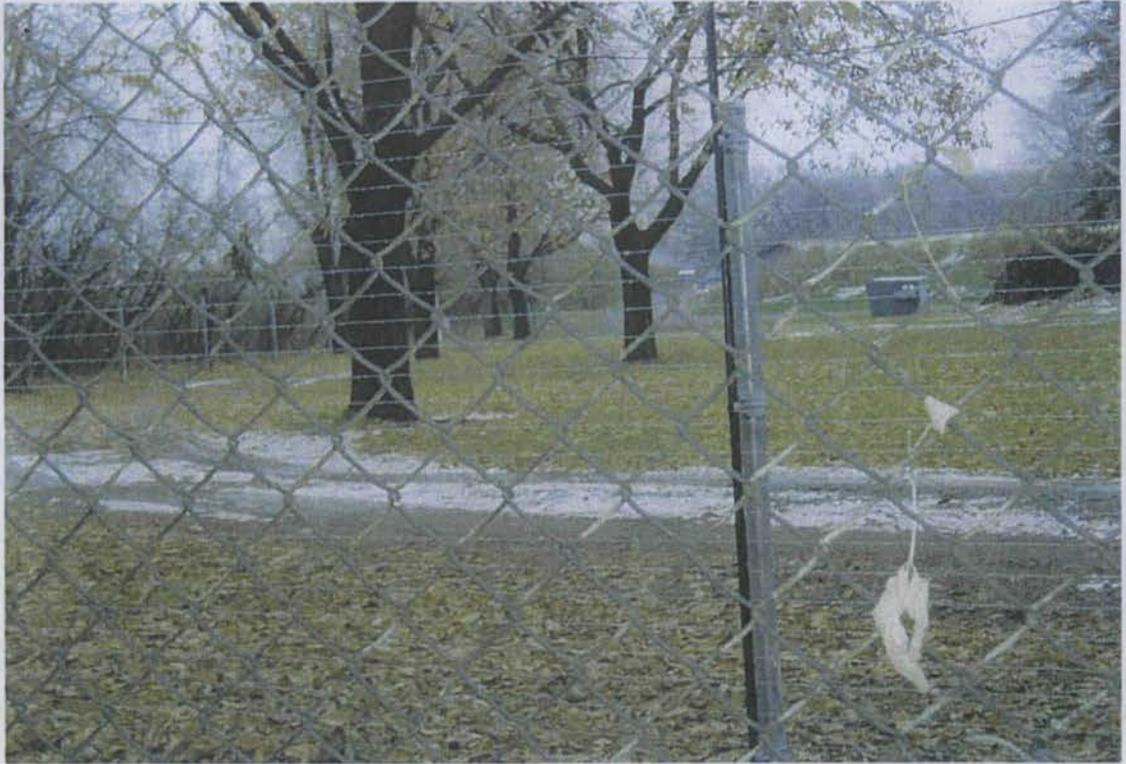


Photo ID	Description: MWW property looking toward FMC-53	Direction
31	Date: 11-12-08	SE



Photo ID	Description: FMC-71 (right) and FMC-70 (left)	Direction
32	Date: 11-12-08	W



Photo ID	Description: FMC-70 (right), FMC-43, FMC-21A and FMC-21B (background)	Direction
33	Date: 11-12-08	S



Photo ID	Description: FMC-20	Direction
34	Date: 11-12-08	S



Photo ID	Description: Seep in center right portion of photograph	Direction
35	Date: 11-12-08	S



Photo ID	Description: 96 inch storm sewer outfall (lower center, near tree), Seep in upper center of photograph	Direction
36	Date: 11-12-08	S