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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAR 30 1999

REPLY TO THE ATTENTION OF

SR-6J

Karen Studders, Commissioner
Minnesota Pollution Control Agency
520 LaFayette Road North
St.. Paul, MN 55155

RECEIVED
APR 5 1999
MPCA, Metro District
Site Remediation

Re: FMC Corporation Site, Fridley, Minnesota
Five-Year Review Report

Dear Ms. Studders:

The U. S. Environmental Protection Agency (U. S. EPA) has reviewed the Five-Year Review Report prepared by the Minnesota Pollution Control Agency for the subject site. The report is hereby approved.

U. S. EPA appreciates the efforts of Dave Douglas of your staff in conducting this review. Please feel free to contact me if you have any questions.

Sincerely,

for William E. Muno, Director
Superfund Division

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FIVE-YEAR REVIEW REPORT

FMC Corporation Site
Fridley, Minnesota

Prepared by:
Minnesota Pollution Control Agency
St. Paul, Minnesota
for the U.S. Environmental Protection Agency
Region V
Chicago, Illinois

for William E. Muno, Director
Superfund Division

3/30/99
Date

FIVE-YEAR REVIEW REPORT

FMC Corporation Site
Fridley, Minnesota

I. INTRODUCTION

A. Purpose

The Minnesota Pollution Control Agency (MPCA) staff has completed a Five-Year Review of the Remedial Actions (RAs) conducted at the FMC Corporation Site (FMC Site) in Fridley, Minnesota. This Five-Year Review evaluates whether the RAs remain protective of public health, welfare, and the environment.

Section 121(c) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and Section 300.430(f)(4)(ii) of the National Oil and Hazardous Substance Contingency Plan (NCP), require that periodic (no less often than five years) reviews be conducted for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that will not allow for unlimited use or unrestricted exposure following the completion of all RAs for the site. The purpose of such a review is to assess whether the RAs implemented continue to be protective of human health and the environment. This review focuses on the protectiveness of the FMC Site RA ten years from the time the RA commenced.

OSWER Directive 9355.7-02 (Structure and Components of Five-Year Reviews, May 23, 1991) provides that the U.S. Environmental Protection Agency (EPA) will conduct a Policy Review at sites where no hazardous substances will remain above levels that allow unlimited use and unrestricted exposure after completion of a RA, but the RA goals specified in a Record of Decision (ROD) will require five or more years to attain, e.g., a long-term response actions site (LTRA). The FMC Site is considered a LTRA site.

OSWER Directive 9355.7-02A (Supplemental Five-Year Review Guidance, June 26, 1994) established a four-tier approach to conducting Five-Year Reviews, the most basic of which provides a minimum protectiveness evaluation (Type I Review). EPA contemplates that a Type I Review will be appropriate in all but relatively few cases where site-specific circumstances suggest otherwise. A Type II Review contemplates recalculation of the risk and is appropriate only if warranted by site-specific circumstances. A Type III Review involves a new risk assessment and should be utilized only when site-specific circumstances show it to be necessary.

A copy of this five year review is being placed in the repository for the Site at the Anoka Public Library, which is located at 2135 3rd Avenue in Anoka, Mineesota.

A Type II or III Review was not deemed necessary because the primary FMC Site applicable or relevant and appropriate requirement (ARAR) for ground water has not changed. A Type Ia Review is to be used for LTRAs where RA is ongoing, but should not be used when site-specific circumstances indicate the appropriateness of a higher level review. Because this review raises questions about ROD objectives concerning containing the ground water plume and the "dissipation" of the plume in Anoka County Park, a Type Ia Review was deemed inappropriate. For these reasons, a Type I Review was deemed the most appropriate for this Five-Year Review.

The FMC Site ROD for ground water remediation intended to establish RA goals that allow for unlimited use of ground water outside the FMC Corporation property and eventual remediation of on-site ground water to an acceptable level. Ten years after implementation of the ROD, RA goals specified in the ROD have not been achieved. The MPCA staff has determined that a second Type I Review should be conducted at the FMC Site.

The Five-Year Review is being conducted to determine whether the FMC Site RAs remain protective of public health and the environment. The more specific purpose of the reviews is two-fold: (1) to confirm that the remedy as spelled out in the ROD and/or remedial design remains effective at protecting human health and the environment (e.g., the remedy is operating and functioning as designed, institutional controls are in place and are protective), and (2) to evaluate whether original clean-up levels remain protective of human health and the environment.

The first purpose of a Five-Year Review may be accomplished primarily through a review of operation and maintenance records of the site, a site visit, and limited analysis of site conditions. The second purpose requires an analysis of newly promulgated or modified requirements of federal and state environmental laws to determine if they are ARARs and to determine if they call into question the protectiveness of the remedy [NCP Section 300.430(f)(1)(ii)(B)(1)]. Five-Year Reviews may also consider whether ARARs for substances not addressed under contaminants of concern (COCs) have changed such that the remedy is no longer protective. A further objective of a Five-Year Review is to consider the scope of the operation and maintenance, the frequency of repairs, changes in monitoring indicators, costs at a site, and how this relates to protectiveness.

For LTRAs, the Five-Year Review should focus on both the effectiveness of the technology and the specific performance levels established in the ROD.

The first Five-Year Review for the FMC Site was completed on September 30, 1992.

B. Site Background

The FMC Site is located within the city limits of Fridley in Anoka County (Figure 1). The FMC Site is approximately 1,000 feet east of the Mississippi River. The ground water plumes from the FMC Site are predicated to enter the river near the intake of the city of Minneapolis' municipal water supply (Minneapolis Water Works [MWW]). The MWW serves approximately 500,000 people. The MWW service area includes the cities of Golden Valley, Crystal, New Hope, Colombia Heights, Hilltop, parts of Bloomington and Edina (Morning Side) as well as the Minneapolis/St. Paul International Airport. The MWW produces an average of 70 million gallons of water per day and an annual average withdrawal from the river of 25 billion gallons.

The FMC Site is an 18 acre tract of land that was used for the burning and disposal of wastes between 1945 and 1969. Wastes generated from naval ordnance manufacturing included plating wastes, paint, paint sludges, oils, bottom ash, and chlorinated and nonchlorinated solvents.

Adjacent land use consists of the Naval Industrial Reserve Ordnance Plant to the north; industrial land use to the south; recreational land use to the west; and rail yards and commercial/light industrial to the east.

Recreational land use to the west consists of Anoka County Riverfront Regional Park and the Mississippi River. The location of nearby populations is limited to a residential neighborhood approximately 200 feet east of the adjacent rail yards. The FMC Site is situated in a flat outwash terrace that is approximately 30 feet about the river.

In November 1980, the MPCA staff was informed that FMC Corporation had disposed of industrial and hazardous waste from the 1940s through 1969 on the FMC Site. In December 1980, at the request of the MPCA, FMC Corporation began an investigation of the site. The MPCA staff conducted a surface water sampling program and found low levels of trichloroethylene (TCE) at the intake to the MWW. In 1982, the FMC Site was placed on the National Priority List.

The soil in the disposal areas was found to be contaminated with volatile organic compounds (VOCs) and 44 drums containing hazardous materials were discovered.

The ground water was found to be contaminated by a variety of chlorinated and nonchlorinated VOCs; however, TCE was found to constitute approximately 98 percent of the contamination and was identified as the COC for the FMC Site. The contaminated ground water was found to extend from the disposal sites to the river in two aquifers, a shallow, unconfined sand and gravel aquifer and a deep, confined sand aquifer.

On September 10, 1986, the MPCA staff executed an FMC Site Enforcement Decision Document under the Minnesota Environmental Liability and Response Act (MERLA) that documented the MPCA's selection of a RA for the contaminated ground water of the

FMC Site. The RA selected was a ground water pumpout and treatment system with discharge to the Pigs Eye Wastewater Treatment Facility, a publicly operated treatment works (POTW).

On October 14, 1986, FMC Corporation and the MPCA signed a Response Order by Consent under MERLA for the implementation of above-cited RA for the FMC Site's contaminated ground water, the site's only operable unit.

The FMC Site ROD, dated September 30, 1987, documented the EPA's selection of the same RA for the FMC Site's operable unit.

The ground water RA includes an extraction well system with discharge of untreated ground water to the POTW and institutional controls. These controls ensure that ground water between the FMC Site and the Mississippi River is not used until the ground water plume has sufficiently dissipated.

The extraction well system was designed to hydraulically contain the TCE plume at the FMC Site boundary and reduce contaminant concentrations on site. Over time, contaminated ground water in Anoka County Riverfront Regional Park (Anoka County Park) is expected to dissipate to an acceptable level.

The ground water extraction well system consisting of five extraction wells (RW1-RW5), was installed to remove contaminated ground water from the shallow, unconfined sand and gravel aquifer and the deep, confined sand aquifer (Figure 2). Two wells were screened in the shallow aquifer (RW1, RW2) and three wells were screened in the deep aquifer (RW3, RW4, RW5). Several weeks after system startup, FMC Corporation was allowed to shutdown extraction well RW1 when FMC Corporation personnel reported the extraction well would "run dry" shortly after startup.

Ground water discharge to the sanitary sewer is monitored by FMC Corporation and regulated by the Metropolitan Waste Control Commission (MWCC). Treatment of extracted ground water is accomplished at the POTW. The MWCC permit restricts VOC effluent concentrations greater than 10 parts per million (ppm) total, with no greater than 3 ppm for any one VOC.

II. REMEDIAL OBJECTIVES

The FMC Site ROD selected the following site RA: hydraulic containment of the ground water plume through ground water extraction wells; discharge of untreated ground water to a publicly owned treatment works; and long-term ground water monitoring. The RA included institutional controls and land use that would assure that ground water between the FMC Site (as defined in the Response Order By Consent, dated October 14, 1986, between FMC Corporation and the MPCA - also known as the FMC and Burlington Northern Railroad [BRN] lands) and the Mississippi River (Anoka County Park) would not be used for drinking water.

The remedial objectives cited in the ROD are to minimize ingestion of contaminated ground water and river water contaminated by contaminated ground water. As stated in the ROD, the goal is to keep the ingestion risks from exceeding 1E-6 additional lifetime cancer deaths at any existing receptor which includes those who consume finished water from the Minneapolis Water Works (MWW).

In the ROD, the overall objectives cited in Section V are further broken down further in Section VI, "Recommended Alternative." In Section VI, the ROD breaks down the recommended alternative into three components: hydraulic containment; discharge of untreated ground water to the publicly owned treatment works; and long-term monitoring and assigns performance requirements for each of these components. These components are further broken down into the following performance requirements:

- Reduce ground water contamination source areas on the FMC Site;
- Reduce general off-site migration of elevated contaminant levels;
- Reduce the ground water contamination at the FMC Site boundary to the maximum contaminant levels (MCLs) and/or Minnesota Department of Health (MDH) Recommended Allowable Limits (RALs) for the COCs; for example, since TCE is the major COC; the remedial goal for TCE was 5 micrograms/liter (μg/l) at the FMC Site property boundary;
- Reduce the ground water contamination beyond the FMC Site boundary (in the area between the boundary and the Mississippi River) through dissipation of the ground water plume;
- Discharge the contaminated ground water to the sanitary sewer for treatment at the Pigs Eye Wastewater Treatment Facility;
- Implementation of a ground water monitoring system, including:
- Monitoring extracted ground water to determine flow rate and contaminant concentration;
- Hydraulic containment monitoring;
- Monitoring surficial aquifer and confined aquifer;
- Monitoring surficial aquifer and confined aquifer near Mississippi River south of the MWW and Anoka County Park property line; and
- Monitoring intake to the MWW.

III. ARAR REVIEW

As stated above, the Five-Year Review is being conducted to determine whether the FMC Site RAs remain protective of public health and the environment. The more specific purpose of the reviews is two-fold: (1) to confirm that the remedy as spelled out in the ROD and/or remedial design remains effective at protecting human health and the environment (e.g., the remedy is operating and functioning as designed, institutional controls are in place and are protective), and (2) to evaluate whether original clean-up levels remain protective of human health and the environment. ARARs and "to be considereds" (TBCs) are key elements in fulfilling these two purposes.

A. ARARs Cited in the ROD

Safe Drinking Water Act (SDWA) (40 CFR Parts 141 - 146)

Establishes federal MCLs and Maximum Contaminant Level Goals to protect public drinking water supplies. This ARAR applies to any aquifer that could be used for a public water supply.

In the ROD, EPA stated that it required that the MCLs and/or RALs be met at the FMC Site boundary and an acceptable risk level at any receptor including any that are located between the site boundary and the river.

The major COC in ground water is TCE and its MCL is 5 μg/l.

Resource Conservation and Recovery Act (RCRA) (40 CFR Section 264.94)

The ROD cites that Background Levels, Listed Maximum Concentration Levels (LMCLs), and Alternate Concentration Levels (ACLs) (as defined by RCRA) are possible ARARs for the FMC Site. The ROD states that the MCLs have been selected as the relevant and appropriate cleanup standard and are identical to the LMCLs for the FMC Site COCs. It also states that MCLs would be appropriate as ACLs if it were necessary to establish ACLs (which it was not). The Background Level is that level of a chemical in the ground water in an area not impacted by contamination from a specific source. The ROD did not consider Background Levels.

There has been no change in the status of MCLs relative to LCMLs and ACLs; therefore, LCMLs and ACLs remain addressed by MCLs for the FMC Site COCs.

Federal Clean Water Act, 33 U.S.C. Section 1251, et seq., as amended

Requires U.S. EPA to establish water quality criteria for bodies of water, including ground water, based on the effects of pollutants on human health an aquatic life. Section 121 of CERCLA states that remedial actions shall attain these water quality criteria where they are relevant and appropriate under the circumstances of the release, based on the usage or

potential usage of the water receiving the release.

The ambient water quality criteria for TCE cited in the document "Ambient Water Quality Criteria of Trichloroethylene," EPA 440'/5-80-077, October 1980 are as follows. The chronic aquatic life criterion is 21,900 ug/l and the final acute aquatic life criterion is 45,000 ug/l. The human health aquatic criterion for ingestion of contaminated surface water and contaminated aquatic organisms is 27 ug/l at the incremental increase of cancer risk over the lifetime at 1E-5.

Section 307 (b) of the Clean Water Act , Section 1317 (b) and regulations promulgated thereunder (40 CFR 403) require public owned treatment works to develop and enforce treatment standards so as to prevent interference with operation of th POTW and pass through of the pollutants through the system. The current pretreatment permit limits to the POTW, Metropolitan Council Environmental Services Special Discharge Permit No. 2154 are 3 mg/l for any single toxic organic and 10 mg/l for the total of all toxic organic compounds. In 1997, the TCE discharged into the POTW treatment system remained less than 1 mg/l and the total of all toxic organic compounds remained less than 1.6 mg/l.

B. <u>To Be Considereds Cited in the ROD</u>

Minnesota Department of Health Recommended Allowable Limits

RALs were cited in the ROD as possible ground cleanup levels that could be established where no MCL was established. The ROD cited RALs for the COCs. RALs have now been replaced by MDH Health Risk Limits (HRLs), which are TBCs as explained below.

Minnesota Rules Parts 4717.7100 to 4717.7800

A HRL is the concentration of a ground water contaminant or mixture of ground water contaminants that can be safely consumed daily for a lifetime. A HRL is expressed as a concentration in parts per billion or calculated as a "hazard index."

The MDH developed HRLs using scientific risk assessment methods and data. The HRLs are calculated using the same methodology as for the "recommended allowable limits," which were advisory levels MDH used before the HRL rules were promulgated. HRLs apply to private ground water drinking water wells only. HRLs are not promulgated as cleanup ARARs, but are used by the MPCA as cleanup TBCs by agreement between the MPCA and the Minnesota Department of Health. The HRLs replace all of the RALs cited in Table 1 of the ROD.

EPA Policy Memorandum, "Discharge of Wastewater from CERCLA Sites into POTWs," dated April 15, 1986

In order to safely discharge contaminated ground water from a Superfund site into a

publicly owned treatment works (POTW), the ROD listed certain factors that had to be considered. These factors were derived from an EPA policy memorandum, "Discharge of Wastewater from CERCLA Sites into POTWs," dated April 15, 1986. The factors are as follows:

1. Potential of pollutants to cause pass through or interference, including a health hazard to employees at the POTW.

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

3. The POTW's record of compliance with the NPDES permit and pretreatment program requirements.

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

5. The potential for ground water contamination from transport of CERCLA wastewater to the POTW, and the need for ground water monitoring.

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

The MPCA staff requested that the Metropolitan Council Environmental Services (MCES) re-evaluate the factors as they were evaluated in the ROD. The Metropolitan Council is the regulatory authority for the POTW into which the contaminated ground water from the FMC site is discharged. In a letter from the MCES to the MPCA staff, dated November 16, 1998, the MCES stated that it "is not aware of any significant changes related to the six factors discussed in pages 29-32 [of the ROD]."

Institutional Controls

The ROD cites a Fridley ordinance restricting private drinking water wells and Minnesota Department of Health reviews of drinking water well locations to assure that no wells will be placed on lands over contaminated ground water from the FMC site. The MPCA staff has verified that these institutional controls remain in place.

C. <u>ARARs Not Cited in the ROD</u>

Minnesota Rules Chapter 7060

Establishes uses and the nondegradation goal for ground water, as well as restoration of contaminated aquifers for use as potable water supply. This ARAR establishes a goal of returning contaminated ground water to potability for both public and private water supplies and reinforces using MCLs as ARARs where the ground water under the FMC Site and between the site boundary and the river would be used for public water supplies

and reinforces using HRLs as TBCs in these same areas where the ground water would be used for a private water supplies.

Minnesota Rules Part 7050.0470, Subpart 4

The Mississippi River in the reach of the river where the contaminated ground water discharges in it is protected as a source of drinking water (Class 1B), for aquatic life and recreation (Class 2B), as well as for other, usually less sensitive uses (Classes 4, 5, and 6). This ARAR is important when evaluating the impact of discharge of the ground water plume into the river (see below discussion for Surface Water Quality Standards that apply to the Mississippi River.)

Minnesota Rules Parts 7050.0220, Subpart 4; 7050.0221, Subpart 4; and 7050.0222, Subpart 3

These ARARs establish the applicable water quality standards for TCE for this reach of the river which are:

Class	Concentration in μg/l
Class 1 (drinking water)	5
Class 2 (aquatic life):	
Chronic Standard	25
Maximum Standard	2,500* (6,988)
Final Acute Value	5,000* (13,976)

* a TBC, see explanation below

The most stringent applicable chronic standard is the 5 μg/l drinking water standard, and it is to be met at all locations in this reach of river. In Minnesota, the discharge of pollutants to surface waters, including pollutants in ground water plumes, must be controlled to: (1) meet chronic water quality standards downstream; (2) prevent acutely toxic conditions in the effluent (ground water in this case) and mixing zone; and (3) meet minimum technology-based treatment requirements.

D. <u>To Be Considereds Not in the ROD</u>

In situations where the receiving stream provides ample dilution to a contaminated plume, such as at the FMC Site, meeting the chronic standard in the river is usually not a concern. However, the fact that the MWW intake is immediately downstream from the FMC Site and on the same side of the river, is reason enough to apply an extra measure of caution in assessing the potential risks to human health at the site. With this consideration in mind, the policy of the MPCA, regarding the FMC Site, is to require that the quality of ground water in the well(s) closest to the river, and any discharge of treated ground water to the

river, meet chronic standards for COCs.

MPCA policy when dilution is adequate, and when extenuating circumstances are not involved, is to apply the maximum standard (2,500 μg/l for TCE) as the limit in the well closest to the surface water. The maximum standard for TCE is listed as 6,988 μg/l but is lowered to 2,500 μg/l under this same provision.

IV. SUMMARY OF SITE VISIT

Site visits have been periodically conducted throughout the review period; however, another site visit was conducted on March 23, 1998. Monitoring wells referenced in this document are in place and contaminated ground water was observed being pumped into the POTW collection system as permitted. The cover over the areas were contaminated soil was removed is well maintained.

V. RECOMMENDATIONS/TECHNOLOGY

It is recommended that the current remedy consisting of operating a pump-out system and discharge of the water to the local POTW and monitoring of ground water conditions be continued. However, it is believed that capture of the confined and unconfined plumes at the property boundary may not be occurring. In order to monitor this situation, it is recommended that modifications to the monitoring well network be evaluated to ensure the ability to monitor plume capture, downgradient plume conditions and compliance with ARARs.

The recommendations are further broken down by the performance requirements of the recommended alternative discussed in Section VI of the ROD. The performance requirements are:

- Reduce ground water contamination source areas on the FMC Site;

Although every effort was made to remove source materials by doing soil excavations at the site, some residual contamination remains below the water table at the FMC Site. It is expected that residual contamination exists in aquifer and (or) aquitard-like materials below the water table as a result of the sinking of VOCs more dense than water into the saturated subsurface environment. It is expected that the residual material continues to release dissolved VOCs to ground water at the site. Ground water contamination source areas have been reduced, but not eliminated. Areas of residual contamination most likely correspond to areas where dumping and burial of wastes occurred and correspond in general to where soil excavations were performed.

Recommendation: UDLP should do an evaluation of additional methods that may enhance the performance of the existing remedy to remediate sources and control site plumes. If it is determined that more effective methods of source and plume control are available UDLP should provide documentation of these technologies to the MPCA staff.

- Reduce general off-site migration of elevated contaminant levels;

The current ground water remedy, which includes pumping of contaminated ground water in the unconfined and confined aquifers and discharge of the effluent to the POTW, has removed VOCs from site ground water. The pump-out effluent is discharged to the local POTW where it is treated. The levels of off-site (outside the FMC Site property boundaries) TCE in ground water in the confined aquifer have decreased with time based on limited ground water monitoring as observed in monitoring wells MW-21 and MW-39 (see Figure 2) and it is estimated from 1996 data that 1,597.1 pounds of VOCs have been removed from the confined aquifer.

It is estimated from 1996 data that 11,994.2 pounds of VOCs have been removed from the unconfined aquifer. No off-site downgradient monitoring wells with shallow screened intervals exist to monitor the off-site status of the unconfined VOC plume. It is expected that the VOC removal due to pumping of contaminated water has reduced off-site migration of VOCs; however, deficiencies in the downgradient monitoring well network has made the evaluation of the condition of the downgradient plumes difficult (see Figure 3).

Data contained in the "1993 Report RAP Groundwater Remediation" indicated that an area of noncapture of the confined plume existed between recovery wells RW-3 and RW-4. Subsequent MODFLOW analytical modeling of the ground water conditions at the site (Capture Zone Modeling and Evaluation of Groundwater Recovery System, RMT, Inc., September 1996) indicated that capture of ground water in the confined aquifer may not be complete at the current pumping rates in extraction wells RW-2, RW-4 and RW-5. The report indicated that pumping rates should be increased in an effort to ensure plume capture. United Defense Limited Partnership (UDLP), a successor company to FMC Corporation, has proposed the installation of additional monitoring wells to help resolve the capture issue. Resolution of the issue of whether capture of both the unconfined and confined aquifers is occurring is ongoing.

- Reduce the ground water contamination at the FMC Site boundary to the MCLs and/or MDH RALs for the COC; for example, since TCE is the major COC; the remedial goal for TCE was 5 μg/l at the FMC Site property boundary;

The remedial goal of 5 μg/l TCE at the property boundary has not been achieved at the FMC Site for the confined plume. Off-site TCE levels greater than 5 μg/l were observed in off-site monitoring wells (see Figure 2) in the 1996 data.

Off-site levels of TCE for the unconfined plume cannot be determined from the existing monitoring well network. It is expected that off-site levels of TCE greater than 5 μg/l exist downgradient of the unconfined source area. On-site TCE levels of up to 9,000 μg/l were observed in the 1996 data and TCE levels in monitoring wells at the property boundary of between 25 to 120 μg/l were observed in the 1996 data.

- Reduce the ground water contamination beyond the FMC Site boundary (in the area between the boundary and the Mississippi River) through dissipation of the ground water plume;

It is expected that portions of both the unconfined and confined plumes exist beyond the capture ability of the ground water pumping system and that the plumes are present downgradient of East River Road between the road and the Mississippi River. Given deficiencies in the current off-site monitoring well network it is difficult to evaluate the horizontal and vertical extent and the concentration of the off-site plumes. With the current limitations of the downgradient monitoring network it is not possible with any degree of certainty to determine how much dissipation of the off-site plume has occurred. Downgradient exceedences of the MCL for TCE were observed in monitoring wells FMC-45 (45 μg/l) and FMC-54 (33 μg/l).

Recommendations (Items 2, 3, and 4): An evaluation of the downgradient plume not captured by the pump-out system should be performed by UDLP to evaluate the effectiveness of dissipation of the downgradient plume. The results should be reported in the Annual Monitoring Reports.

Discharge the contaminated ground water to the sanitary sewer for treatment at the Pigs Eye Wastewater Treatment Facility;

Discharge of contaminated ground water to the sanitary sewer for treatment at the POTW continues to be part of the remedy.

Implementation of a ground water monitoring system, including:

- Monitoring extracted ground water to determine flow rate and contaminant concentration;
- Hydraulic containment monitoring;
- Monitoring surficial aquifer and confined aquifer;

Although a ground water monitoring system was installed at the FMC Site to monitor contaminant concentrations, hydraulic containment of the unconfined (surficial) and confined aquifers, and dissipation of the downgradient plume; deficiencies exist in the monitoring network. These deficiencies include the number and location of wells and the lack of discrete vertical aquifer characterization. Existing downgradient monitoring wells were constructed with very long screened intervals (70-100 foot screens) which make interpretation of data from the wells including contaminant concentrations and hydraulic heads uncertain.

The current monitoring well network makes determination of plume location (both aerial

and vertical location), plume concentrations, hydraulic heads, plume capture, compliance with ARARs at various boundaries, the condition of the downgradient plume and the relationship of the plume discharge to the Mississippi River uncertain. Recommendations concerning improvements of the monitoring network follow in this document.

Recommendations (Items 6a, 6b, and 6c): It is recommended that the current monitoring well network be evaluated and modified by UDLP with concurrence of modification by the MPCA staff. Some existing monitoring wells should be recommended for abandonment. Nested monitoring well locations should be determined and nested monitoring wells installed downgradient of both the confined and unconfined plumes to determine plume capture, downgradient plume conditions (i.e., is dissipation of the downgradient plume occurring), and compliance with site ARARs and TBCs including an evaluation if both plumes meet water quality standards before discharge to the Mississippi River.

Based on data from the new monitoring network an evaluation of the performance of the remedy with relation to site ARARs should be performed by UDLP and included in the Annual Monitoring Reports. A surface water assessment of site plume discharges to the Mississippi River should be done by the MPCA Division of Water Quality.

UDLP should perform aquifer tests in the field to gather aquifer properties and to evaluate the effectiveness of the current pump-out system to capture the ground water plumes. Based on the aquifer evaluations, modifications required to achieve plume capture should be submitted to the MPCA staff. Modifications to pumping rates, pumping well locations and screened depths may all be considered in evaluation of the system.

Limited ground water monitoring has occurred near the Mississippi River to determine the condition of ground water before ground water discharges to the Mississippi River for the confined aquifer. Monitoring wells MW-21, MW-39 are monitored annually to determine TCE levels near the river. A TCE level of 3.4 μg/l was observed in MW-21 in 1996 and no TCE was reported in MW-39. This limited sampling would indicate that ARARs are being met for the river; however, how representative these two wells are of the confined downgradient plume is unknown.

Due to deficiencies in the monitoring well network, it cannot be determined with certainty that the surface water quality standards for the Mississippi are being met at the FMC Site. Recent analytical results from wells MW-21 (3.4 μg/l) and MW- 39 (no detection of TCE) provide limited data from the confined plume. The results would indicate that current water quality standards are most likely being met at this location in the plume; however, it is uncertain if these two wells are representative of the confined plume. No appropriately screened downgradient wells exist to monitor compliance with water quality standards in the unconfined aquifer near the river.

Monitoring intake to the MWW.

Annual monitoring of the MWW raw water intake by UDLP has consistently indicated no

detections of TCE at the water intake. The detection limits for TCE for the UDLP sampling was 5 μg/l which is at the MCL. Recent sampling at the raw water intake by the MDH using lower detection limits have indicated 0.1 to 0.2 μg/l TCE at the intake. The MCL for TCE is 5 μg/l. No exceedence of the MCL for TCE has been observed in the raw water at the MWW during the review period.

VI. STATEMENT OF PROTECTIVENESS

The remedy would be protective if recommendations cited in Section VI are implemented so that it can be determined that the performance requirements of the remedy cited in Section II are being met.

VII. NEXT REVIEW

Hazardous substances, pollutants, or contaminants will remain at the FMC Site which will not allow for unlimited use or unrestricted exposure. EPA or the MPCA, if delegated to do so by EPA, will conduct another Five-Year Review by September 30, 2002.

VII. IMPLEMENTATION REQUIREMENTS

UDLP should provide a proposed workplan and schedule to implement the recommendations in this Five-Year Review by June 30, 1999.

IX. BIBLIOGRAPHY

Metropolitan Council Environmental Services, November 16, 1998, letter regarding Record of Decision statement concerning the safety of the discharge of contaminated water to publicly owned treatment works

Minnesota Pollution Control Agency, September 10, 1986, "FMC Site Enforcement Decision Document"

Minnesota Pollution Control Agency, December 2, 1994, letter response to 1993 Report - RAP Groundwater Remediation Response Action Plan, United Defense Limited Partnership

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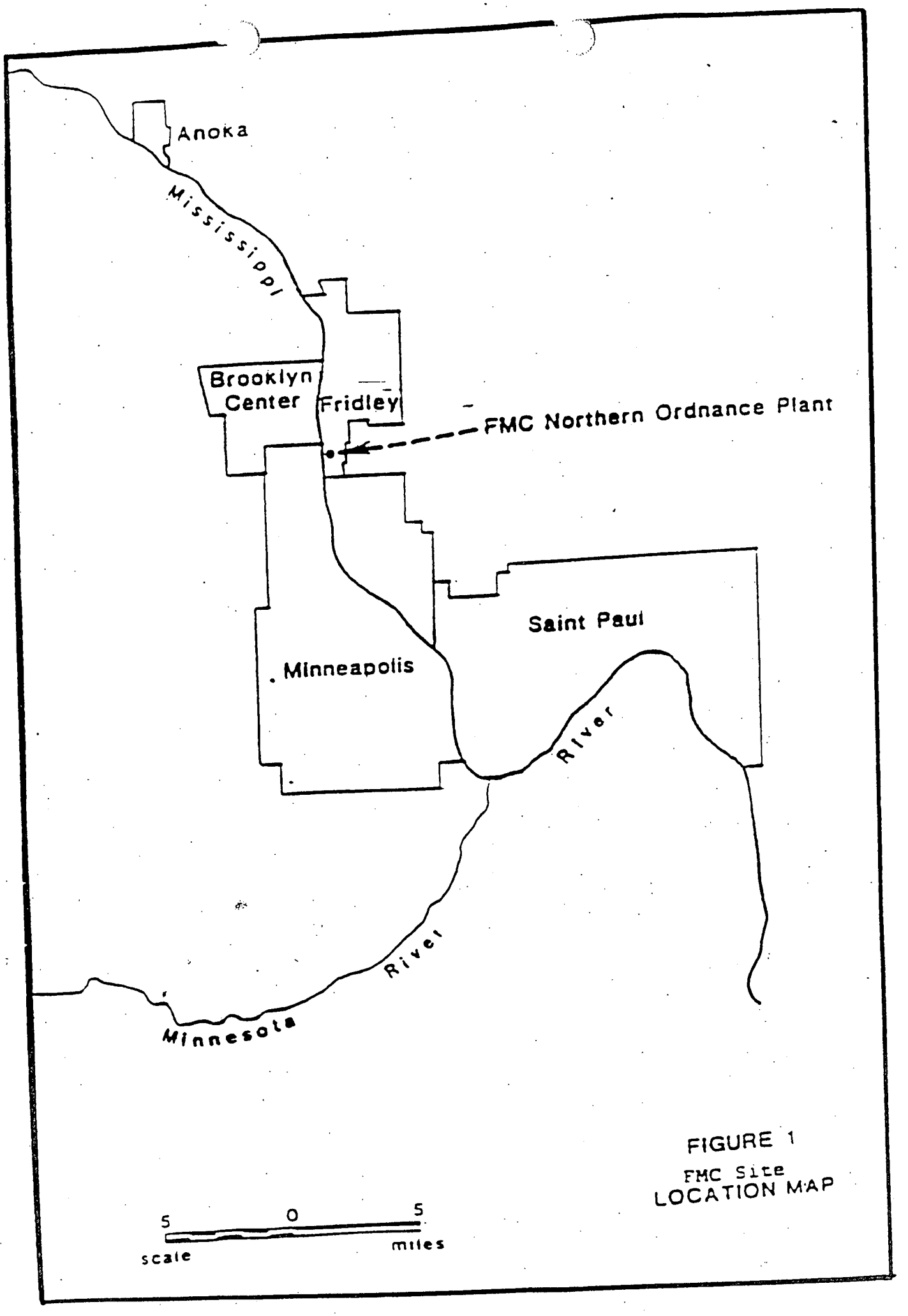

FIGURE 1
FMC Site
LOCATION MAP

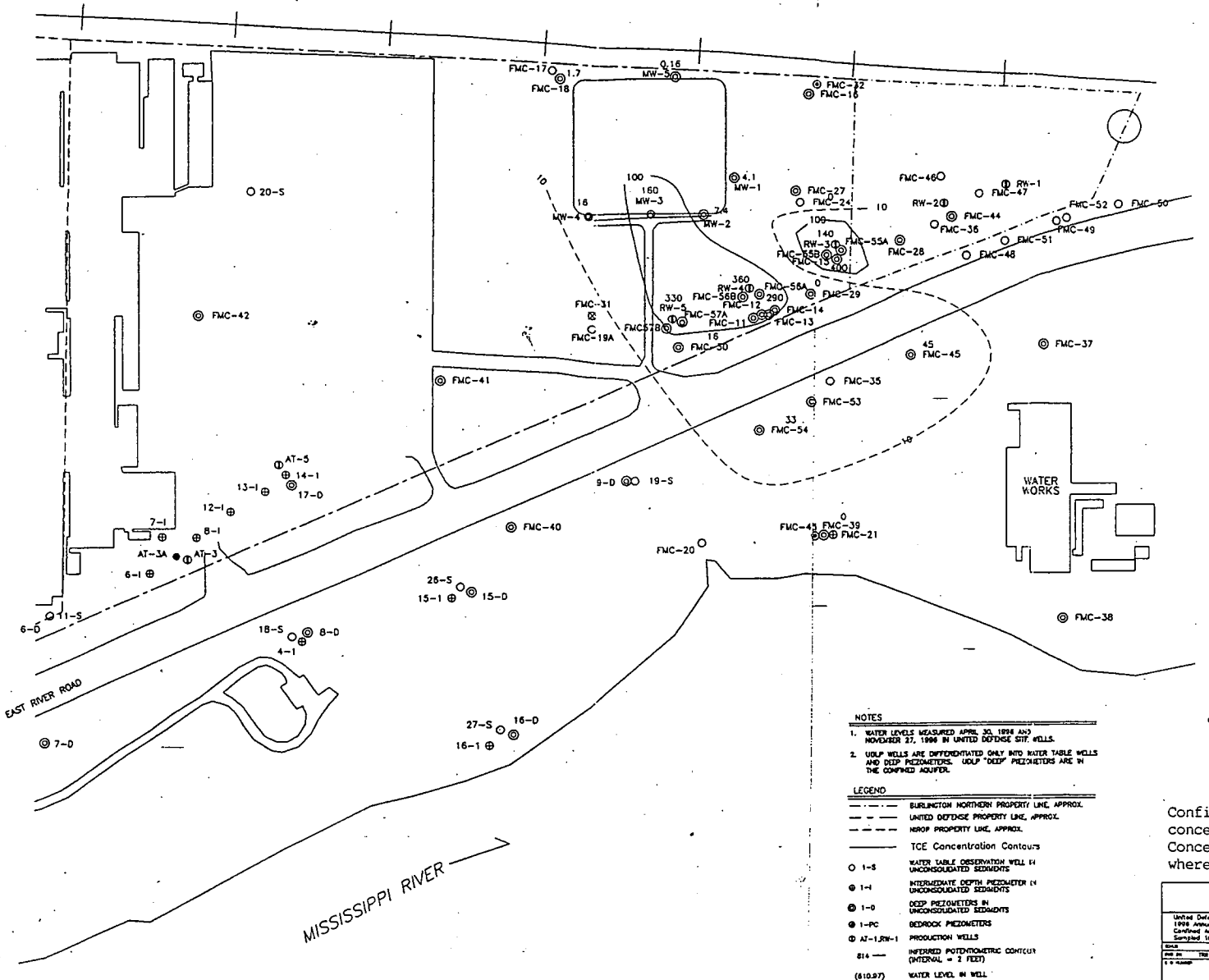

FIGURE 2

Confined aquifer TCE concentrations (ug/l). Concentrations dashed where inferred.

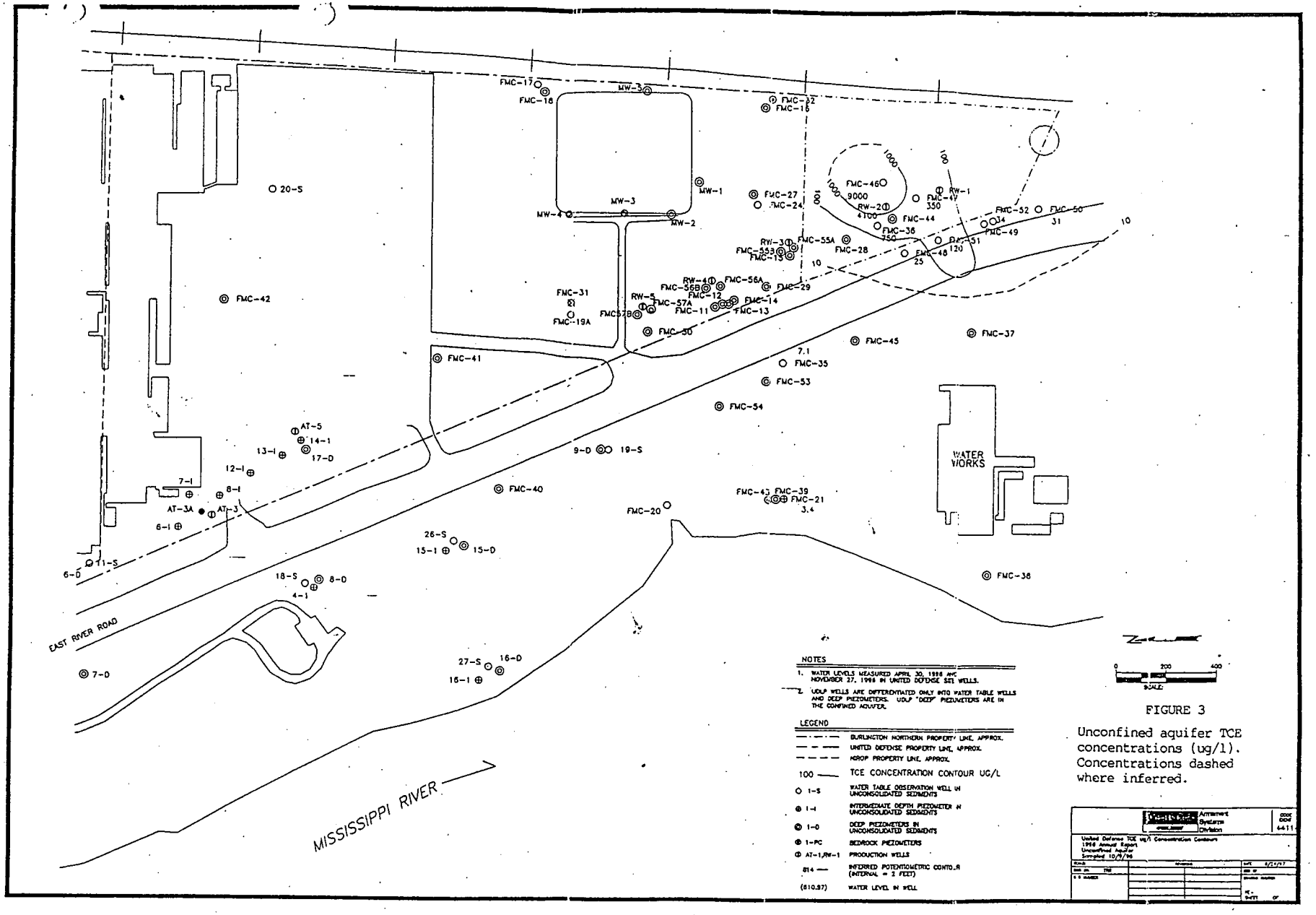

FIGURE 3

Unconfined aquifer TCE concentrations (ug/l). Concentrations dashed where inferred.