Five-Year Review Report

Pursuant to CERCLA

Second Five-Year Review Report
Kysor Industrial Corp., Superfund Site
Cadillac, Wexford County, Michigan

Prepared by:

U.S. Environmental Protection Agency
Region 5
Chicago, Illinois

In conjunction with:

Michigan Department of Environmental Quality
Lansing, Michigan

Approved By:

Richard C. Karl, Director
Superfund Division

Date: 9/30/05

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
ESD	Explanation of Significant Difference
GAC	Granular Activated Carbon
LDFA	Local Development Finance Authority
MCL	Maximum Contaminant Level
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PRP	Potentially Responsible Party
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVE	Soil Vapor Extraction
TCE	Trichloroethene
UAO	Unilateral Administrative Order
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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EXECUTIVE SUMMARY

The Kysor Industrial Corp., Superfund site is located in Cadillac, Michigan, in an industrial park that is approximately one square mile in area. In addition to the Kysor Industrial Corp. (Kysor Industrial or Kysor) site and another Superfund site, the Northernaire Plating site, over 40 other manufacturing plants are located in the industrial park. The primary concern at the Kysor site is groundwater contaminated with volatile organic compounds (VOCs). The intent of the remedy was to address six commingled groundwater plumes arising from releases of waste from Kysor Industrial Corporation and three other facilities.

The municipal well field for the City of Cadillac is located approximately 2500 feet northeast of the Kysor site. Since 1993, re-occurring detections of the VOC, trichloroethylene (TCE), have been found in one of the seven wells in the City well field. It has not been definitively concluded whether the VOC in the municipal well is due to the Kysor site, to a facility to the east of the Kysor site, or to a commingling of the two groundwater plumes.

The cleanup of the Kysor Industrial site included installing a soil vapor extraction system to address contaminated soils in an area behind the Kysor plant, extracting and treating groundwater, and implementing access and use restrictions related to well drilling and groundwater use. The Unilateral Administrative Order for Kysor Industrial Corporation also specified that soils and drummed waste at a nearby property that received waste from Kysor had to be cleaned up also.

The remedy for the Kysor site is protective of human health and the environment in the short term. Current exposure pathways are not complete, and the remedy is functioning as planned. A partial excavation of soils, along with the soil vapor extraction system, addressed the risks associated with direct contact with and ingestion of contaminated soil. These actions have also eliminated areas of significant soil contamination that would otherwise act as a continuing source of groundwater contamination and would work counter to the extraction and treatment system.

The groundwater treatment system is achieving all surface water discharge limits and performance standards. Data indicate that the site groundwater plume may be migrating towards a residential area where private wells still exist. Residential well samples collected to date, however, have not shown evidence of contamination. Although attaining the groundwater target cleanup levels established in the ROD is not expected to occur for a number of years, significant clean-up progress has already been made. The VOC treatment system operates at a very high rate of efficiency, and all groundwater exiting the system has been non-detect for total VOCs since the system began operating in 1996.

In the long term, to ensure that the remedy for the Kysor site continues to be protective, institutional controls regarding use of private wells in a subdivision north of the site must be implemented and the effectiveness of existing institutional controls much be confirmed. An Institutional Controls Study Plan will be developed to thoroughly evaluate the all of these issues. Long-term protectiveness will be achieved when target cleanup levels are attained.

This is the second five-year review report for the Kysor Industrial site. The report covers the Kysor site only. A separate five-year review report was prepared for the Northernaire Plating Superfund site.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Kysor Industrial Corp.		
USEPA ID *(from WasteLAN)*: MID043681840		
Region: 5	**State:** MI	**City/County:** Cadillac/Wexford County
SITE STATUS		
NPL status: Final		
Remediation status: On-going		
Multiple OUs*: No	**Construction completion date:** September 23, 1996	
Has site been put into reuse? Yes. Although it is under new ownership, the Kysor Corporation facility is still operating.		
REVIEW STATUS		
Lead agency: USEPA Region 5		
Author's name: Mary Tierney		
Author's title: Remedial Project Manager	**Author's affiliation**: USEPA	

Review period:** 12/01/2004 to 9/30/2005
Date(s) of site inspection: April 26 and 27, 2005
Type of review: Post-SARA
Review number: Second
Triggering action: First Five-Year Review
Triggering action date *(from WasteLAN)*: July 26,2000
Due date *(five years after triggering action date)*: July 26, 2005

* ["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:
(1) Institutional controls do not extend into a neighboring subdivision in Haring Township, which is north of the Kysor site, where private wells still exist. Also, the adequacy of the current city ordinance in place to restrict groundwater use, prevent well installation, and prohibit activities in the area that would compromise the cleanup has not been confirmed.

(2) The groundwater extraction system for the Kysor site may not be adequately capturing contaminated groundwater. In addition, it is possible that the system may be capturing a plume emanating from a neighboring facility. If this is occurring, the achievement of cleanup will likely take longer than expected. The plume from the neighboring facility is not covered by the Record of Decision for the Kysor site. In addition, the facility is not a party to one of the USEPA Unilateral Administrative Orders for the Kysor site and is not contributing to the cost of the cleanup.

(3) Discrepancies in air emission requirements for the groundwater treatment system are present in site documents, and requirements may be inconsistent with standards.

Recommendations and Follow-up Actions:
(1) Prepare an Institutional Controls Study Plan to evaluate options for additional institutional controls and necessary modifications to existing institutional controls. Conduct an inventory of private wells to ascertain how many residences in the Township subdivision and other non-residential establishments in the area are not connected to the municipal water line and how many still have private wells. Document the uses of private well water. Determine if Haring Township has any means, such as the ability to pass an ordinance, to prohibit private well installation and place restrictions on groundwater use in the areas of the subdivision under which the plume may have migrated. Ensure that every effort is made to have as many residents as possible connect to municipal water and have their wells properly abandoned and sealed. In addition, the Institutional Controls Study Plan will evaluate the overall effectiveness of the institutional controls in place, as well as those that may be implemented in the future, to ensure long-term protectiveness of the remedy.

(2) Re-evaluate capture zone analysis and/or design of extraction well system if determined either or both would be useful. State has filed and will continue to enforce a Consent Judgment against the facility that is the source of the plume possibly being captured by the Kysor remediation system.

(3) Review air emission standards to determine the most appropriate requirements for the Kysor site. Verify estimated pounds per hour of VOCs in the discharge to the air from the treatment plant.

Protectiveness Statement(s):
The remedy at the Kysor Industrial site is protective of human health and the environment in the short term. To ensure continued protectiveness, institutional controls must be implemented to restrict installation and use of private wells in the subdivision north of the site, and adequacy of existing restrictions are confirmed. Long-term protectiveness will be attained when it is confirmed that the current extraction system is capturing all VOC-contaminated groundwater from the plumes related to the Kysor Industrial site, when groundwater cleanup levels are achieved, and when institutional controls are implemented.

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KYSOR INDUSTRIAL CORP. SUPERFUND SITE
WEXFORD COUNTY, MICHIGAN
FIVE-YEAR REVIEW REPORT

I. INTRODUCTION

Authority and Purpose

The purpose of a five-year review 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 identify recommendations to address those issues.

EPA is preparing this five-year review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

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

EPA interpreted this requirement further in the NCP. 40 CFR §300.430(f)(4)(ii) states:

> *[i]f 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.*

EPA, Region 5, conducted the five-year review of the remedy being implemented at the Kysor Industrial Corp., Superfund site (Kysor Industrial site, Kysor site, or the site) in the City of Cadillac, Wexford County, Michigan. This review was conducted by the USEPA Remedial Project Manager, Mary Tierney, with assistance from Scott Cornelius, Michigan Department of Environmental Quality (MDEQ), and James Skipper, MDEQ, Cadillac District, from December 2004 through September 2005. This report documents the results of the review. The final review report will be placed in the USEPA site files and at the local repositories for the Kysor Industrial Corp., site at the Cadillac-Wexford County Public Library, 411 South Lake Street, Cadillac, Michigan, and the Cadillac City-Municipal Complex, 200 North Lake Street, Cadillac, Michigan. This is the second five-year review for the Kysor Industrial site.

The triggering action for this statutory review is the last five-year review completed on July 26, 2000. This five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

II. CHRONOLOGY

Table 1. Chronology of Site Events

EVENT	*DATE*
Kysor Industrial Corporation begins operating	1955
Disposal practices at Kysor include dumping barrels of spent solvent directly on ground behind plant	As early as 1955 (exact date unknown) to 1980s
Four Winns (Frisbie Street) begins operating	1975
A.H. Joynt begins operating	1977
Voluntary excavation of some soils from waste pits behind Kysor plant and from nearby property	July 22 and 23, 1981
Hydrogeological Study, Kysor of Cadillac, Inc.	March 1982 (Phase I) and August 1983 (Phase II)
ROD (OU1) for Northernaire Plating site signed	September 11, 1985
MDNR inspection of Four Winns (Frisbie Street)	1986
Proposal of Kysor Industrial Corp., site to NPL	June 24, 1988 (initially proposed in September 1985)
OU1 remediation (Northernaire site)	October/November 1988
General notice letters and 104(e) requests sent	May 20, 1988
FS for Cadillac area groundwater completed	August 1988
ROD (OU2) for groundwater cleanup signed	September 29, 1989
Final NPL listing	October 4, 1989
UAO issued for remedial design of OU2	May 16, 1990
Remedial Design Additional Studies report	October 1992
TCE detected above MCL in city drinking well	1993
Explanation of Significant Difference (ESD)	March 3, 1994
Two separate UAOs for RA issued (Kysor Industrial and Four Winns/A.H. Joynt)	January 30, 1995
Third UAO for RA issued (Northernaire Plating)	April 11, 1995
On-site construction for OU2 begins	June 29, 1995
Groundwater extraction and treatment begins	August 1996
Final inspection of RA construction by USEPA	September 19, 1996
Construction Completion	January 24, 1997
First five-year review completed	July 26, 2000

III. BACKGROUND

Physical Characteristics

The Kysor Industrial Corp., site is about ½ mile northwest and within the city limits of Cadillac, Michigan (see Attachment 1, Figure 1). Cadillac has a population of about 10,000 and is approximately 100 miles north of Grand Rapids, Michigan. The dominant physical feature of the City is Lake Cadillac, which is about three square miles in area.

The Kysor Industrial Corp., site is located in one of Cadillac's industrial parks. The park is approximately one square-mile in area and includes about forty manufacturing facilities, a number of residences, municipal buildings, a trailer park, and a few light industrial/commercial establishments. The City of Cadillac municipal well field is located in the center of the industrial park. A subdivision borders the site to the north. The site is considered to include the plume within the one square mile park area and the areas in Haring Township to which the plume has migrated. There are no environmentally sensitive ecosystems in the immediate area of the site.

The former Kysor Industrial Corporation[1], which is the name on which the Superfund site name is based, was located at 1100 Wright Street, in Cadillac, Michigan. The Kysor property is about 30 acres in area, and is now owned and operated by BorgWarner. The Kysor Industrial site, however, refers not only to the groundwater contamination originating from the Kysor facility on Wright Street, but also from another location where the Kysor Corporation deposited waste, and to three other groundwater contamination plumes as well. Some reports maintain that the two Kysor Corporation plumes may be responsible for the majority of the groundwater contamination being addressed by the cleanup of the Kysor site.

The first Kysor Corporation plume is due to disposal of wastes in two unlined lagoons behind its plant on Wright Street. The second Kysor plume is due to waste disposal on the Leo Ingraham property, a private residential property located 1500 feet northwest of the Kysor plant.

In addition to those plumes attributable to Kysor Corporation, there are additional plumes included as part of the Kysor site from releases at three facilities: Four Star Service Corporation (Four Star), Four Winns (Frisbie Street), and Four Winns/A.H. Joynt. All are hydraulically downgradient from the Kysor Corporation location. Four Star and Four Winns/A.H. Joynt are northeast of Kysor and Four Winns (Frisbie Street) is directly north of Kysor.

Groundwater in the commingled plumes is contaminated by a number of VOCs, with trichloroethylene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and tetrachloroethene (PCE) being the main contaminants. The approximate extent of the plume[2] being addressed by the remedial action for the Kysor Industrial site is 4000 feet in length (north to south and beginning at the Kysor Corporation property) and, at its' widest (east to west), 2500 feet in width. At its widest point, the eastern boundary of the plume extends to the west edge of the City well field and the western boundary extends approximately to Leeson Avenue (although some trace detects west of Leeson have been seen). (See Attachment 1, Figure 2, for features in the area of the site). The

[1] Throughout this report, references to the "Kysor Industrial Corp., site," the "Kysor Industrial site," the "Kysor site," or the "site" all refer to the Superfund site, which includes a number of different facilities. When referring to the Kysor Corporation itself, the terms "Kysor Corporation" or "Kysor" are used. In some site file documents, the Kysor Corporation is also referred as "Kysor of Cadillac, Inc."

[2] In this report, the commingled plumes from the facilities that are part of the Kysor site are referred to as a single plume. If a groundwater plume from an individual plume is being referenced, the name of the specific facility is used, e.g., the "Four Winns (Frisbie Street) plume."

municipal wells, however, draw water from about 340 feet below ground level (bgl), while the greatest depth of the Kysor site plume is estimated at slightly over 200 feet bgl. In addition, a clay confining layer is generally interpreted to be present over part of the plume area between the intermediate aquifer and the aquifer from which the municipal wells draw.

A number of other facilities in the area are known or possible sources of groundwater contamination; however, these are being addressed separately from the Kysor Industrial site. (See Attachment 1, Figure 3). A partial list of other documented releases and sources of groundwater contamination follows.

Paulstra/CRC Corporation, formerly known as Cadillac Molded Rubber, Inc. (Paulstra)

- Located at 600 Seventh Street and northeast of Kysor Corporation
- Rupture of above-ground storage tank containing TCE in 1984
- Installed recovery wells in 1984; operated until November 1986
- Involved in third-party lawsuit related to the Kysor site; dismissed from suit by Federal District Court
- Installed additional extraction well in 2000 that is still operating

Mitchell Corporation

- 1400 feet east of and side-gradient to Kysor Corporation
- Began operating in late 1960s
- Investigation in 1991 indicates spill of tetrachloroethene (PCE) occurred in area of former underground storage tank; date of release unknown
- Extraction well system installed to capture PCE plume
- Extraction system was recently shut down temporarily due to mechanical problems

Rexair, Inc.

- East-northeast of and side-gradient to Kysor Corporation
- Michigan Department of Natural Resources (MDNR)[3] files indicate that approximately twenty barrels containing unknown substances were stored outside the east side of the facility; barrels appeared to be leaking
- In late 1980s, investigation of area groundwater revealed a plume, primarily TCE (nearly 100%), from the facility
- State of Michigan Consent Judgment in 1991
- Installed a number of extraction and monitoring wells
- Report prepared by MDEQ contractor and reviewed by three independent experts maintains that Rexair extraction well system is not adequately capturing its plume, leading to commingling with the Kysor site plume and resulting in the Kysor remediation system capturing and treating part of the contamination arising from Rexair since 1997

Because of the number of groundwater plumes in the vicinity of the Kysor site, over a dozen different parties have installed monitoring and extraction wells. A total of 340 wells are present in the area. (See Attachment 1, Figure 4, for a depiction prepared by an MDEQ contractor of the various plumes, and Attachment 1, Figure 5, for a map showing some of the wells in the area.)

Land and Resource Use

In USEPA documents, the industrial park in which the Kysor Industrial site is located has historically been referred to as the "Cadillac Industrial Park" or the "Cadillac Industrial Park

[3] MDNR is the predecessor agency to the Michigan Department of Environmental Quality (MDEQ).

Area." The park is approximately one square mile in area and is generally bounded by Thirteenth Street to the north, Mitchell Street (Route 131) to the east, Wright Street to the south, and Leeson Avenue to the west. (See Attachment 1, Figure 6). Kysor Corporation, the Ingraham property, Four Winns (Frisbie Street), Four Winns/A.H. Joynt, and Four Star are located in the western half of the Industrial Park.

Although the area is predominantly industrial, in addition to the more than 40 manufacturing facilities, the park also includes garages and storage areas for the City of Cadillac, the City of Cadillac municipal well field, a number of residences, a trailer park, and a baseball diamond. The City of Cadillac municipal well field is approximately 1000 feet south of Thirteenth Street and mid-way between Mitchell Street and Leeson Avenue.

Currently, the Four Star plant is inactive, the residence on the Ingraham property was torn down and the lot is vacant, and Four Winns plans to use it as a storage facility and parking lot, Four Winns (Frisbie Street) facility is still operating, the Kysor Corporation facility is an operating plant owned by BorgWarner, and the Four Winns/A.H. Joynt is an operating plant that manufactures fiberglass boats and is owned by Four Winns. Future land use for each of these properties is projected to be industrial. The Ingraham property is unique in that it fronts Leeson Avenue which has more commercial establishments and residential lots.

The land and resource use of primary concern near the site is groundwater that is used for drinking. The City of Cadillac well field includes seven municipal wells and is the sole community drinking water source for the City's 10,000 residents. (See Attachment 1, Figure 7). One of the seven city wells has been shut down since 1994 due to detections of TCE in 1993. Also, the residential area to the north of the Industrial Park, commonly referred to as the North Park subdivision, is located in Haring Township, a charter township adjacent to Cadillac. A number of the residences in the North Park area still operate private wells. Some of the residents still use their wells for drinking water, but the exact number of wells used for drinking is not known.

Studies of the area have shown that there are three distinct aquifers at, or near, the Kysor site. The three aquifers are referred to as "shallow," "intermediate," and "well field" (or "deep"). The shallow and intermediate aquifers consist of sand with some silty clay and gravel. Clay layers separating the three aquifers from one another are present predominantly in the southwest part of the Industrial Park. It appears, however, that the shallow and intermediate aquifers become hydraulically connected northeast of the Kysor Corporation in the area near the North Park subdivision.

The clay layer also appears to be absent in the vicinity of the City well field. The City wells draw from a deep, predominantly sand aquifer. Flow in the shallow aquifer is generally to the north, while flow in the intermediate is more to the northwest.

The closest surface water bodies to the site are the Clam River and Lake Cadillac. Both are approximately ¾ of a mile to the southeast. Some of the surface water drainage from the Industrial Park ends up in a water retention pond located near Leeson Avenue, but the majority of it flows south and east towards the Clam River.

The effluent from the groundwater treatment facility discharges via an outfall to the Clam River. According to the application submitted to MDNR for National Pollutant Discharge and Elimination System (NPDES) permitted discharge limitations, the river is protected for the following uses: agricultural use, navigation, industrial water supply, cold-water fish, partial body

contact recreation, and total body contact recreation. Currently, the main uses are recreation and sport fishing.

History of Contamination[4]

Kysor Corporation began operating in 1955 at the location on Wright Street. The company manufactured truck parts and temperature control systems for the automotive industry. Processes at the plant included stamping, machining metal parts, and painting. A variety of solvents, degreasers and paints were used at the facility.

Two adjacent areas behind (north of) the plant were used as waste disposal areas. Some reports refer to the areas as "lagoons" or "waste pits." Spent solvents were disposed of in these areas and directly to the ground upgradient of a residential property northwest of the plant. The contaminants from the Kysor plant included toluene; xylenes; ethylbenzene; TCE; 1,1,1-TCA; and PCE.

Four Star operated from 1967 to 1979. Between 1979 and 1981, the site was used for storage. During its operation, the plant manufactured polished aluminum and stainless steel trim for the automotive industry. Steel was used as the primary raw material, and parts were stamped, welded, and assembled into roll-formed or stamped products. TCE was used to clean the finished parts. Soils collected at Four Star were found to contain elevated levels of 1,1,1-TCA; TCE; toluene and methylene chloride. Water samples from the Four Star site indicated that PCE and TCE were the principal contaminants released into groundwater.

The Four Winns plant on Frisbie Street began operating in the mid-1970s. Four Winns manufactures fiberglass boats. Solvents and degreasers used in the manufacturing process included acetone, methylene chloride, toluene, methanol, PCE, TCE, and 1,1,1-TCA. In an inspection of the plant by MDNR in 1986, soils were found to be contaminated with these contaminants as well as styrene, ethylbenzene and xylenes. 1,1,1-TCA is a compound typically used in fiberglass hardening.

A.H. Joynt operated its facility on Thirteenth Street from 1977 to 1982. A.H. Joynt was an automotive parts wholesaler and machine shop. Degreasers were used in their operations. Four Winns bought the facility in 1982 and has operated the Four Winns' Cruiser Division at the location since that time. In 1992, the State of Michigan found hazardous substances, including TCE, in a concrete sump located at the Four Winns/A.H. Joynt property.

Initial Response

The Kysor Industrial Corporation was the facility at which the most significant actions were taken prior to the remedial action specified in the ROD for OU2. Four Winns did conduct limited investigations in 1986 and 1987, but no remediation is known to have been done. Under an agreement later with the State of Michigan, Four Winns did install a number of monitoring wells (designated by "FWMW"). Four Star completed a two-phase hydrogeologic study in 1983. The 26 monitoring wells (designated by "FS") installed did not extend more than 20 feet below the water table (to approximately 52 feet bgl), so the plume was not considered adequately characterized by MDNR. Additional wells installed by MDNR at this time were designated with the prefix "DNR." At the Four Star site, the MDEQ conducted soil vapor extraction to remove contaminants, and the plant owner conducted a soil removal.

[4] An expanded chronology is provided in Attachment 2.

In 1980 and 1983, Kysor Corporation installed a series of borings and monitoring wells (designated by "K") for hydrogeologic studies of groundwater contamination. On July 22 and 23, 1981, Kysor conducted a voluntary excavation of some of the contaminated soils from the two disposal areas behind the facility. (See Attachment 1, Figure 8). Approximately 700 cubic yards of soil were sent to a Type I landfill for disposal. The average depth of the excavation was six feet, and the average depth to the water table is 25 feet in the area. Drums, buckets, rags, and paint sludge were removed along with the soil.

When thirty soil samples from the former lagoon areas were analyzed in 1987 (six years after the excavation), concentrations of total VOCs ranged from a low of 29 ug/kg to a high of 752,000 ug/kg. The depths of the borings ranged from 6 to 25 feet below ground level. On average, the total concentration of VOCs in the thirty samples was almost 88,000 ug/kg (see Attachment 3). The results showed that the contamination was made up primarily of toluene, xylenes, ethyl-benzene, and TCE. 1,1,1-TCA was also present at high concentrations in some of the borings. PCE was for the most part between non-detect and 50 ug/kg in most samples, although in one sample, it was at a concentration of 2,200 ug/kg. The highest concentrations of the five predominant contaminants are listed below:

Toluene	95,000 ug/kg
Xylenes (total)	520,000 ug/kg
Ethylbenzene	68,000 ug/kg
TCE	74,000 ug/kg
1,1,1-TCA	24,000 ug/kg

Basis for Taking Action

Hazardous substances that have been released into groundwater and soil from the Kysor Industrial site include acetone; methylene chloride; toluene; methanol; styrene; ethylbenzene; xylenes; PCE; TCE; 1,1,1-TCA; 1,2-DCE; 1,1-DCE; and 1,2-DCA.

The primary exposure pathway of concern at the site is via ingestion of groundwater. Evaluation of the potential exposure and risk showed that a resident drinking groundwater from either the shallow or the intermediate aquifer would be exposed to excess lifetime cancer risks in the range of 10^{-5} to 10^{-3}. In addition: (1) the eastern extent of the contaminated groundwater plume from the Kysor Industrial site is close to the western boundary of the City of Cadillac municipal well field; (2) TCE, a primary compound of concern at the Kysor site, has been detected in city well #7 above the maximum contaminant limit (MCL) of 5 ug/l on a number of occasions since 1993; and (3) a number of residents in the North Park subdivision, where the northern extent of the plume has migrated, still use their private drinking wells as either drinking water or for other domestic purposes.

III. REMEDIAL ACTIONS

A ROD for operable unit #1 (OU1) was signed by USEPA in September 1985. This ROD related to the Northernaire site and was a source control remedy that focused on removal of contaminated soils and sediments. The OU1 remedial action took place in October and November 1988.

The second part of the investigation involved a broader look at the groundwater contamination in the Cadillac Industrial Park area. The State-led, federally-funded study, "Cadillac Area Groundwater Contamination Remedial Investigation," was completed in August 1988. Based on these results, the ROD for OU2 for both the Kysor and Northernaire sites was signed on September 29, 1989.

Remedy Selection

The September 1989 ROD for OU2 addressed the groundwater contamination at both Superfund sites. The ROD served as the second and final action for the Northernaire site and the first and final action for the Kysor Industrial site. The predominant compound of concern at the Northernaire site is hexavalent chromium, while contaminants in groundwater arising from the Kysor site include a number of VOCs.

The OU2 ROD has two separate cover sheets, referred to as the "Declaration for the Record of Decision," but the remainder of the document serves as a single ROD for both the Northernaire and the Kysor Industrial sites. It was after this ROD was signed that the sites began to more often be referred to as the "Northernaire/Kysor" sites rather than by their individual names. One reason why the sites were treated as one in the OU2 ROD was that the designs for the treatment systems were developed jointly. Another reason was that plume from the Northernaire site was contained within the Kysor site plume, so designing separated groundwater extraction systems would be difficult. The chromium and VOC treatment systems are housed in one building and are operated and maintained by the same party.

The components of the groundwater remedies required for each site were identical except that the remedy for the Kysor site also called for the installation of a soil vapor extraction (SVE) system. For the Kysor site, the OU2 ROD called for the following:

- Install a groundwater extraction and treatment system to remove groundwater contamination from the area surrounding the site
- Conduct groundwater monitoring to assess the quality of area groundwater
- Install a vacuum extraction system to remove contamination from soils
- Impose access and use restrictions

The installation of the SVE system was the one component unique to the ROD requirements for the Kysor site. Because an SVE system had been constructed at the Kysor property as part of a pilot test, implementing this part of the OU2 ROD involved expanding the existing system.

The Statement of Work attached to the Unilateral Administrative Order (UAO) issued to Kysor in January 1995 added one extra remedial component: addressing soil contamination, via removal or otherwise, at the Ingraham property, where Kysor had disposed of a number of drums of waste.

Groundwater cleanup levels in the ROD, referred to as "target cleanup levels," for VOC contamination in groundwater are:

Compound	Target Cleanup Level (ug/l)
1,1,1-trichloroethane	200
trans-1,2-dichloroethene	70
1,1-dichloroethene	5
1,2-dichloroethane	5
methylene chloride	5
tetrachloroethene	1
trichloroethene	5
xylene	440
toluene	40

Soil cleanup levels in the ROD for VOC contamination being treated by the SVE system are:

Compound	Target Cleanup Level (mg/kg)
1,1,1-trichloroethane	7.6
trichloroethene	0.07
xylene	141
toluene	724

In 1994, USEPA signed an Explanation of Significant Difference (ESD) to document a slight change in the remedy. The purpose of the ESD was to document the decision by USEPA to include the contaminated groundwater from the Northernaire/Kysor site that had migrated into the North Park subdivision area, which is to the north of the Cadillac Industrial Park, as part of the site. The intent was not to change any of the required actions in the OU2 ROD, but was simply to document that the current remedy would be addressing the further extent of the plume. The cleanup established in the OU2 ROD and to which the ESD applies is the remediation of the releases from the facilities to which USEPA issued a UAO. Through a mechanism put in place by the City of Cadillac, other facilities in the Cadillac Industrial Park are also contributing to the costs of the cleanup.

Remedy Implementation

A UAO for remedial design of OU2 was issued in May 1990. Nine parties, including Northernaire Plating Company, were named on the Order. The other parties were: Top Locker Enterprises, Inc., R.W. Meyer, Inc./Meyer Construction, Co., Willard S. Garyood, Kysor of Cadillac, Four Winns Company, Four Star Corp., Jomar Company, and Leo Ingraham, Sr. The remedial design addressed the work required in the OU2 ROD for both the Northernaire site and the Kysor Industrial site and was finalized in March 1995.

In 1995, three separate UAOs for remedial action, each for a different group of potentially responsible parties, were issued. By 1996, the groundwater extraction and treatment system, as well as the SVE system at the Kysor site, were constructed and in operation.

Based on the findings of remedial investigative activities, the areas of contamination to be addressed by this remedial action were:

- A VOC plume in the shallow aquifer containing up to 115 mg/l of VOCs
- A less concentrated VOC plume (up to 12 mg/l) in the intermediate aquifer
- A hexavalent chromium plume at a depth of 150 feet bgl in the intermediate aquifer and also in the shallow aquifer
- An area of soil contaminated with VOCs

The various components of the systems designed to remediate these areas are:

- A groundwater extraction system consisting of 16 wells (originally 17 wells; one is no longer used due to low yield). (See Attachment 1, Figure 9).
- Associated pipelines to convey VOC and VOC/chromium-contaminated groundwater to the treatment system
- A discharge pipe to convey treated groundwater to the Clam River
- A packed tower air stripping (PTAS) system to remove VOCs from groundwater
- A carbon adsorption system to remove hexavalent chromium from groundwater
- A treatment building to house the treatment system components

- Expansion of a SVE and treatment system to remediate soils contaminated with VOCs at the Kysor property

Air Stripping System for Removal of VOCs from Groundwater

For groundwater treatment, water entering the plant from the 16 VOC-extraction wells is sent directly to the air stripping towers. The treatment system for removing VOCs from groundwater consists of two packed air stripping columns. Both units are typically used in series. The second may be used alone, however, if exiting air emissions meet requirements. The concentrations on which the design of the air stripping system were based were those detected during the pilot tests run in May 1991. At that time, TCE was present in the influent groundwater at an average concentration of 1,190 ug/l, with a range of 970 to 1,430 ug/l. During the pilot test, which was conducted over the course of four days in 1991, TCE was roughly 30 times greater than the next most prevalent contaminant, PCE. The average concentration of PCE in the influent was 39 ug/l.

An influent concentration of 1,430 ug/l for TCE was used as the basis for designing the air stripping system for two reasons: One, it was the compound typically found to be at the highest concentration in groundwater; and, two, it was determined to be the rate-limiting compound. The treatment system was built to be able to reduce TCE in exiting groundwater to 5 ug/l.

Granular Activated Carbon System for Removal of Hexavalent Chromium from Groundwater

The design consisted of one extraction well that pumps groundwater contaminated with chromium that is conveyed via a separate piping system to the treatment plant. The water entering the treatment plant from this well goes through the carbon adsorption treatment system first and is then routed to the air stripping system. The treatment system for chromium includes two granular activated carbon (GAC) contactors, a pH control system, and associated valves and piping. Under normal conditions, the effluent from the chromium removal system is conveyed directly to the influent line for the air stripper.

Discharge of Treated Groundwater to Clam River

Via gravity outfall piping, the effluent from the groundwater treatment system discharges to the Clam River. (See Attachment 1, Figure 10). Alternatively, the treatment facility design includes vertical turbine pumps which are designated as cooling water make-up pumps and may be used to pump up to 800 gpm to the Co-generation Power Plant located 4,000 feet west of the facility. Revenue from sales of cooling water to the Power Plant is used to help fund the costs of operating the treatment plant.

An initial list of discharge limitations was provided by MDNR in the OU2 ROD. During remedial design, however, the Respondents went through the formal application process with MDNR, Surface Water Quality Division, to obtain final limits. A Substantive Requirements Document (SRD) prepared by MDNR in 1994 and the new NPDES discharge permit issued in 1996 provided the discharge monitoring requirements (DMRs) for the treatment plant. The purpose of the SRD and the discharge permits were to establish requirements and limits for discharging treated groundwater via an outfall to the Clam River. For Superfund sites, the SRD can substitute for receiving permits such as an air emissions permit or an NPDES permit. The 1994 SDR and 1996 permit provide the following limits for discharging to the Clam River:

Compound	**Daily Maximum (ug/l)**
1,1,1-trichloroethane	5
1,2-dichloroethane	5
tetrachloroethene	5
trichloroethene	5

Compound	Monthly Average (ug/l)
Hexavalent chromium	8.3
Total chromium	59

In 2002, a reissued permit changed the DMR monthly averages for chromium to 12 ug/l (increased from 8.3 ug/l) for hexavalent chromium and 92 ug/l for total chromium (increased from 59 ug/l). DMRs are requirements that are expected to be met as of the start of treatment and throughout the remediation. Samples to test compliance with DMRs are collected at the Clam River outfall pipe, after the treated groundwater travels through approximately 4,000 feet of underground piping. However, it is the groundwater cleanup levels, referred to as target cleanup levels (TCLs) in the ROD, which are the objectives the remedial action is intended to achieve and which indicate ultimately when the cleanup will be considered to be completed. The TCLs are compared to results of groundwater samples as the water exits the treatment systems.

For two of the compounds that have both a DMR limit and a TCL, the two limits are the same. For one compound, the TCL is more stringent than the DMR, and for the other two compounds the TCLs are less stringent than the DMR. The comparison between the TCLs and DMRs is shown below:

- TCE and 1,2-DCA — ROD cleanup levels are the same (5 ug/l)
- PCE — ROD cleanup level is more stringent (1 ug/l)
- 1,1,1-TCA — ROD cleanup level is less stringent (200 ug/l)
- Hexavalent chromium — ROD cleanup level is less stringent (50 ug/l)

SVE System for Removal of VOCs from Soil at the Kysor Plant

The SVE system at the Kysor plant consists of 23, four-inch-diameter extraction/induction wells at a depth of approximately 25 feet and set approximately 5 feet above the water table. A negative pressure is applied to the system by a mounted blower system. Collected vapors are blown through two vapor phase carbon contactors in series, each containing 2,000 pounds of vapor-phase carbon. The treated airstream is discharged through a four-inch stack. The system is able to draw from four wells at any one time, with the remaining wells used as induction wells on an alternating basis. On-site construction of the remedial action for the OU2 ROD began in June 1995. The groundwater treatment and extraction system and the SVE system began operating in September 1996, and the first round of the quarterly monitoring program was completed in November 1996.

Institutional Controls

Another component of the remedies for the Northernaire and the Kysor sites was to "impose access and use restrictions." In the Statement of Work attached to the UAOs this requirement is further defined to be "implementation of institutional controls in the form of deed restrictions and/or enforceable ordinances." To meet this requirement, the City of Cadillac passed an ordinance imposing restrictions on the real estate described in ordinance. The restrictions include prohibiting installation of drinking water wells on the site and installation of any wells that might interfere with the operation and maintenance of the groundwater extraction or treatment systems, except with written consent by USEPA. The ordinance also prohibits tampering with or removal of the containment or monitoring systems at the site. A copy of the ordinance, along with a certification that it is still in effect, is in Attachment 4.

In the late 1970s, when hexavalent chromium from releases at the nearby Northernaire Plating site was found in on-site groundwater, residences located in the Industrial Park were connected to the City of Cadillac municipal water system. The closest off-site residences are in the North Park subdivision across Thirteenth Street, which forms the northern border of the Industrial Park. (See Attachment 1, Figures 2 and 11.) When the ROD was written in 1989, data indicated that contaminated groundwater had not migrated beyond Thirteenth Street. In more recent years, however, VOCs have been detected in monitoring wells near and in the subdivision. Although the City of Cadillac passed the ordinance restricting groundwater use and well installation in the Cadillac Industrial Park, because the North Park subdivision is in Haring Township the ordinance does not cover these wells. In the past, residents who still had private wells were made aware of the potential threat and were advised to connect to the municipal water line. Some connected to municipal water, however, it is reported that some residents still maintain their own wells for non-drinking water purposes, such as watering gardens. It is not known whether any residents still use their private wells for drinking or whether there are other, non-residential establishments north of the site that still operate and use private wells.

One of the recommended follow-up actions included in this report (see Table 6) is to develop an Institutional Controls Study Plan. This plan will serve not only to review issues, but will propose options for addressing them. The plan will also include developing timelines for the implementing the approved approach(es) and carrying out the necessary steps to put the institutional controls into effect. Regarding the city ordinance, examples of the types of information that the plan will need to document are: the methods used to monitor compliance with and enforce the ordinance; whether there have been any instances of non-compliance, and, if so, what action was taken; whether there is a plan in place for notifying USEPA if the ordinance is changed, and, if not, developing a plan; whether any variances to the ordinance have been granted; and assessing, overall, whether the ordinance has been effective and is the best approach for achieving the intended objective of the ROD.

The Institutional Controls Study Plan will also address the lack of institutional controls regarding private wells in the North Park subdivision. If Haring Township is able to pass an ordinance to impose use restrictions in the area, some of the same questions as listed above for the city ordinance will need to be answered. Because an ordinance may only be able to restrict use that occurs in the future, solutions for the current situation will also need to be devised.

As stated above, attempts were made in recent years to encourage residents in the North Park area who have wells to connect to the municipal water system. This is one approach that should be re-evaluated in the Institutional Controls Study Plan. Based on the results of earlier efforts, however, a contingency plan would also need to be developed for cases where residents may choose to not abandon their private wells. An inventory of wells in the subdivision, to determine the exact number of existing wells, their approximate depths, if known, and how the water from the well is used, will be one of the first steps taken.

Operation and Maintenance (O&M)

Routine maintenance of the wells, extraction wells, SVE system, and groundwater treatment plant is done by the employees of the City of Cadillac. Some of the routine checks and maintenance are checking and replacing oil, belts, heat tape, worn valves and packing; cleaning roof-top heating unit; pulling and cleaning extraction wells if needed, and checking wells for freezing, damage, secured locks, and extraction well failure. Daily bench logs are kept up-to-date. Logs and data are electronically stored. One particular monitoring well, F-10S, has not been sampled lately due to the field crew not being able to locate it. It is suspected that the well may have been paved over by a property owner. One of the shallow VOC extraction wells, S-7, is not

operational due to the lowering of the water table at the location by the pumping of the other extraction wells.

During the initial two years of operation, sampling frequency was quarterly. Annual monitoring began in October 1998. Several intermediate wells (F-6, CMS-5W, and MW-18) are still monitored on a quarterly basis. Currently, 23 shallow and 23 intermediate wells are included in the groundwater monitoring program. (See Attachment 1, Figure 12, for extraction well locations. Wells with a well name enclosed in a rectangle are those wells that extract VOC-contaminated groundwater.) In the 1995 Performance Monitoring Plan (PMP), 27 shallow wells were designated as monitoring wells, but four wells, DNR-10S, FS-1-10, SLW-1, and S-7, have since been eliminated from the program. The PMP also called for 27 wells in the monitoring program. Two additional wells, I-11 and CMS-5W, were added to the program when sampling began in 1996, and between 1997 and 2001, a number of wells were eliminated from the program, including K-12, F-2, F-4D, GW-9D, GW-10D, and MW-18.

The current sampling program to monitor the progress in cleaning up the VOCs in the shallow and intermediate aquifers includes:

- Annual sampling of 17 shallow monitoring wells
- Annual sampling of 12 deep monitoring wells (3 of these are sampled quarterly)
- Annual sampling of 6 shallow extraction wells
- Annual sampling of 11 deep extraction wells
- Monthly sampling at the treatment plant of the influent, midpoint and effluent flows
- Weekly sampling of effluent for compliance with DMRs
- Annual static water level measurements at about 100 wells

A construction summary for the extraction wells is in Attachment 5. Generally, shallow wells are screened between 35 and 70 feet bgl, and deep wells are screened between 120 to 200 feet bgl.

Air emission samples exiting the SVE system are analyzed for VOCs as part of O&M requirements. The PMP requires that soil sampling be conducted quarterly to evaluate the progress of the SVE cleanup. The samples would be collected at five-foot intervals. Initially after the system began operating, two soil sampling locations would be identified in each area for VOC analysis. As cleanup progresses, the number, location and frequency of sampling could be modified. Borings collected after cleanup has progressed would be located throughout the area of remediation and near the boundaries. Each soil sampling location would be a point of compliance for soil cleanup.

Air emission sampling requirements during O&M for the air stripping towers were not established in the OU2 ROD. The ROD states that the PTAS system would be considered a source of air contamination and would necessitate compliance with substantive requirements for installation and operation of an air stripping unit. The State of Michigan establishes maximum allowable emission rates from new sources of VOCs on a case-by-case basis. In the 1995 PMP, it stated that the "ROD did not specify air discharge requirements for the treatment facility, but that VOC emissions would be calculated based on flow and the differences between influent and effluent VOC concentrations." The report specified that air emissions from the air strippers were not to exceed the following:

Parameter	Rate
Hexavalent chromium	0.00007 lb/hour
TCE (Stripper 1)	38.8 mg/cubic meter and 0.487 lb/hour
TCE (Stripper 2)	2.4 mg/cubic meter and 0.101 lb/hour
Total VOCs	0.95 lb/hour
Opacity	0%

As part of the follow-up actions to this review related to air emission requirements, evaluating potential loading increases to the treatment system may be recommended. This will help assess the ability of the system to effectively treat a greater volume of contaminated groundwater, in case a reassessment of the plume shows it is larger than currently estimated.

Costs and Operation

Approximate annual costs of O&M for both the Northernaire and Kysor sites are shown in the table below. Omitting the first partial year of operation and the estimated budget for 2006, the average amount spent per year is approximately $222,000. The estimate for annual O&M expenditures in the 1989 ROD was $125,000. In fiscal years 2004 and 2005, the costs of contractual expenses and utilities comprised from 50 to 65% of the total annual expenditures. On average since 2001, almost 900 staff-hours per year have gone into running and maintaining the remedial action. Capital and construction costs were significantly less than expected (about $1.3 million) and came in very close to the amount projected in the OU2 ROD.

Table 2. Approximate Annual Operations/O&M Costs (fiscal year ending June 30)

Dates		Total Cost
From	To	
9/1996	6/1997	$110,000
7/1997	6/1998	$225,000
7/1998	6/1999	$190,000
7/1999	6/2000	$270,000
7/2000	6/2001	$160,000
7/2001	6/2002	$210,000
7/2002	6/2003	$240,000
7/2003	6/2004	$240,000
7/2004	6/2005	$235,000
7/2005	6/2006	$230,000
7/2006	6/2007	$275,000 (proposed)

Typically, Respondents to a UAO incur the full costs and responsibility for constructing the remedy and conducting O&M. For the Northernaire and Kysor sites, however, a public/private sector partnership was formed to address the cleanup. Although the City of Cadillac was not identified by USEPA as a potentially responsible party (PRP) and is not a Respondent to a

USEPA UAO, it has taken the lead in constructing and operating the remedy. Using State legislation, the City of Cadillac formed a Local Development Financing Authority (LDFA) to facilitate construction of the remedy and assist with the capital expenditures of building the treatment system. The development project that was the catalyst for the formation of the LDFA was the construction of the Co-generation Power Plant. Revenue generated through tax increment funding (TIF) authorities, and funds from $7.4 million in bonds issued by the City, helped to finance the remedial construction. The bonds were paid off in March 2005.

To finance the annual costs of operating the plant, the City established a Special Assessment District. Annual costs include running the plant, conducting monitoring, and any unexpected costs (see Attachment 5). The area covered by the Special Assessment District coincides to a certain extent with the area of the Cadillac Industrial Park. All non-exempt property owners, which include the City of Cadillac, within the Special Assessment District pay a yearly special assessment in addition to their property taxes. An example of an exempt party would be a resident. Within the LDFA, the non-exempt properties identified as contributing to the contamination are collectively responsible for 75% of the total operational costs; the other property owners in the Industrial Park are responsible for paying the remaining 25%. The portion each facility pays is based on the acres of property owned.

In addition, revenues from the sale of treated groundwater to the Power Plant for its cooling processes also go towards annual operating expenditures. Further description of the LDFA Remediation Project and a diagram showing the Special Assessment District is in Attachment 6.

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

Table 3. Actions Taken Since the Last Five-Year Review

Recommendations From Previous Review	Party Responsible	Action Taken
Continue groundwater treatment	Respondents	On-going
Evaluate groundwater for contaminant trends	Respondents	Evaluation of trends included in annual monitoring reports; also, in response to a related legal case that MDEQ is handling, contractors for MDEQ have completed an additional investigation of the multiple groundwater plumes in the area and summarized their findings in a report, a technical memo and a PowerPoint presentation; further trend analyses will be recommended
Analysis of monitoring well network	Respondents	MDEQ had several additional wells installed related to a neighboring plume; no other changes made to monitoring network; review of the network with more recent data will be recommended

Recommendations From Previous Review	Party Responsible	Action Taken
Review extraction and treatment system for optimization opportunities	Respondents	One GAC unit is now used for the chromium treatment train; no pH adjustment is necessary; NaOH and HCl tanks emptied in 2001
Review request to decrease cleanup level ARAR for PCE	USEPA/MDEQ	In many cases, lower cleanup level is already being met; may reevaluate to determine if any change is necessary

VI. FIVE-YEAR REVIEW PROCESS

Administrative Components

MDEQ and the City of Cadillac LDFA were notified of the initiation of the five-year review in October 2004 and December 2004, respectively. The preparation of the Kysor five-year reviews was led by Mary Tierney, USEPA, with assistance and review provided by Scott Cornelius, MDEQ, and James Skipper, MDEQ. USEPA was the lead-Agency for the review.

The components of the five-year review schedule include:

- Community Notification
- Document Review
- Data Review
- Site Inspections
- Report Development and Review

Community Involvement

A Public Notice was published on May 18, and 23, 2005, in the Cadillac News announcing that a five-year review of the Kysor site was to be conducted. Community meetings and interviews with residents and City officials were held on April 26 and 27, 2005. Several residents said their impression of the problem was that it was being handled very well by the City. Residents were supportive of the approach the City was using, that is, how they had developed a creative way to solve the Superfund problem and had formed partnerships with the industries in the Industrial Park to clean the groundwater.

The City has been very satisfied with the progress of the cleanup and has requested that MDEQ and USEPA evaluate the proposal for shutting down the chromium treatment system and for doing preliminary soil sampling as part of the first step to developing a closure plan, if sample results support it, for the SVE system. They would also like the cleanup level for PCE to be reduced based on the level published in a ROD for another Superfund site in Michigan.

One citizen voiced serious concerns about the groundwater plume from the Rexair facility. She felt confident that the contamination from the Northernaire and Kysor sites was being cleaned up and that the treatment was running smoothly, but her perception was that the cleanup of the Rexair plume was not going as well, and she was concerned that the problem Rexair was creating might end up being worse than the Superfund problem. She was also concerned about air emissions from a nearby power plant.

Document Review

This five-year review consisted of a review of relevant documents including RODs, the ESD, investigatory reports and studies, correspondence, memoranda, O&M records, construction specifications, hydrogeologic studies, performance management plans, remedial action construction report, City of Cadillac summary description of LDFA and annual budgets, expert opinion reports, annual evaluation reports, and monitoring data (see Attachment 7). Applicable cleanup standards and goals, and applicable or relevant and appropriate requirements (ARARs), as listed in the 1985 and 1989 RODs, were also reviewed (see Attachment 7).

Data Review

Descriptions of data related to the Kysor Industrial site are provided below. A brief summary of key points are shown in the bulleted lists.

SVE System

- 669 pounds of VOCs removed between September 1996 and September 2000
- Since September 2000, readings of soil vapor entering the system have been non-detect
- System will be reviewed and samples collected prior to development of closure plan
- Estimated time in OU2 ROD for achieving cleanup levels was 2 years

Since the SVE system began operating in September 1996, over 220 million cubic feet of air have been treated, and 669 pounds of VOCs have been extracted from the waste pit areas behind the former Kysor Corporation plant. During predesign studies, during the 15 days the pilot system operated in May 1991, 499 pounds of VOCs were removed. Altogether this comes to a total of 1,168 pounds of VOCs removed.

The 669 pounds removed during full operation of the system was extracted over four years – from September 1996 to September 2000. For the past five years, since September 2000, readings using the flame ionization detector (FID) to test for VOCs at the influent sampling ports have shown no result, meaning no VOCs have been detected. Because of the lack of VOCs entering the system, a change-out of the activated carbon has not been required since April 1999. Except for the period just prior to breakthrough in April 1999, when the capacity of the system was exceeded, the system has retained 99% of incoming VOCs.

The lack of VOCs in the influent air to the system may indicate that cleanup levels have been achieved, or it may mean that residual contamination exists outside of the capture zone of the extraction wells. It is also possible that contaminated soils exist below the water table in the former disposal pit area that the SVE system is not removing. In the OU2 ROD, the cleanup timeframe for attaining cleanup goals for the SVE system was estimated to be two years. One indicator of whether levels of residual soil contamination are low enough to be protective are results from the four groundwater monitoring wells immediately downgradient of the SVE area. All four wells nearest the site, S-1 and SLW-25 (closest to the plant) and S-2 and SLW-9, have exhibited decreasing concentrations of contaminants, however, of these four wells, only S-1 has achieved TCLs for the nine VOCs that were specified as compounds of concern (COCs) in the OU2 ROD.

One factor that should be reviewed when evaluating the SVE system and the lack of VOCs in the air entering the extraction wells is the rotation of the wells in the SVE area between induction and extraction. Since only four of the 23 extraction/induction wells may be used at once to extract

soil vapor from below ground, if there are some wells that were mainly used for induction, areas of contamination may still exist near these wells. The SVE system design will be carefully reviewed and a sampling plan may be developed to provide more information about residual contamination in soils both in the area of influence and east of the area currently being treated. Part of the review will include assessment of the mechanical system and its ability to remove contamination from the vadose zone. A formal closure plan would be prepared and closure sampling conducted prior to dismantling the system.

Discharge to Clam River

- VOC limits for discharge of treated groundwater have been met since start-up in 1996
- Amount of VOCs pumped from extraction wells has steadily declined since start-up

VOC requirements in the discharge of treated groundwater to the Clam River have been met without exception since treatment began in September 1996. Concentrations of VOCs in the effluent from the air stripping system have also been non-detect since then. The air strippers were designed based on an average TCE concentration of 1,430 ug/l. Since start-up of the system, TCE has always been less than 450 ug/l. The concentration of TCE entering the treatment plant from the VOC-extraction wells has declined since September 1996; currently the average concentration in the air stripping influent is about 180 ug/l. This indicates that the system is more than sufficiently designed for the levels of TCE extracted so far. The decreasing concentrations in the influent also may indicate that progress is being made toward cleaning up the site.

City Well #7 (CW-7)

- CW-7 has been out of service since 1994 due to the presence of TCE in well in 1993
- 1,2-DCE started appearing in samples from CW-7 in May 1999
- Kysor site plume may not be the source of the contaminants in the well
- The plume from a nearby facility, Rexair, Inc., may be the source of the contamination in the well field

CW-7 is one of seven wells in the City of Cadillac's municipal well field. At its widest point, the eastern edge of the Kysor site plume is adjacent to the western border of the well field. CW-7 is the northernmost of the seven city wells. The well has been out of operation since 1994 due to TCE detections in 1993.

TCE was detected above the reporting limit of 0.5 ug/l (one tenth of the MCL) during two monthly sampling events in 1993. For TCE, the MCL is equivalent to the State of Michigan standard – the residential drinking water criteria (RDWC). TCE was then detected at concentrations above reporting limits in all 12 monthly samples collected from the well in 1994. During the period from January 1995 to October 1997, concentrations of TCE in CW-7 exceeded the MCL of 5 ug/l with a maximum concentration of 27.8 ug/l in August 1997. From 1998 through at least March 2002, TCE was detected at concentrations just above and just below the MCL. Trace concentrations of 1,2-DCE, which is one of the breakdown products of TCE, have also been found in the well during some sampling rounds since May 1999 to at least March 2002.

Because TCE and 1,2-DCE are the only two VOCs being detected in CW-7, and based on historical ratios of PCE, 1,1,1-TCA and other constituents in the various plumes in the area, an MDEQ contractor, in a report reviewed by three independent experts, concluded that it was

probable that the contamination in CW-7 is from the Rexair groundwater plume. (See Attachment 9 for a comparison of constituents in area groundwater plumes. The table is from a report prepared by a contractor for MDEQ). Contaminated groundwater from the release at Rexair contains almost 100% TCE. Over time, the percentage of TCE, compared to the historical contaminant profile of the Kysor site plume, that has been detected in groundwater extraction well I-7 has increased.

Areal Extent of Kysor Industrial Site Plume

- The plume from the Kysor site appears to have migrated further north and into the area of the North Park subdivision north of Thirteenth Street

In the 1992 predesign study for the Kysor site, a comparison of 1991 data to data collected in 1987 showed the highest VOC concentrations in the center of the plume area. At that time, the areal extent of the intermediate plume was bounded approximately by Leeson Avenue on the west, Thirteenth Street on the north, Sixth Avenue on the east and Sixth Street on the south. Contaminated groundwater in the shallow aquifer appeared to almost reach Thirteenth Street. Contaminants in the intermediate aquifer followed the general extent of those in the shallow aquifer, except the intermediate plume may have extended beyond Thirteenth Street to the north and northwest. The 1992 report concluded that between 1987 and 1991, no significant movement of the contaminant plume at either depth occurred.

Since 1991, however, data indicates that the shallow and intermediate plumes, which become hydraulically connected near Thirteenth Street, have migrated further north and northwest. St. Ann's Church, north of Thirteenth Street, was considered an approximate location for the northern end of the plume. (See Attachment 1, Figure 2). In a report completed in 2002 by a contractor for MDEQ, it was estimated that the Kysor site plume meets with the plume from the Rexair facility at or near St. Ann's, near and to the northwest of extraction well I-7. Three monitoring locations in the North Park subdivision showed trace concentrations of TCE during two sampling events in 2001. None of the samples collected from private wells in the North Park subdivision have had detectable levels of any VOCs. Because of the ratios of the constituents in the samples, an MDEQ contractor, in the report mentioned above, concluded that the contamination in the monitoring wells and in an extraction well at 14th Street was derived from the Rexair plume. If this is the case, it is possible that extraction well I-7 is capturing the Rexair plume in addition to the Kysor site plume. This would also mean that the length of time until TCLs are reached for groundwater in the Kysor site plume may be significantly prolonged. This would increase the cost of the cleanup.

Under a 1991 Consent Judgment (amended in 1995) that MDEQ entered against Rexair, Rexair installed a number of extraction wells and is treating groundwater using an air stripping system. Based on extensive evaluation of the data, an additional study completed in 2002 by a State contractor, and reviews by experts from the academic community, MDEQ believes that the Rexair plume has migrated within the capture zone of and is being treated by the Northernaire/Kysor remediation system. After similarly reviewing the data, consultants for Rexair have concluded that this is not the case, and they have presented data to support their position. The State is currently taking steps to enforce the Judgment.

Groundwater Monitoring Results

- Concentrations of VOCs have decreased in the shallow extraction wells and in a number of the intermediate extraction wells

- TCLs have been attained for three of the nine VOCs in all 46 wells
- Forty-five out of 46 wells are in compliance with the TCL for another three of the VOCs
- Only 12% of the results in the last round of sampling were out of compliance with a TCL
- Number and magnitude of exceedences have decreased since 1997
- Another indicator of progress toward cleanup is that the concentration of VOCs entering the treatment plant from the 16 extraction wells has steadily decreased; during the first several years of operation, the highest concentration of TCE entering the treatment plant was around 450 ug/l; currently, the average concentration of TCE is about 180 ug/l. (See Attachment 11, Graphs 15, 16, 18 and 20 for VOC concentrations over time in groundwater entering the treatment plant.)
- PCE and TCE are the two COCs for which multiple wells have not attained TCLs
- A total of 340 wells have been installed in the area by over a dozen different parties
- Although the number of plumes makes the evaluation of the Kysor site plume more complex, the amount of data from the 340 wells and the differences in the types of VOCs present in the various releases assists in differentiating between sources
- None of the samples collected from private wells in the North Park subdivision north of the site have had detectable levels of any VOCs. In addition, shallow groundwater monitoring wells in the subdivision have only shown two TCL exceedences. Both exceedences were for TCE and occurred in 1997.
- See Attachment 11 for summary tables containing information on non-compliant wells and on the cleanup status of monitoring and extraction wells.

The nine VOCs designated in the OU2 ROD as COCs, along with their TCLs, are:

Compound	**Target Cleanup Level (ug/l)**
1,1,1-trichloroethane (1,1,1-TCA)	200
1,2-dichloroethene (1,2-DCE)	70
1,1-dichloroethene (1,1-DCE)	5
1,2-dichloroethane (1,2-DCA)	5
tetrachloroethene (PCE)	1
trichloroethene (TCE)	5
methylene chloride	5
xylene	440
toluene	40

Forty-six wells are part of the routine groundwater monitoring program for the Kysor site. The monitoring program for VOCs in groundwater consists of 23 shallow and 23 intermediate wells. Originally, 27 shallow wells were designated as monitoring wells, but four wells, DNR-10S, FS-1-10, SLW-1, and S-7, have since been eliminated from the program. Twenty-seven wells were also planned for the intermediate network. Two additional wells, I-11 and CMS-5W, were added to the program as soon as the initial sampling began in 1996. Then, between 1997 and 2001, six wells, K-12, F-2, F-4D, GW-9D, GW-10D, and MW-18, were eliminated from the program.

Three intermediate wells are sampled quarterly (F-6, CMS-5W, and SLW-34), and the remaining 43 are sampled annually. F-6 and CMS-5W are located to the west of the site beyond the lateral extent of the plume in that direction, and SLW-34 is located in the North Park subdivision.

A general measure to track the progress of cleanup is to compare the number of wells meeting cleanup goals for each round of data. This type of measurement does not take into account any specifics about a well, such as its location or whether it is believed to be within or outside of the

plume's estimated boundaries, but it does provide one view of data trends. It also provides an idea of the conditions at a specific point in time. Statistical trend analyses of the results of individual wells would provide information on the groundwater conditions over time and at specific locations.

One factor to keep in mind is that the extraction wells are responsible for capturing and drawing contaminants from the aquifers. Therefore, initially during the remediation of groundwater, contaminants should be present in the wells. If no contamination were seen in the extraction wells during initial remediation, this would indicate the extraction network was incorrectly designed. Eventually, as more of the remaining contamination is removed from groundwater, the concentrations in the extraction wells should decrease. The objective of the OU2 ROD for groundwater at the Kysor site is, in fact, to achieve TCLs in both the monitoring wells and the extraction wells.

Each monitoring network for the Kysor site is comprised of both monitoring wells and extraction wells. Most of the wells are now sampled annually, although three are still sampled on a quarterly basis. For those wells sampled annually, the most recent results are from September 2004. For the wells that are sampled quarterly, the most recent results are from March 2005. The monitoring program includes collecting at least annual samples from these wells:

Shallow monitoring wells	17
Shallow extraction wells:	6
Intermediate monitoring wells:	12
Intermediate extraction wells:	11
	46

For each annual sampling event, results from 46 wells and for nine COCs means there is a total of 414 possible instances of compliance (attainment of TCLs) or non-compliance (exceedence of TCLs).[5] This, again, is the number of possible instances of non-compliance for each round of annual sampling.

As of the sampling round in September 2004, of these 414, there were 50 cases of non-compliance which is a 12% non-compliance rate for the 46 wells and nine COCs. This is down from an 18% non-compliance rate in 1997. What this particular measurement does not reflect, however, is how much higher the exceedences of the TCLs were in September 2004 compared to previous years. Using statistics to analyze each well for trends would provide better information about this question.

For three of the COCs, methylene chloride, toluene, and xylenes, all 46 wells have been in compliance with TCLs since the beginning of the remedial action in September 1997. For 1,1,1-TCA; 1,2-DCE and 1,2-DCA, only one of the forty-six wells, K-16D, is currently out of compliance for all three compounds. K-16D, located in the center of the plume area, has recently become a concern due to a sharp increase in concentrations of a number of contaminants during the last sampling round. Extraction well I-1, located close to the Four Winns location on Frisbie Street, was in exceedence of the TCL for 1,2-DCA in 2004.

The three remaining COCs are 1,1-DCE; PCE; and TCE. The two compounds for which the greatest number of wells are in exceedence of TCLs are PCE and TCE.

[5] 46 wells x 9 COCs = 414 possible instances of compliance/non-compliance per annual sampling event.

For 1,1-DCE, there were only four exceedences during the last sampling round. One was in well K-16D, which had the sharp increases in concentrations for four COCs in the past sampling round. The other three exceedences of the 1,1-DCE limit were in three extraction wells – I-1, I-2, and I-10. Extraction well I-1 is about 100 feet downgradient of the Four Winns location on Frisbie Street, and I-2 is about 500 feet downgradient of the same facility. The two wells are also downgradient of the Ingraham Property. Extraction well I-10 is very close to the Ingraham property. These exceedences may indicate that a mass of contaminants has dislodged from a source area at either Four Winns or the Ingraham Property.

As of the September 2004 sampling, eighteen of the 46 wells are currently out of compliance for PCE. Twenty-one of the 46 wells are out of compliance for TCE. The wells that were out of compliance are listed below:.

PCE

Shallow monitoring wells:	F-1S, FWMW-16, GW-10S, SLW-9, SLW-25
Shallow extraction wells:	S-2, S-4, S-5
Intermediate monitoring wells:	K16D, DNR-14D
Intermediate extraction wells:	I-1, I-2, I-3, I-4, I-5, I-6, I-10, I-11

Of these eighteen cases of non-compliance for PCE, seven occurred at monitoring wells and eleven at extraction wells.

TCE

Shallow monitoring wells:	K-11, K-13, FWMW-9, FWMW-16, SLW-9, SLW-25
Shallow extraction wells:	S-2, S-4
Intermediate monitoring wells:	K16D, F-7, GW-17
Intermediate extraction wells:	I-1, I-2, I-3, I-4, I-5, I-6, I-7, I-9, I-10, I-11

Out of these twenty-one cases of non-compliance for TCE, nine occurred at monitoring wells and twelve at extraction wells. Attachment 12 contains graphs showing TCE and total chlorinated ethenes in the shallow extraction wells and total chlorinated ethenes in the intermediate extraction wells.

The general locations of the wells in which PCE and/or TCE exceeded TCLs are listed below:

- Wells near Four Winns (Frisbie Street): F-1S; FWMW-9; K-16D; S-5; I-1; and I-2
- Wells near the Ingraham Property: GW-10S and I-10
- Wells downgradient of the Kysor Corporation property: SLW-9, SLW-25, and S-2
- Wells centrally located in the plume: S-4; I-4; I-5; and I-6

Exceedences near sources of contamination or in the middle of the plume are not necessarily of the most immediate concern. These types of wells need to be monitored to track cleanup progress, get an overall idea of the plume movement, and help to assess whether the extraction network is adequate. During the initial years of operation of the treatment system, in most cases it is expected that wells near the center of the plume will show exceedences.

Exceedences in wells beyond the predicted edges of a plume and/or in areas that would be put at risk, are cause for more immediate concern. For these cases, it is important to review the level of the exceedence and the historical concentrations in the well and determine whether there is an

increasing trend of contamination in the well. Extraction wells along the edge of a plume, such as I-9 at the Kysor site, are designed to capture the plume before it can expand or migrate further.

The wells at the Kysor site that fall into one or more of the categories describe above, along with their general locations, are shown below:

- Wells near City Well #7 (CW-7) include DNR-14D and K-13.
- The well near City Well #1 (CW-1) is K-11.
- The well across Leeson Avenue (beyond the general western edge of the plume) is I-9.
- Wells across Thirteenth Street, near the North Park subdivision area, are F-7; GW-17; I-3; I-7; and I-11.

In the September 2004 sampling, one of the wells near a City well, K-13, which is near CW-7, had an exceedence of 14 ug/l of TCE, which has a TCL of 5 ug/l. CW-7 is relatively shallow compared to the other City wells and is the well that has been shut down since 1994. The TCE exceedence in K-11, near CW-1, was 5.1 ug/l, slightly above the TCL of 5 ug/l.

The five exceedences in the wells north of Thirteenth Street, near the North Park subdivision, were all above the TCL for TCE. These exceedences are of greater concern than those in the wells near the City well field for two reasons. One is the fairly high concentrations detected, and the second is the shallow depths of a typical residential well compared to a municipal well. All five of the wells are screened in the intermediate aquifer. Concentrations ranged from 26 ug/l in GW-17 to 100 ug/l in I-3 and I-7. The detection of TCE in F-7, the monitoring well furthest downgradient from the site, was 5.6 ug/l. The concentrations in GW-17, I-3 and I-7 are similar to previous results. However, the slight exceedence in F-7 is the first detected result in the well since sampling began in 1996. The 2004 sample from F-7 showing the TCE exceedence was collected in September 2004. This sample was also the first time 1,2-DCE was ever detected in the well. These results may indicate that contaminated groundwater is migrating further downgradient. It is not known whether this contamination is due to the Kysor site plume or the Rexair plume. No samples collected in the past from private wells in the North Park subdivision have had detectable levels of any VOCs.

Another item of concern is the dramatic increase in 2004 of contaminant levels in well K-16D, near the Four Winns (Frisbie Street) location. The level of TCE in K-16D in 2004 is similar to the concentrations in the well in 1996 and 1997. The amount of 1,1,1-TCA and 1,2-DCE detected were at levels never before present in the well since extraction and treatment began in 1996. 1,2-DCE was non-detect in the well through December 1999 and was well below the TCL from 1999 to September 2002. Although 1,2-DCE is a breakdown product of TCE and concentrations would be expected to increase over time if TCE was degrading, the amount of 1,2-DCE seen in K-16D in 2004 may be too high for this to be the reason.

Operating Conditions and Design Estimates – Groundwater Extraction System

- ROD estimate of time until achievement of TCLs was 29 years for the shallow aquifer and 64 years for the intermediate aquifer
- Re-estimate using data from Kysor site predesign studies in 1992 indicated that the cleanup level for the primary VOC, TCE, would be close to being achieved in 15 years (2007)

- Based on a review of pumping rate assumptions in the remedial design, shallow extraction wells are generally pumping below design rates, and intermediate extraction wells are pumping above design rates
- Actual pumping rates should be evaluated to ensure they are not adversely impacting the remedy (such as drawing contamination from the shallow aquifer into the intermediate)

In the 1989 ROD, the time to attain TCLs for VOCs in the intermediate aquifer was estimated to be 64 years. This was a preliminary estimate and was based on limited information about aquifer conductivity, three-dimensional groundwater flow and achievable pumping rates. A re-estimation, using data collected for the Remedial Design Additional Studies report (1992), calculated the time to achieve VOC concentrations below 10 ug/l in all of the extraction wells to be 15 years.

The assumptions for this 15-year estimate were: a combined pumping rate of 1,430 gpm (gallon per minute), with seven wells in the shallow aquifer pumping at 50 to 75 gpm and nine wells in the intermediate aquifer pumping at 65 to 125 gpm. In the current system, six instead of seven shallow wells comprise the shallow extraction network, and eleven wells, instead of the original nine planned, make up the intermediate extraction network. The flow rates specified in the remedial design for the site and the average pumping rates for 2004 are shown below:

Extraction Well	Design Flow Rate	Flow Rate in 2004
S-1	87	14
S-2	87	45
S-3	87	20
S-4	87	50
S-5	58	51
S-6	58	45
S-7	58	(not operating)
I-1	115	128
I-2	115	162
I-3	115	171
I-4	115	98
I-5	115	91
I-6	115	60
I-7	115	119
I-8	115	184
I-9	115	144
I-10	115	184
I-11	(not included in original design)	171

All of the shallow wells and three of the eleven intermediate wells are operating below their designed flow rate. Design flow rates, however, are meant to be estimates. Depending on factors at each specific well location, such as soil conductivity and productive capacity of the aquifer, actual rates may vary. What is critical is that the variation in pumping rates is not adversely affecting the remedy and that cleanup is progressing as anticipated. Periodic reevaluations of extraction pumping rates can be conducted to ensure the remedy is operating optimally.

Site Inspection

After a preliminary site inspection with MDEQ on January 13, 2005, the five-year review site inspection of the Kysor site was conducted on April 26 and April 27, 2005, by the USEPA Remedial Project Manager, MDEQ personnel, and City of Cadillac officials. The purpose of the inspection was to assess the progress of remedy implementation, ensure records and site documents were available and up-to-date, inspect treatment units and the SVE system to verify they were operational and did not appear to have significant problems or flaws, view general site conditions and areas of other groundwater releases and plumes in the Industrial Park, and meet with officials from the City. The intent was to collect information to be able to better assess the protectiveness of the remedy and try to foresee any future remedy implementation problems and needs.

Most issues related to the remedy for the Kysor site were identified at the time of the site inspection or prior to it. Because of the cold temperature, the SVE system had not been running in the winter. This was noted during the site visit in January 2005. The treatment plant was very well-maintained and no significant problems were noted. (See Attachment 13 for site inspection notes.)

VII. TECHNICAL ASSESSMENT

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

Yes. The remedy is functioning as designed and is protective in the short-term. The groundwater extraction and treatment system and the SVE system are operating as planned. The extraction and treatment system seem to be very well-designed and is capturing groundwater contaminated with VOCs from the Kysor site. The air stripping system operates at 99% efficiency. As a result, VOCs in treated groundwater have been non-detect since start-up. All surface water discharge requirements for VOCs have been met since remediation began. Since 1996, the SVE system has removed over 1,000 pounds of VOCs. Since the last five-year review, over 5000 million gallons of groundwater have been extracted and treated, and almost 9000 pounds of VOCs have been removed from groundwater.

To ensure the continued protectiveness in the long term, restrictions on private wells in the North Park subdivision to the north of the site need to be addressed, and the adequacy of the existing city ordinance prohibiting groundwater use and well installation within the Cadillac Industrial Park area must be verified. Another issue of concern is the possibility that the groundwater extraction and treatment system for the Kysor site is capturing and treating contaminated water from the Rexair site. If this is true, this will increase the time needed to achieve groundwater cleanup goals. At this time, the issue is being addressed by the State of Michigan via a Consent Judgment with Rexair.

Long-term protectiveness of the groundwater will occur after target cleanup levels are attained, measures are in place to restrict use of private well water for drinking in the residences north of the site, and institutional controls currently in place are determined to be adequate.

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

Yes. The assumptions and information on which the OU2 ROD was based are still valid. The City well field should continue to be monitored to ensure that actual exposure to contaminated

drinking water does not occur. There have been no changes in the physical conditions at the site that would affect the protectiveness of the remedy.

Changes in Standards and To-Be-Considered Requirements
A list of ARARs is included in Attachment 8. One standard for allowable contaminant levels in groundwater has become less stringent. Other than that change, there have been no changes in these ARARs and no new standards or to be considered (TBC) requirements affecting the protectiveness of the remedy.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics
The exposure assumptions used to develop the Human Health Risk Assessment included exposure to both VOC- and chromium-contaminated groundwater via ingestion. There has been no change in this exposure pathway. There have also been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment. No changes to these assumptions appear to be needed. Furthermore, there has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. The remedy is progressing as expected and it is expected that all cleanup goals will be met, as specified in the OU2 ROD.

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

No. Although the possibility exists that the Kysor extraction well system may be capturing a the Rexair plume, as long as treatment continues until cleanup goals are met and groundwater use measures are in place, the remedy will remain protective. Capturing the Rexair plume, however, may result in it taking longer for goals to be achieved and increase the cost of the remedy.

Technical Assessment Summary

According to the data reviewed, information gathered at the site inspection and interviews, and review of relevant documents, the remedy is functioning as intended by the ROD, as modified by the ESD, and is protective in the short term. No exposure pathways are complete, and none of the samples collected from private wells in the North Park subdivision have had detectable levels of any VOCs. In addition, shallow groundwater monitoring wells in the subdivision have only shown two MCL exceedences. Both exceedences were for TCE and occurred in 1997. To ensure the remedy continues to be protective in the short term, institutional controls to restrict groundwater use in the North Park subdivision will be implemented, and the adequacy of the existing ordinance that restricts groundwater use and well installation on the site is confirmed. Long-term protectiveness will be achieved when TCLs are attained.

VIII. ISSUES

Table 4. Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Institutional controls do not extend into a subdivision north of the Kysor site, the North Park subdivision in Haring Township, where private wells still exist, and the adequacy of the protections provided by the existing city ordinance has not been confirmed.	N	Y
The groundwater extraction system for the Kysor site may not be adequately capturing the contaminated groundwater from the site. Kysor remediation system may be extracting and treating part of a plume from a neighboring facility. The facility's plume is not covered by the OU2 ROD. In addition, the facility is not a party to one of the USEPA UAOs for the Kysor site and is not contributing to the cost of the cleanup.	N	Y
Discrepancies in air emission requirements for the air stripping system are present in site documents, and requirements may be inconsistent with standards.	N	N

X. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 5: Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Institutional controls do not extend into a subdivision north of the Kysor site, North Park subdivision in Haring Township, where private wells still exist, and the adequacy of the protections provided by the existing city ordinance has not been confirmed.	Develop an Institutional Controls Study Plan to evaluate the city ordinance currently in place and to devise and implement a plan to prevent exposure of residents in the North Park subdivision to contaminated groundwater from the Northernaire/Kysor sites. Examples of the types of questions the plan will answer and the actions that may be taken are described in this report in Section IV, Remedial Actions, under "Institutional Controls."	Respondents	USEPA MDEQ	6/2006 (Completion of Study Plan) 11/2005 (Inventory of private wells in North Park subdivision)	N	Y

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Extraction system for the Kysor site may not be adequately capturing contaminated groundwater.	Re-evaluate capture zone analysis and review design and current operation of extraction well system to determine if there are modifications that could increase the effectiveness.	USEPA/ Respondents	MDEQ	3/2006	N	Y
Kysor remediation system may be extracting and treating part of a plume from a neighboring facility. The facility's plume is not covered by the OU2 ROD, and the facility is not a party to one of the USEPA UAOs for the Kysor site.	State has filed, and will continue to enforce, a Consent Judgment against the facility that is the source of the plume possibly being captured by the Kysor remediation system. Continue to track progress of enforcement actions and to evaluate data for indications of commingling of plumes	MDEQ	USEPA	On-going		
Discrepancies in air emission requirements are found in site documents and requirements may be inconsistent with standards.	Review standards to determine the most appropriate requirements for the Kysor site. Verify estimated pounds per hour of VOCs in the discharge to the air from the treatment plant.	Respondents	USEPA MDEQ	6/2006	N	N
Protectiveness Statement						

XI. PROTECTIVENESS STATEMENT

In the short term, the remedy for the Kysor Industrial site required in the OU2 ROD continues to be protective of human health and the environment. To ensure the continued protectiveness, restrictions on private wells in the North Park subdivision need to be implemented, and adequacy of current city ordinance for prohibiting groundwater use and well installation on the site must be verified. Long-term protectiveness will occur after TCLs for the nine VOCs are attained.

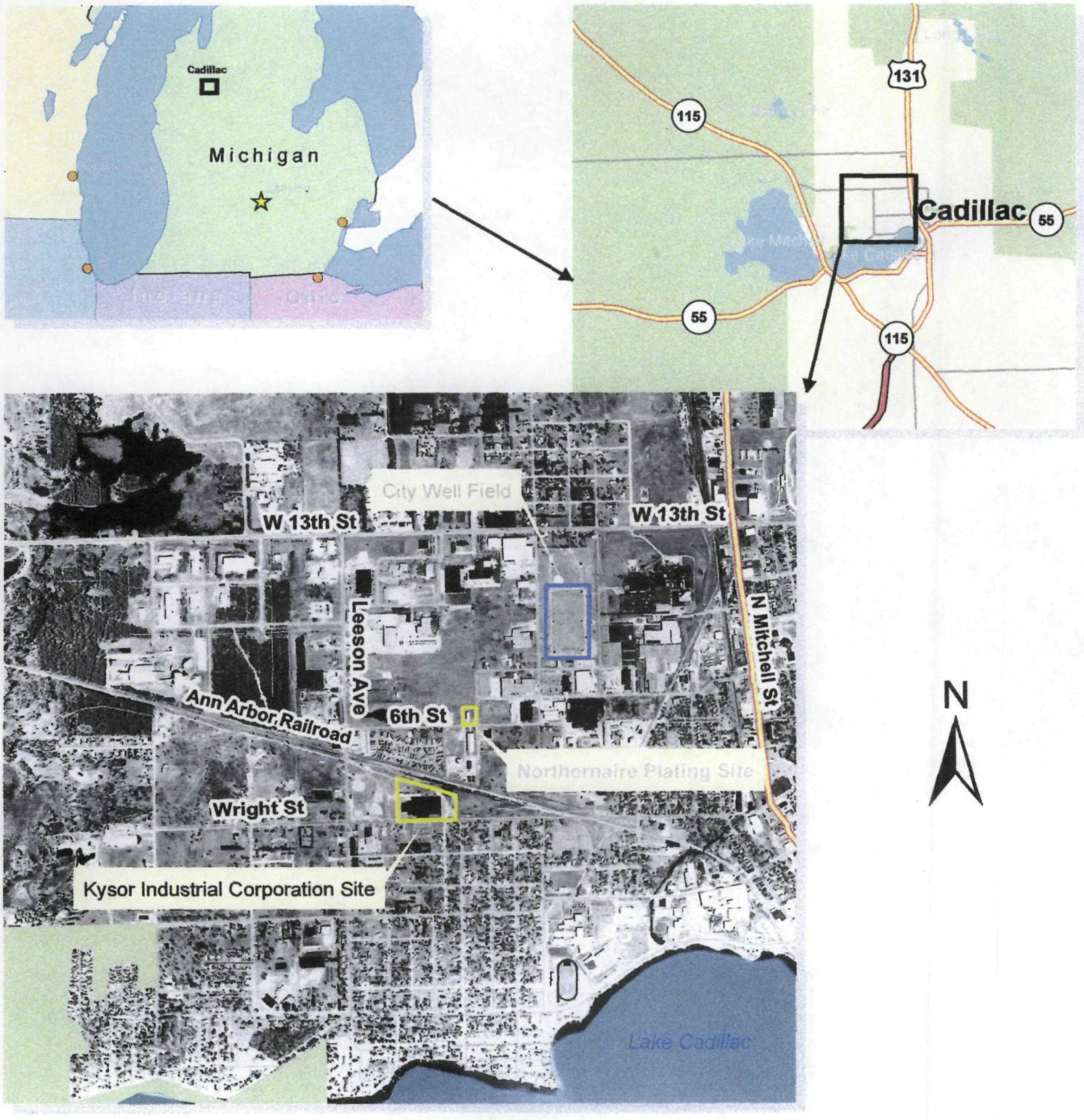
XII. NEXT REVIEW

The next five-year review will be completed by September 2010, which is approximately five years from the date of this review.

ATTACHMENTS

ATTACHMENT 1

Kysor Industrial Site Location Figures
Cadillac, Wexford County, Michigan

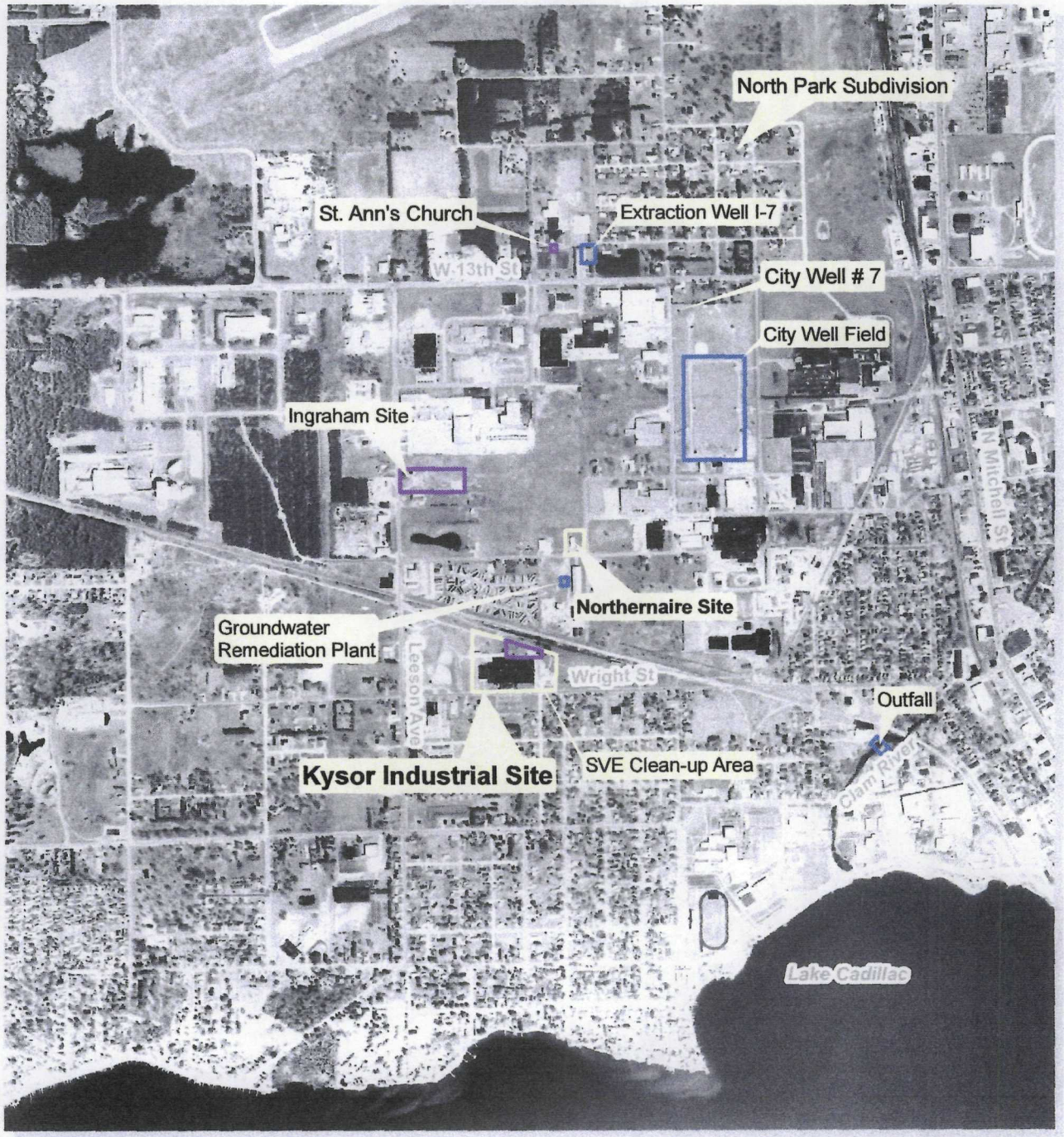


Plot created by Andrea Porter U.S. EPA Regon 5 on 9/27/2005

GEOS
Groundwater Evaluation and Optimization System

Figure 1

Features Near Kysor Industrial Site



GEOS
Groundwater Evaluation and Optimization System

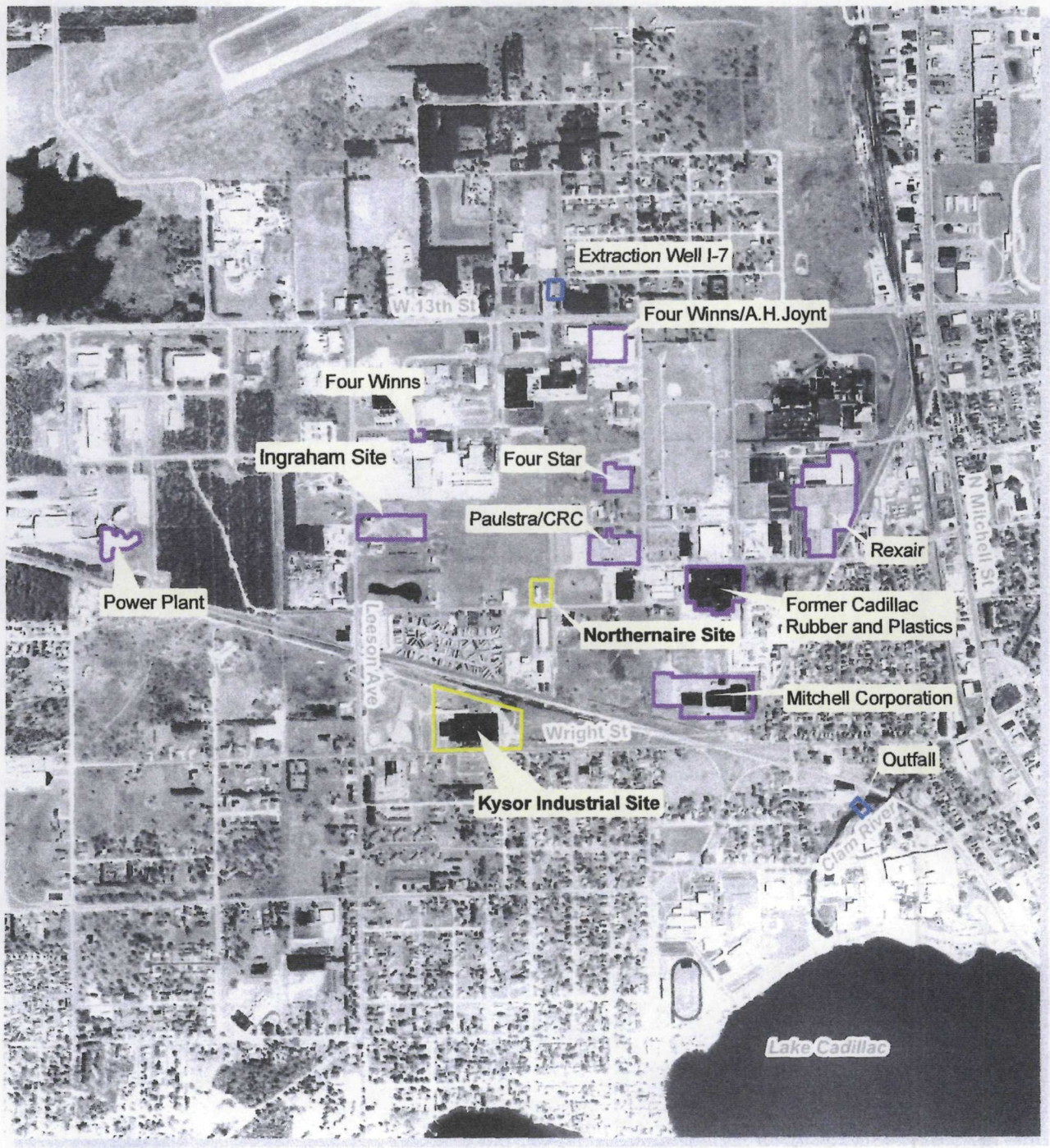
N

0.25 0.125 0 0.25 Miles

Plot created by Andrea Porter U.S. EPA Region 5 on 9/27/2005

Figure 2

Kysor Industrial Site
Facilities Referenced in the Five-Year Review



GEOS
Groundwater Evaluation and Optimization System

N

0.25 0.125 0 0.25 Miles

Plot created by Andrea Porter U.S. EPA Regon 5 on 9/27/2005

Figure 3

Cadillac Industrial Park Groundwater Plumes

Weston Solutions, Inc., 2003

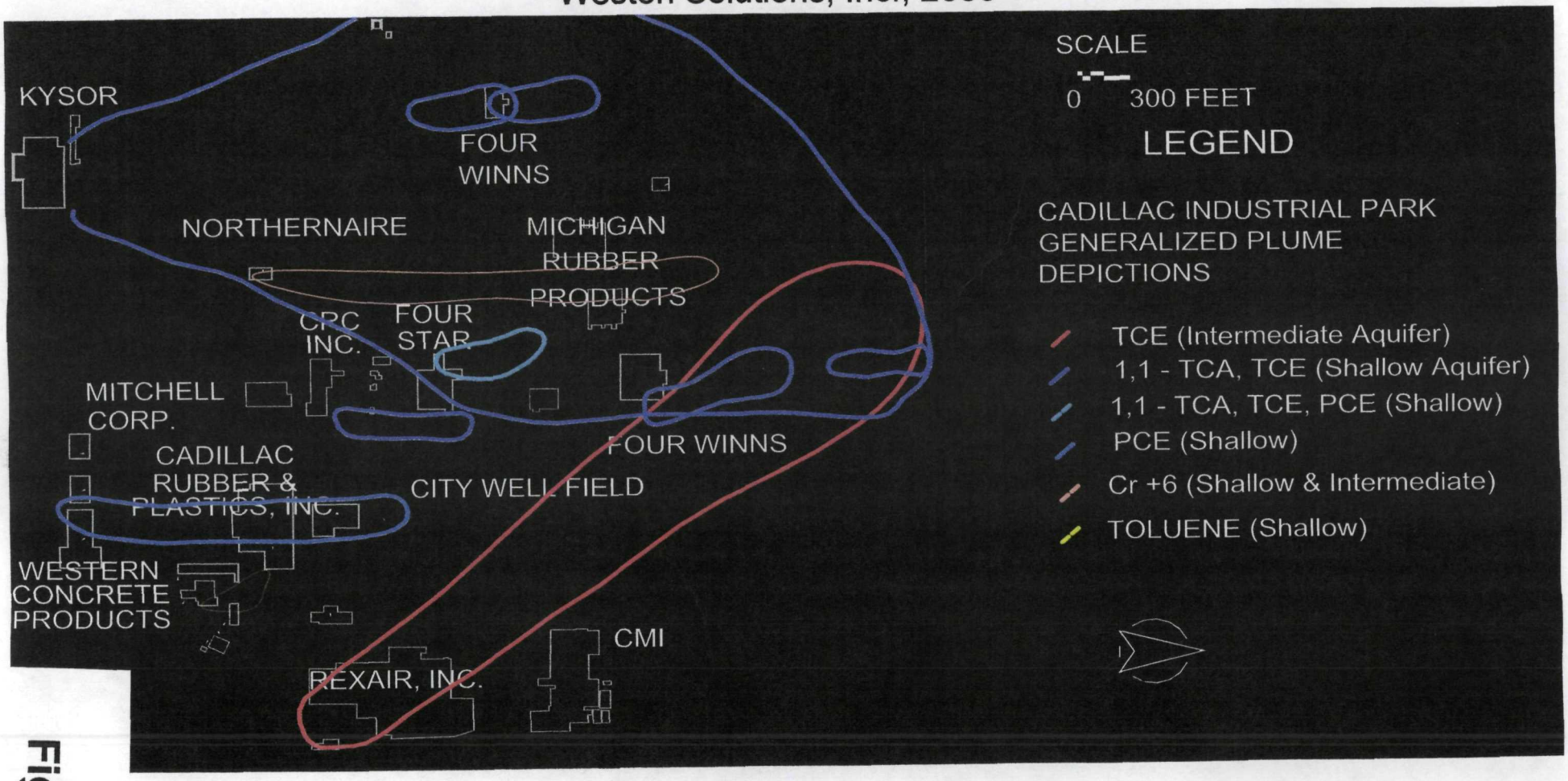


Figure 4

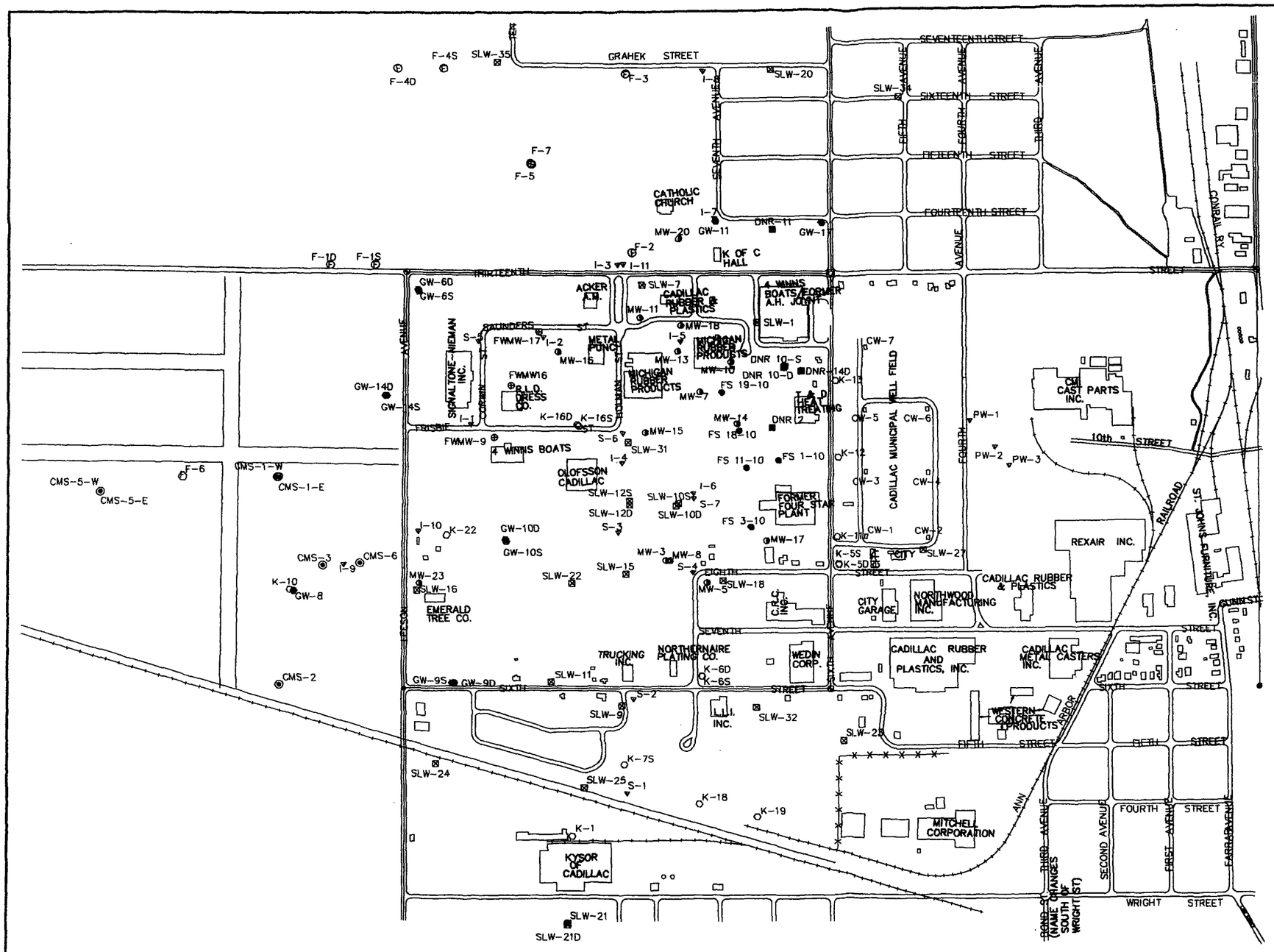


Figure 5

GeoTrans, Inc.
A TETRA TECH COMPANY

CHECKED:

DATE:

2004 ANNUAL PERFORMANCE MONITORING REPORT
NORTHERNAIRE/KYSOR SITES

GROUNDWATER SAMPLING LOCATIONS

FIGURE 1

P:\PROJECTS\CADILLAC\CADD\LDFASITEPLAN.dwg 04/28/05 DRB 1

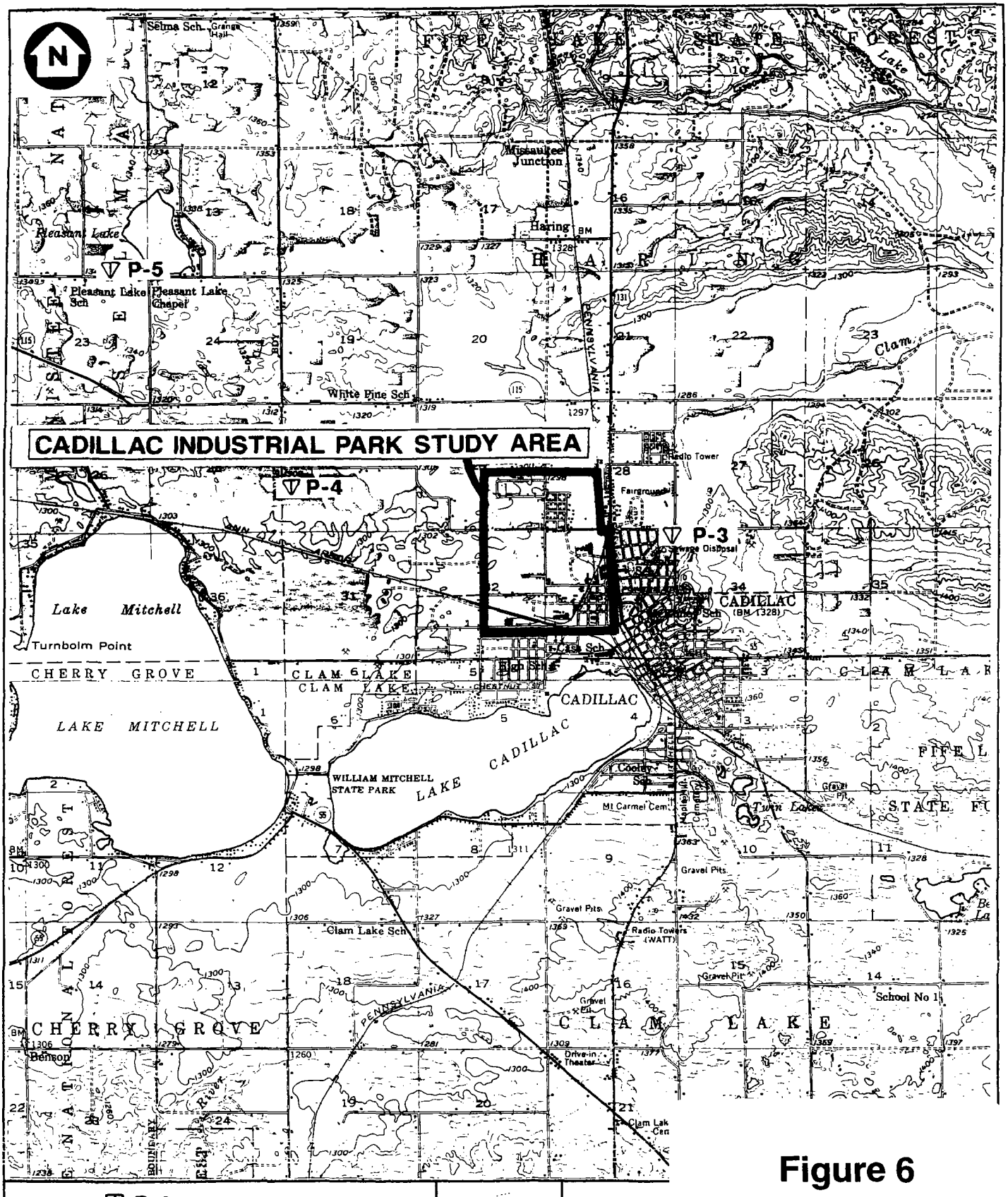


Figure 6

FIGURE 1-1
SITE LOCATION MAP
CADILLAC AREA RI
CADILLAC, MICHIGAN

E.C. JORDAN CO.

4656-52

Location of City of Cadillac Well Field

GEOS
Groundwater Evaluation and Optimization System

N

0.25 0.125 0 0.25 Miles

Plot created by Andrea Porter U.S. EPA Regon 5 on 9/27/2005

Figure 7

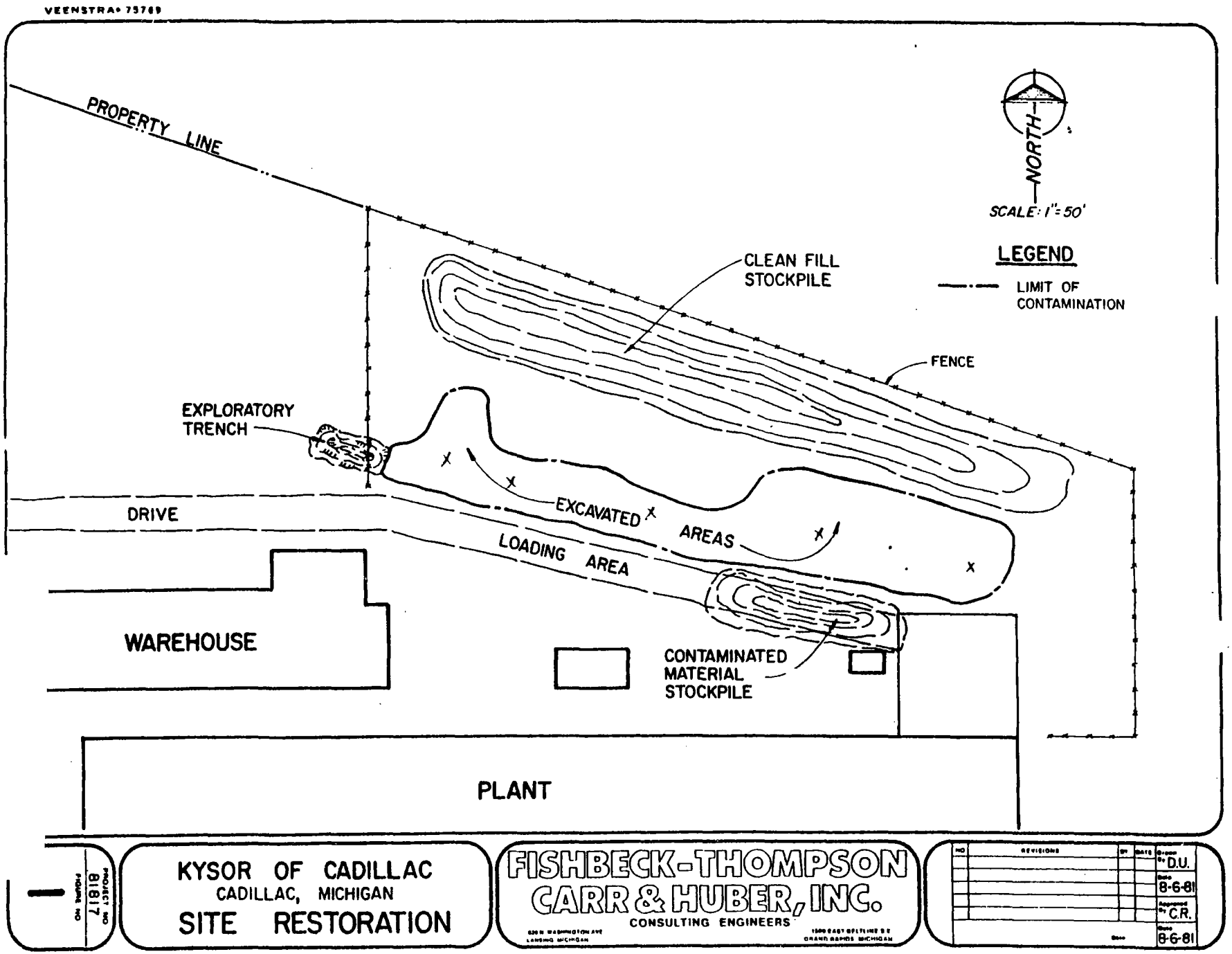

VEENSTRA 75769
PROPERTY LINE
NORTH
SCALE: 1"=50'
LEGEND
LIMIT OF CONTAMINATION
CLEAN FILL STOCKPILE
FENCE
EXPLORATORY TRENCH
EXCAVATED AREAS
DRIVE
LOADING AREA
WAREHOUSE
CONTAMINATED MATERIAL STOCKPILE
PLANT
PROJECT NO 81817
KYSOR OF CADILLAC
CADILLAC, MICHIGAN
SITE RESTORATION
FISHBECK-THOMPSON CARR & HUBER, INC.
CONSULTING ENGINEERS
D.U.
8-6-81
C.R.
8-6-81

Figure 8

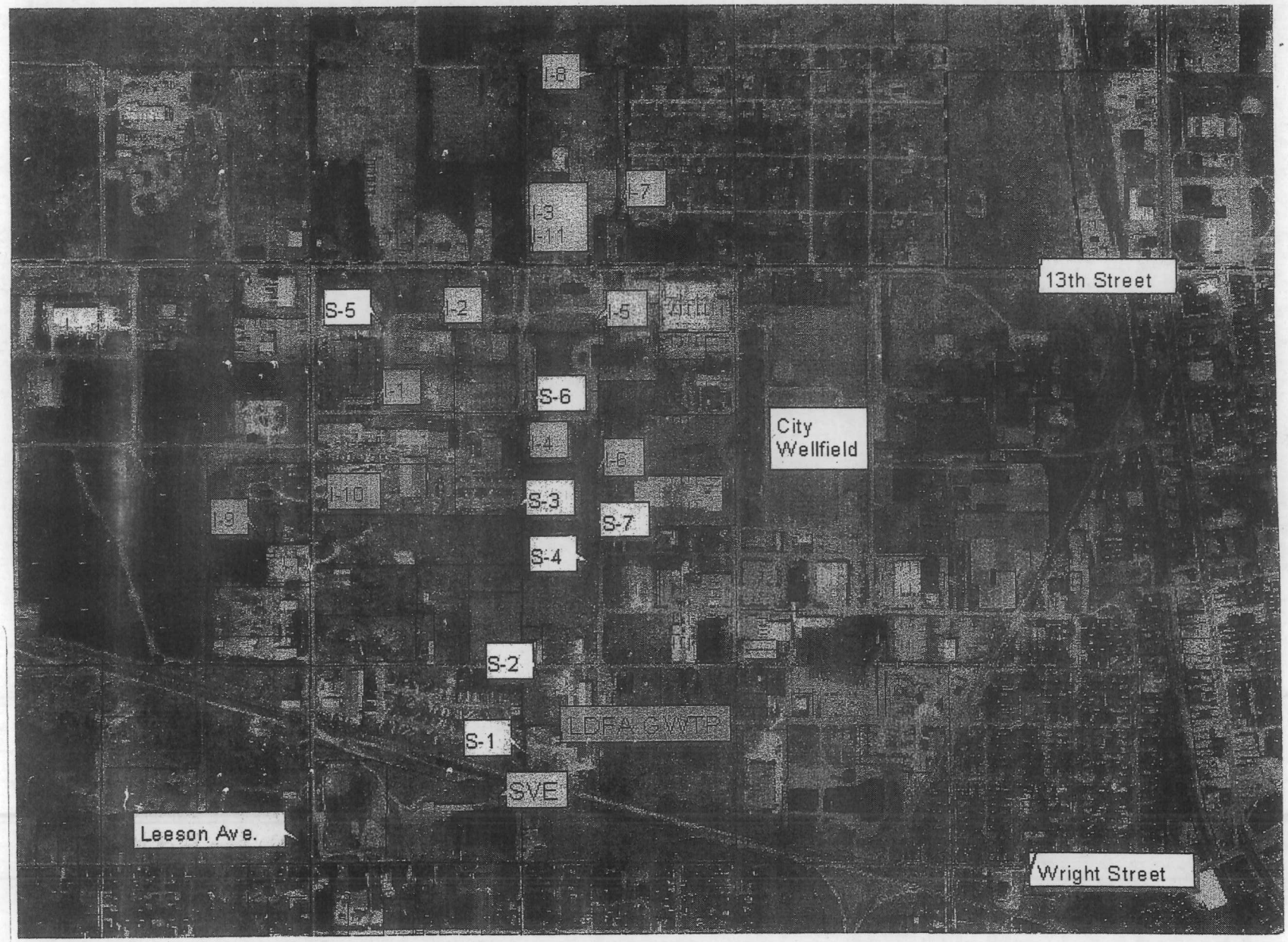
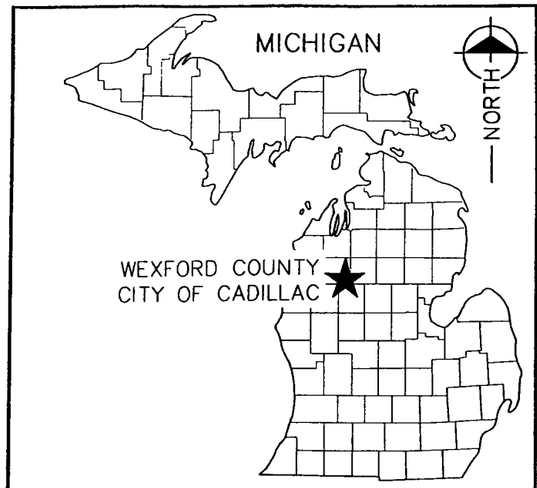

I-8
I-3
I-11
I-7
13th Street
S-5
I-2
I-5
I-1
S-6
City
Wellfield
I-4
I-6
I-10
S-3
S-7
I-9
S-4
S-2
LDFA & WTP
S-1
SVE
Leeson Ave.
Wright Street

Figure 9



VICINITY MAP

NORTH

0 500
SCALE IN FEET

GROUNDWATER EXTRACTION AND DISCHARGE PIPING

GROUNDWATER EXTRACTION AND DISCHARGE PIPING (N.I.C.)

BEAVER CADILLAC GENERATING FACILITY

EXISTING WELL HOUSE

COGENERATION MAKE-UP WATER FORCEMAIN

SOIL VACUUM EXTRACTION SITE (N.I.C.)

KYSOR INDUSTRIAL CORPORATION WRIGHT ST. PLANT

GROUNDWATER REMEDIATION FACILITY (N.I.C.)

OUTFALL PIPE

WELL I-1
WELL I-2
WELL I-3
WELL I-4
WELL I-5
WELL I-6
WELL I-7
WELL I-8
WELL I-9
WELL I-10
WELL I-11
WELL S-1
WELL S-2
WELL S-3
WELL S-4
WELL S-5
WELL S-6
WELL S-7

PINE ST
W. 16TH ST
W. 15TH ST
W. 14TH ST
13 TH ST
SAUNDERS ST.
FRISBIE ST.
FRANK MILTNER ST.
8 TH ST
7 TH ST.
6 TH ST.
5 TH ST.
6TH ST
WRIGHT ST.
7TH AVE.
6 TH AVE.
8 TH AVE.
LEESON AVE
CORWIN ST.
HOLMAN ST.
MICHIGAN NORTHERN RAILROAD
TUSCOLA AND SAGINAW BAY RAILROAD
US-131
3RD AVE.
2ND AVE.
1ST AVE.
FARRAR AVE.
SENECA PL.
HUSTON ST.
WALDO ST
COLFAX ST.
BOOM ST.
SELMA ST
LINDEN ST.
CLAM
RIVER

Figure 10

EXTRACTION AND DISCHARGE PIPING PLAN

NO.	REVISIONS	DATE	Drawn By	Checked By	Designed By	Date 1997

fishbeck, thompson, carr & huber
engineers • scientists • architects
Ada • Lansing • Kalamazoo
Michigan
Since 1956

CADILLAC LDFA
CADILLAC, MICHIGAN
ANNUAL REPORT 1997

PROJECT NO.
951370

SHEET NO.
5

PLOT INFO: 951370\DWG\951370209 DATE: 01/24/98 TIME: 10:47 am USER: SC

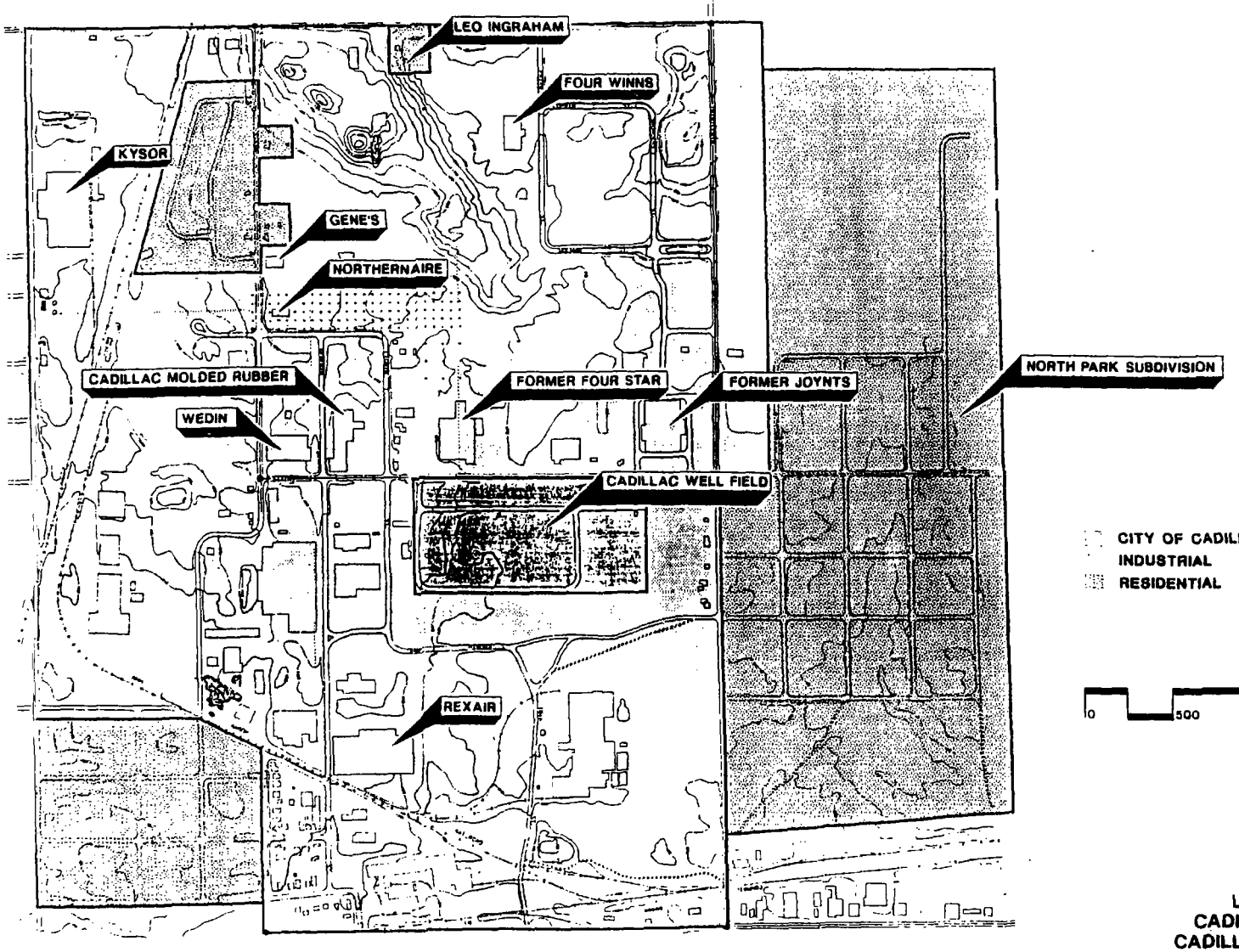


Figure 11

FIGURE 1-2
LAND USE MAP
CADILLAC AREA RI
CADILLAC, MICHIGAN

E.C.JORDAN CO.

PREPARED FROM : REMEDIAL INVESTIGATION, NORTHERNAIRE SITE, MAY, 1985

4858-52

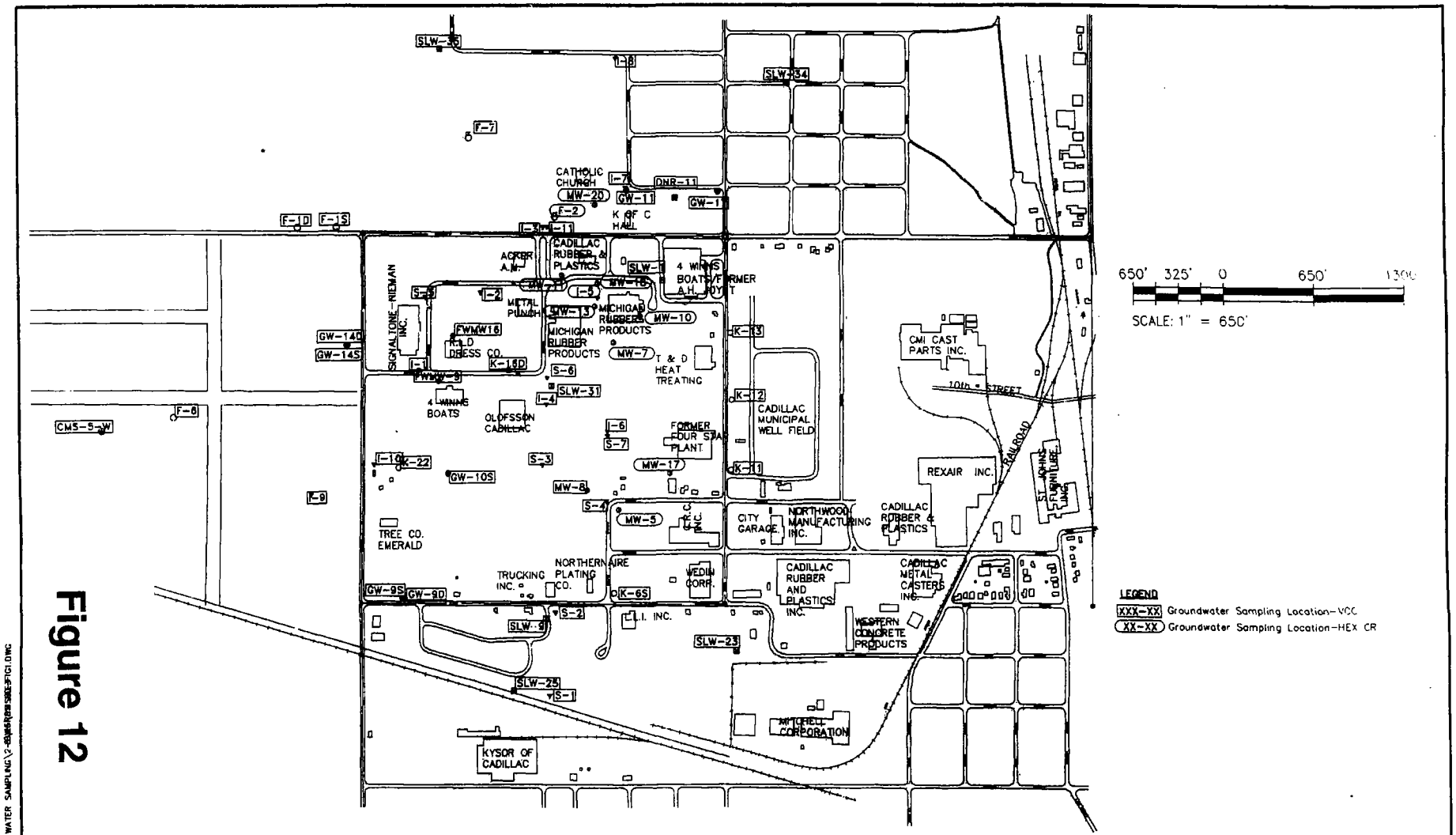


Figure 12

TETRA TECH MPS

CHECKED: P. DAUKSS | DATE: 8/25/05

NORTHERNAIRE/KYSOR SITES
GROUNDWATER
SAMPLING LOCATIONS

FIGURE 1

O:\X6004\01\GROUND WATER SAMPLING\2-

ATTACHMENT 2

Expanded Chronology of Site Events

EVENT	*DATE*
Kysor Industrial Corporation (Settling Defendant) begins operating	1955
Disposal practices at Kysor include dumping barrels of spent solvent directly on ground behind plant	As early as 1955 (exact date unknown) to 1980s
Wedin Corporation begins operating	1959
Cadillac Molded Rubber Company begins operating	1960
Four Star Corporation (Settling Defendant) begins operating	1967
Rexair, Inc., begins operating	1969
Mitchell Corporation begins operating	Late 1960s
Northernaire Plating, Inc., (Settling Defendant) begins operating	1971
Four Winns (Sixth Ave.) (fka, A.H. Joynt) (Settling Defendant) begins operating	1973
Four Winns (Frisbie St.) (Settling Defendant) begins operating	1975
Partial excavation of soil from waste pits behind Kysor plant	July 22 and 23, 1981
Contaminated soils reportedly removed (based on visual inspection) at a location near Kysor Industrial Corporation (property of Leo Ingraham (Settling Defendant)) where waste had been disposed	1981
Hydrogeological Study Report, Kysor of Cadillac, Inc., completed	March 1982 (Phase I) and August 1983 (Phase II)
USEPA and MDNR conduct emergency removal action at Northernaire site	July 5, 1983 to August 3, 1983
Relatively small volume trichloroethylene spill occurs at Cadillac Molded Rubber Company; extraction well installed; pumping ceased per MDNR approval; no significant impacts anticipated	1984
USEPA refers case to USDOJ for cost recovery	March 13, 1984
State-led, federally-funded RI/FS	1984 to 1985
State completes focused feasibility study	July 22, 1985
ROD (OU1) for source control at the Northernaire Superfund site signed	September 11, 1985

EVENT	*DATE*
Wedin Corporation, a consultant for Kysor Corporaiton, investigates past disposal of sludge and finds it to be non-hazardous; excavates and disposes of 470 cubic yards of material	1985 and 1986
MDNR inspection of Four Winns facility (Frisbie St.) revealed solvent spills; sampling showed main contaminant was 1,1,1-trichloroethane	1986
Hydrogeology of the Cadillac Industrial Park (MDNR)	August 1986
Proposal to NPL	June 24, 1988 (initially proposed in September 1985)
OU1 remediation (Northernaire site)	October/November 1988
Court judgment granting all response costs for removal action at Northernaire site	May 6, 1988
General notice letter and 104(e) information request sent to potentially responsible parties	May 20, 1988
FS for Cadillac area groundwater completed	August 1988
ROD (OU2) for groundwater cleanup signed	September 29, 1989
Final NPL listing	October 4, 1989
UAO signed for remedial design of OU2	May 16, 1990
Consent Judgment: State of Michigan v. Rexair, Inc., entered	March 21, 1991
Final debris disposal for completion of OU1 remediation (Northernaire site)	March 1991
Remedial Design Additional Studies report completed	October 1992
TCE detected above MCL in city drinking well	1993
Explanation of Significant Difference (ESD) addressing both Northernaire and Kysor sites signed	March 3, 1994
Two separate UAOs for RA signed (Kysor Industrial and Four Winns/A.H. Joynt)	January 30, 1995
Third UAO for RA signed (Northernaire Plating)	April 11, 1995
Final Performance Monitoring Plan for OU2	April 17, 1995
On-site construction for OU2 begins	June 29, 1995
First Five-Year Review completed	September 28, 1995
MDEQ Amended Consent Judgment v. Rexair, Inc. becomes effective	October 16, 1995

EVENT	*DATE*
Remediation of Ingraham Property (waste from Kysor Industrial Corporation)	**May to October 1996**
Referral to USDOJ (Kysor Industrial site)	**July 30, 1996**
Final inspection of RA construction by USEPA	**September 19, 1996**
OU2 Remedial Action begins	**1996**
Construction Completion	**January 24, 1997**
Second Five-Year Review completed	**July 26, 2000**
Additional Hydrologic Investigation Report prepared by MDEQ contractor	**February 2002**

ATTACHMENT 3

APPENDIX A

SUMMARY TABLES, KYSOR BORING VOC ANALYSES
IN SOILS

JULY 1987

	KB-1 S-3	KB-1 S-5	KB-1 S-5D	KB-2 S-4	KB-2 S-5	KB-3 S-3	KB-3 S-4	KB-3 S-4R	KB-4 S-3
Acetone	10	15	26	18	900	2,000	--	--	13
2-Butanone	75	--	--	--	2,100	5,700	--	--	11
1,1,1-Trichloroethane	28	21	64	25	--	920	14,000	24,000	17
Trichloroethene	--	22	110	80	690	12,000	58,000	74,000	69
1,1,2-Trichloroethane	7	27	55	--	--	--	--	--	--
Tetrachloroethene	31	7	5	53	--	2,200	--	--	--
Toluene	16	12	38	--	730	840	92,000	95,000	29
Ethylbenzene	--	7	8	--	--	--	68,000	59,000	15
Total Xylenes	--	40	43	6	1,900	17,000	520,000	420,000	73
TICs	--	17	25	39	--	1,800	--	--	9
Total	99	151	349	134	6,320	40,660	752,000	672,000	227

All results in parts per billion (ppb).
TICs = Tentatively Identified Compounds
-- = Not Detected

APPENDIX K (PAGE 3)

SUMMARY TABLES, KYSOR BORING VOC ANALYSES IN SOILS

JULY 1987

	KB-7 S-3R	KB-8 S-3	KB-8 S-5D/L	KB-8 S-5	KB-8 S-5D/L	KB-9 S-2	KB-9 S-5	KB-9 S-5D	KB-10 S-2
Acetone	--	8	39	23	19	7	18	18	11
1,2-Dichloroethane	--	--	--	5	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--	9
1,1,1-Trichloroethane	--	320	11	300	34	--	37	11	5
Trichloroethene	58,000	530	51	370	67	4	58	36	21
1,1,2-Trichloroethane	--	9	--	28	19	--	--	--	--
Tetrachloroethene	--	45	--	96	31	--	4	--	--
Toluene	--	100	34	110	26	5	60	19	56
Ethylbenzene	11,000	5	--	5	4	--	4	6	--
Total Xylenes	300,000	20	19J	45	50	13	20	36	--
TICs	--	--	--	--	--	--	--	15	--
Total	369,000	1,037	206	982	250	29	201	141	102

All results in parts per billion (ppb).
TICs = Tentatively Identified Compounds
-- = Not Detected

SUMMARY TABLES, KYSOR BORING VOC ANALYSES
IN SOILS

JULY 1987

	KB-10 S-2D	KB-10 S-5	KB-10 S-5R
Acetone	--	22	13
2-Butanone	--	16	10
1,1,1-Trichloroethane	18	10	43
Trichloroethene	48	39	170
Tetrachloroethene	--	--	4
Toluene	32	10	47
Ethylbenzene	5	3	10
Total Xylenes	29	33	59
TICs	15	7	12
Total	140	133	356

All results in parts per billion (ppb).
TICs = Tentatively Identified Compounds
-- = Not Detected

ATTACHMENT 4

CITY OF CADILLAC MICHIGAN
200 North Lake Street • Cadillac, Michigan 49601
231.775.0181• fax 231.775.8755
www.cadillac-mi.net

Certification of Institutional Controls

The City of Cadillac hereby certifies that Ordinance #97-10, Chapter 24, Section 2.300, p. 2-83, establishing institutional controls for the remedial action at the Kysor/Northernire site within the City of Cadillac is still in effect. Said Ordinance was adopted November 3, 1997, and is part of the Codified Ordinances of Cadillac, Michigan.

Certified By:

Larry H. Campbell, Director
Cadillac Utilities Department

Date: May 16, 2005

Jan Nelson, City Clerk

Date: May 16, 2005

AN ORDINANCE TO AMEND THE CITY CODE OF THE CITY OF CADILLAC TO ADD A NEW SECTION 2.300 TO CHAPTER 24, TO ESTABLISH INSTITUTIONAL CONTROLS FOR REMEDIAL ACTION AT THE KYSOR INDUSTRIAL CORPORATION/NORTHERNAIRE PLATING COMPANY SITE LOCATED IN THE CITY OF CADILLAC.

THE CITY OF CADILLAC ORDAINS:

Section 1.
For the purpose of protecting public health, welfare and the environment, and for the purpose of implementing the remedial action plan at the site commonly known as the Kysor Industrial Corporation/Northernaire Plating Company Superfund Site, Section 2.300 is hereby added to read as follows:

Chapter 24, Section 2.300.
A. Use of the following described real estate shall be restricted by the provisions of this Subsection(a):

All land located in Township 22 North, Range 9 West, City of Cadillac, Wexford County, Michigan, described as follows:

1. The East Quarter (E 1/4) of the Northwest Quarter (NW 1/4) of Section 32.

2. The Northeast Quarter (NE 1/4) of Section 32.

3. The North Half (N 1/2) of the Southeast Quarter (SE 1/4) of Section 32.

4. The Southwest Quarter (SW 1/4) of Section 33 lying North and West of the Tuscola-Saginaw Bay Railroad.

5. The Northwest Quarter (NW 1/4) of Section 33, EXCEPT the following: South of Gunn Street and Seventh Street which is East of the Ann Arbor Railroad; the property lying East of the Pennsylvania Central Railroad; and also commencing as the Point of Beginning at the Southwest corner of Block 179 of the Improvement Board Addition; thence North to the Northwest corner of Block 188; thence East along the North line of Block 188 to the Northwest corner of Block 189; thence East along the North block line, 220 feet; thence South 71 feet; thence East 107.43 feet; thence North 71 feet; thence East 212.83 feet; thence South 16°2'30" East, 331.74 feet; thence South 3°28'30" East, 246.56 feet to the West right-of-way line of the Ann Arbor Railroad; thence Southwesterly along the West right-of-way line of the Ann Arbor Railroad to the Southeast corner of Block 177; thence West along the South line of Block 177 to the centerline of Third Avenue; thence North on the centerline of Third Avenue to the

Section 2.300 added, Ord. No. 97-10, adopted 11/3/1997.

South line of Block 179 and Block 178, if extended; thence West to the Point of Beginning of the Improvement Board Addition, City of Cadillac, Wexford County, Michigan.

(Hereafter referred to as the Kysor Industrial Corporation/Northernaire Plating Company Site [the "site"]).

1. No water wells used for drinking water or any other domestic use shall be installed in the Kysor Industrial Corporation/Northernaire Plating Company site (the "site"). There shall be no installation or operation of any wells that may interfere with the operation or maintenance of the groundwater extraction or treatment systems set forth in paragraph 2 following, except with written consent by the United States Environmental Protection Agency.

2. There shall be no tampering with, or removal of the containment or monitoring systems that remain on the site as the result of implementation of any response action by the United States Environmental Protection Agency, or any party acting under order by the United States Environmental Protection Agency, and which is selected and/or undertaken, or ordered by, the United States Environmental Protection Agency pursuant to Section 104 and/or 106 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Section 2. This Ordinance shall take effect twenty (20) days after its passage.

Section 2.300 added, Ord. No. 97-10, adopted 11/3/1997.

ATTACHMENT 5

LDFA
Extraction Well Construction Summary

Extraction Well No.	Date Completed	Well Depth (feet bgl)	Screened Interval (feet bgl)
S-1	7/7/95	92	77 - 92
S-2	7/8/95	71.5	56.5 - 71.5
S-3	8/20/95	67	52 -67
S-4	7/10/95	50	35 - 50
S-5	7/9/95	67	57 - 67
S-6	7/24/95	53	43 - 53
S-7	8/5/95	46	36 - 46
I-1	7/10/95	187	162 - 187
I-2	7/19/95	185	160 - 185
I-3	9/29/95	221	201 - 221
I-4	8/20/95	177	152 - 177
I-5	9/8/95	150	125 - 150
I-6	8/2/95	179	154-179
I-7	10/5/95	164	139 - 164
I-8	8/30/95	158	133 - 158
I-9	7/25/95	190	165 - 190
I-10	8/15/95	191	166 -191
I-11	10/12/95	163	133 - 163

ATTACHMENT 6

THE CADILLAC LOCAL DEVELOPMENT FINANCE AUTHORITY REMEDIATION PROJECT CITY OF CADILLAC

Population: 10,104

I. CAPSULE SUMMARY -

The City of Cadillac and the industrial firms located in the Cadillac Industrial Park needed to resolve the dilemma of groundwater and soils contamination within the industrial park; however, program costs stood in the way. Thus, the City of Cadillac formed a partnership with the industrial sector and created a financial mechanism to fund the program that would clean up the contamination. First, the City of Cadillac utilized Local Development Finance Authority legislation to facilitate construction of the project. Second, a Special Assessment District was established to finance the annual operation costs of the Groundwater Remediation Facility.

partnership, there was potential to remediate the contaminated groundwater and soils.

The two goals of this partnership was to: 1. remediate the contaminated groundwater and soils; and 2. create a financial vehicle to fund the groundwater remediation project. Thus, the second goal had to be achieved before any type of contamination clean-up could be realized.

The method of funding this project began with utilizing the Local Development Financing Authority (LDFA) legislation. The City of Cadillac established a LDFA District and the projects within this district would fall under tax increment financing (TIF). The tax increment financing legislation allows for the capture of increased property taxes of qualified properties, excluding school operating and school debt millage. The revenue generated by TIF capture can be utilized for public improvement projects within the LDFA District boundaries. However, this particular project was able to capture the school operating millage because it was implemented before the adoption of Proposal A. The specific project that was constructed as the financial catalyst for the whole groundwater remediation program, was the Beaver Power Plant.

The cost of the Beaver Power Plant portion of the program was $58 million. The City of Cadillac, along with its private sector partners, obtained the financing from General Electric for the $58 million required to fund construction of the power plant. The profits of the power plant repay the financing provided by General Electric. Now that wealth had been created that could generate property taxes to be captured by the LDFA, the actual Groundwater Remediation Facility was then able to be constructed.

The City of Cadillac LDFA issued $7.4 million in bonds to finance the Remediation Facility. These bonds paid for engineering & legal fees, the permitting process, and construction costs of the clean-up plant. The TIF revenues which are generated from the power plant development finance 100% of the principal & interest costs of these bonds.

However, now that the Remediation Facility had been constructed, the annual operational costs of the facility needed to be addressed. Thus, the Cadillac Industrial Park was designated as a Special Assessment District to fund the $200,000 annual operating expenses. It was determined that all of the properties that had been identified as contributing to the contamination would collectively be responsible for 75% of the total operational costs and other firms residing in the industrial park would pay the remaining 25% of the operating bill since they would still benefit from the clean-up

CADILLAC
L.D.F.A. GROUNDWATER CLEAN-UP
SPECIAL ASSESSMENT ROLL

L.D.F.A. Groundwater Treatment Statistics:

Volume of groundwater pumped and treated:

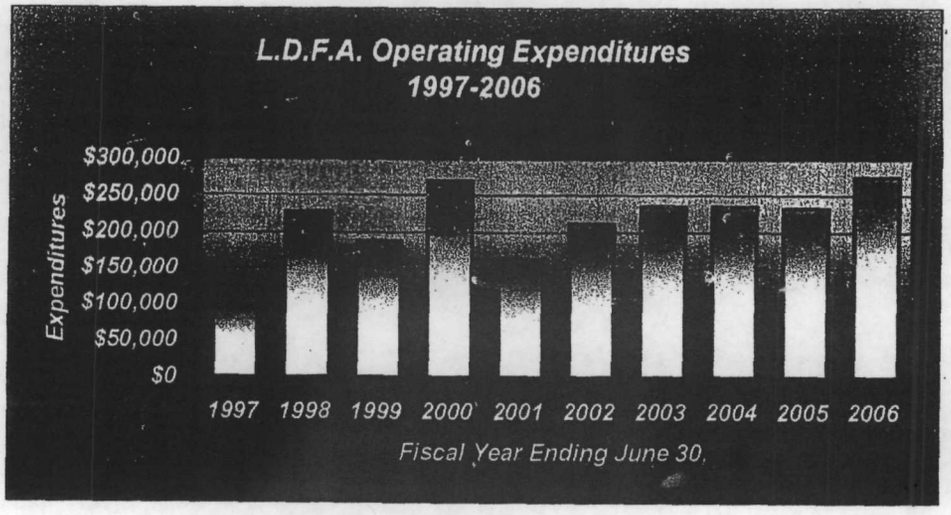
	Gallons per Year	Gallons per Day
1996	324,520,000	2,660,000
1997	967,100,000	2,650,000
1998	924,000,000	2,530,000
1999	889,330,000	2,436,500
2000	880,000,000	2,410,000
2001	870,180,000	2,384,000
2002	845,000,000	2,315,100
2003	851,000,000	2,331,500
2004	878,600,000	2,407,100

Estimated pounds of volatile organics stripped from the water:

1996	1,635 pounds at start up 9/1/96	2001	2,402 pounds per year
1997	4,840 pounds per year	2002	2,322 pounds per year
1998	3,466 pounds per year	2003	2,090 pounds per year
1999	2,761 pounds per year	2004	1,715 pounds per year
2000	2,628 pounds per year		

Hours spent in operation and maintenance:

1996	323 hours for four months	2001	770 hours
1997	750 hours	2002	890 hours
1998	580 hours	2003	940 hours
1999	380 hours	2004	970hours
2000	435 hours		



ATTACHMENT 7

ATTACHMENT 7
List of Documents Reviewed

Annual Performance Monitoring Reports, for LDFA: 1997 (FTCH), 1998 (FTCH), 1999 (Tetra Tech), 2000 (Tetra Tech), 2001-2002 (Tetra Tech), 2003 (Tetra Tech), 2004 (Tetra Tech)

Cadillac Area Groundwater Investigation, E.C. Jordan Co., August 1988

Supplemental RI, E.C. Jordan Co., January 1987

Annual Monitoring Report, City of Cadillac LDFA Project, Longshore Environmental Services, Inc.: 2000 (February 2001), 2002 (October 2002), 2003 (October 2003)

Additional Hydrogeologic Investigation Report, Northwest of the Rexair, Inc. Site, Cadillac Industrial Park, Roy F. Weston Inc., February 2002

Record of Decision, Northernaire site, OU1, USEPA, September 1, 1985

Record of Decision, Northernaire/Kysor sites, OU2, USEPA, September 29, 1989

Explanation of Significant Differences, Northernaire/Kysor sites, OU2, USEPA, March 3, 1994

Preliminary Site Close-Out Report, Kysor Industrial Corp., USEPA, September 23, 1996

First Five-Year Review Report, Northernaire Plating Co., September 28, 1995

Second Five-Year Review Report, Northernaire Plating Co., July 26, 2000

First Five-Year Review Report, Kysor Industrial Corp., July 26, 2000

United States of America v. Robert W. Meyer, Jr., Case No. 1:97-CV-526, Declaration of Leah Evison Supporting Plaintiff's Motion for Summary Judgment on Cost Recovery, 9/24/99

United States of America v. Kysor Industrial Corporation, Raymond Weigel, Robert W. Meyer, Jr., and TransPro Group, Inc., Case No. 1:97-CV-526, Declaration of Leah Evison, 6/1/99

Remedial Action Construction Final Documentation Report, Northernaire/Kysor Sites, FTCH, January 1997

Performance Monitoring Summary, Initial 90 Day Operating Summary, FTCH, February 1997

Cadillac Local Development Finance Authority Remediation Project: Summary, via fax on January 18, 2005

On-Scene Coordinator's Report, No. 68-95-007, Northernaire Plating Co., circa 1983

Remedial Action Work Plan, Northernaire/Kysor Sites, FTCH, April 1995

ATTACHMENT 7 (cont'd.)
List of Documents Reviewed

Final Operation and Maintenance Manual, Volume I, Northernaire/Kysor Sites Remediation, FTCH, April 1995

Final Performance Monitoring Plan for Northernaire/Kysor Sites Remediation, FTCH, April 1995

Remedial Design Additional Studies, FTCH, March 31, 1992

Ingraham Property, Remedial Action Report, FTCH, January 1997

Annual Reports to City of Cadillac, Longshore Environmental Services, 2000, 2002, and 2003

MDNR Substantive Requirements Document, MIU990009, Discharge Requirements to Clam River, application submitted on August 29, 1994

Final Discharge Monitoring Permit, MDNR, Discharge Requirements to Clam River, 1996

ATTACHMENT 8

ATTACHMENT 8
Applicable or Relevant and Appropriate Requirements (ARARs)

Chemical Specific

- Clean Air Act (CAA) 40 CFR 50.1-6,8,9,11 and 12.

- Michigan Environmental Response act 307 (1982), MCL 299.601 R 299.5101, Type "C" cleanup. Under the MDNR's reading of Act 307, this ROD is to be considered an Act 307 interim remedy, as allowed by R 299.5509. *Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).
  U.S. EPA considers this remedy to be a final remedy for Operable Units I and III.

- Michigan Air Pollution Control Act 348 (1965) Part 2,3,9 and 10. *Part 55, Air Pollution Control, of the NREPA.

Action Specific

- Clean Air Act (CAA), 40 CFR Parts 50, 51

- Federal Protection of Wetlands Act, 40 CFR 6, APP.A

- Michigan Act 203 (1974), Wetland Protection Act. *Part 303, Wetlands Protection, of the NREPA.

- Michigan Shoreland Protection and Management Act 245 (1970). *Part 323, Shorelands Protection and Management, of the NREPA.

- Michigan Act 347 (1972), Soil Erosion and Sedimentation Control Act, MCL 282.101 R 323.1701. *Part 91, Soil Erosion and Sedimentation Control, of the NREPA.

- Michigan Act 348 (1965), Parts 2, 3, 9, and 10, Air Pollution Act. *Part 55, Air Pollution Control, of the NREPA.

Location Specific

- Archaeological and Historic Preservation Act, 40 CFR 6.301(c)/16 USC 469

- National Historic Preservation act, 40 CFR 6.301(b)/16 USC 470

- Historic Sites, Buildings and Antiquities Act, 40 CFR 6.301(a)/16 USC 461-467

- Fish and Wildlife Coordination Act, 40 CFR 6.302(g)/16 USC 1531-1566

- Endangered Species Act, 50 CFR Parts 17 and 402/16 USC 1531-1543

- Protection of Wetlands, 40 CFR 6 (App. A)

- Michigan Endangered Species Act 203 (1974), MCL 299.221 R299.1021. *Part 365, Michigan Endangered Species, of the NREPA.

ATTACHMENT 8 (cont'd.)
Applicable or Relevant and Appropriate Requirements (ARARs)

- Michigan Wetland Protection Act 203 (1979), MCL 281.701 R281.921. *Part 303, Wetlands Protection, of the NREPA.

- Michigan Shoreland Protection and Management act 245 (1970), MCL 281.641. *Part 323, Shorelands Protection and Management, of the NREPA.

- Michigan Soil Erosion and Sedimentation Control act 347 (1972), MCL 282.101 R323.1701. *Part 91, Soil Erosion and Sedimentation Control, of the NREPA.

The following regulations are identified as to be considered (TBC) in the 1992 ROD:

- Occupational Safety and Health Act, 29 CFR 120

- Michigan Act 154, Rule 3301 (1974), Michigan Occupational Safety and Health Act.

- MCLA 257.722, Michigan Vehicle Code

* Updated citation. While ARARs are frozen at the time the ROD is signed, the MDEQ has indicated that the citations for some state ARARs (*) can be updated without changing the statutes. For example, the citation for Michigan Environmental Response act 307 (1982) can be updated to Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). When the Natural Resources and Environmental Protection Act (Act 451) was adopted in 1994, it simply consolidated state environmental statues, but did not change them. Thus, Act 307 became Part 201 of Act 451 but nothing that was in Act 301 changed. However, revisions to Part 201 did come later (1995).

ATTACHMENT 9

Analysis and Comparison of Source Area Contaminant Constituent Ratios
Rexair Groundwater Study
Prepared for: Michigan Department of Environmental Quality
Prepared by: Roy F. Weston, Inc.
May 17, 2002

	Rexair and Nearby Early Plume Data				**Downgradient Recent Plume Data**
% of each compound relative to all four of the following compounds	CRC SOURCE PLUME (See Table 1)	FOUR STAR SOURCE PLUME (See Table 2)	MITCHELL CORP SOURCE PLUME (See Table 3)	REXAIR SOURCE PLUME (See Table 4)	PLUME DOWNGRADIENT OF VPB-3 (Wells RX-27 - RX-36)
	(1984-1987)	(1985-1986)	(1991, 1993)	(1987-1988)	(1998-1999)
% PCE	NA	11%	100.00%	0.00%	NA
%TCE	46%	75%	0.00%	99.99%	99.95%
%1,2-TCA	NA	NA	0.00%	0.00%	0.05%
%1,1-TCA	54%	14%	0.00%	0.01%	NA
Max TCE Concentration (ppb)	39	15,000	0	153,000	9,200

Notes:

NA - Parameter not analyzed.

Sampling rounds analyzed for TCE only were not used in chemical ratio calculations.

See attached Tables 1 through 4 for specific plume-source area data.

ATTACHMENT 10

Figure 15. 1,1,1-TCA in Influent to Air Stripper

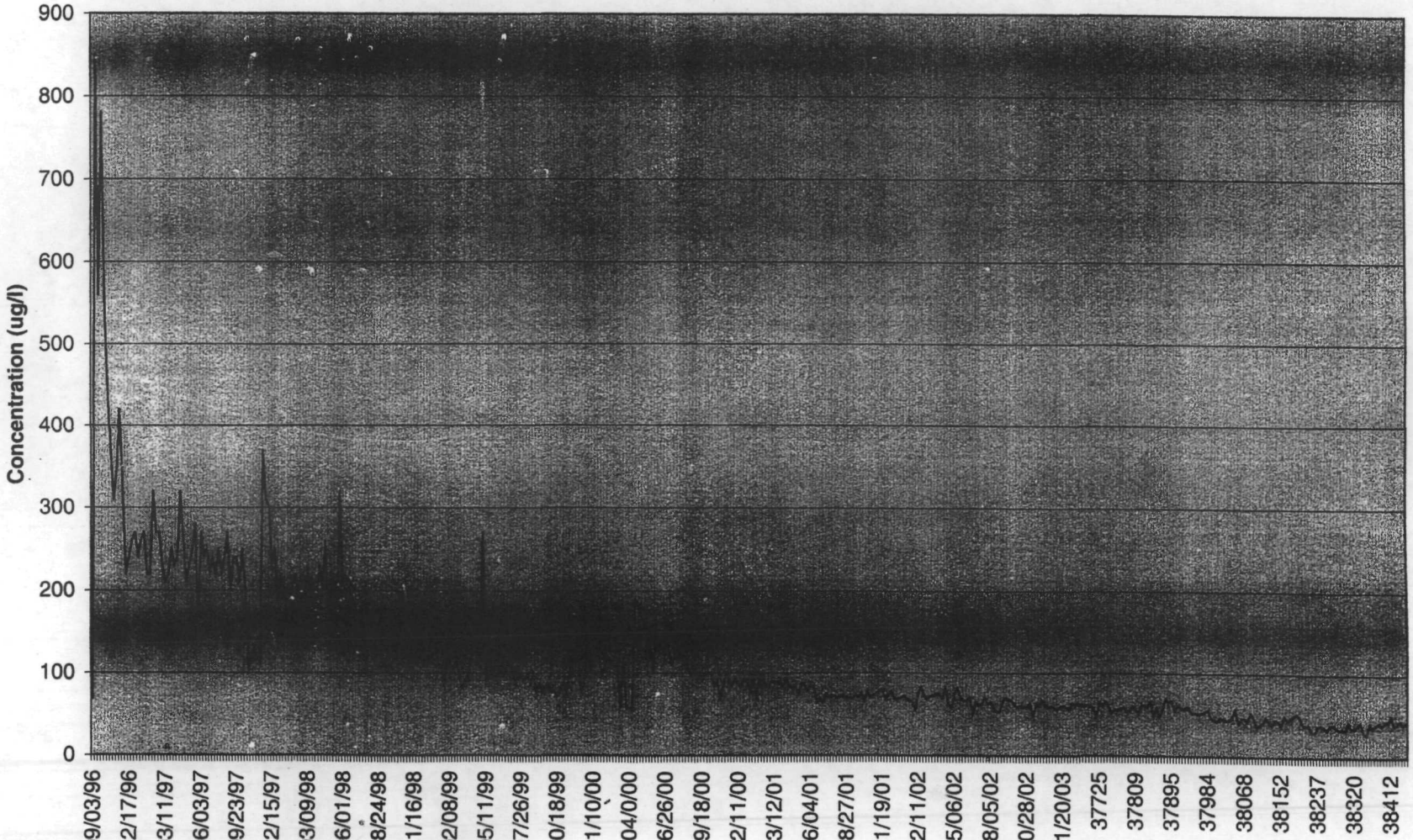


Figure 16. 1,1-DCE in Influent to Air Stripper

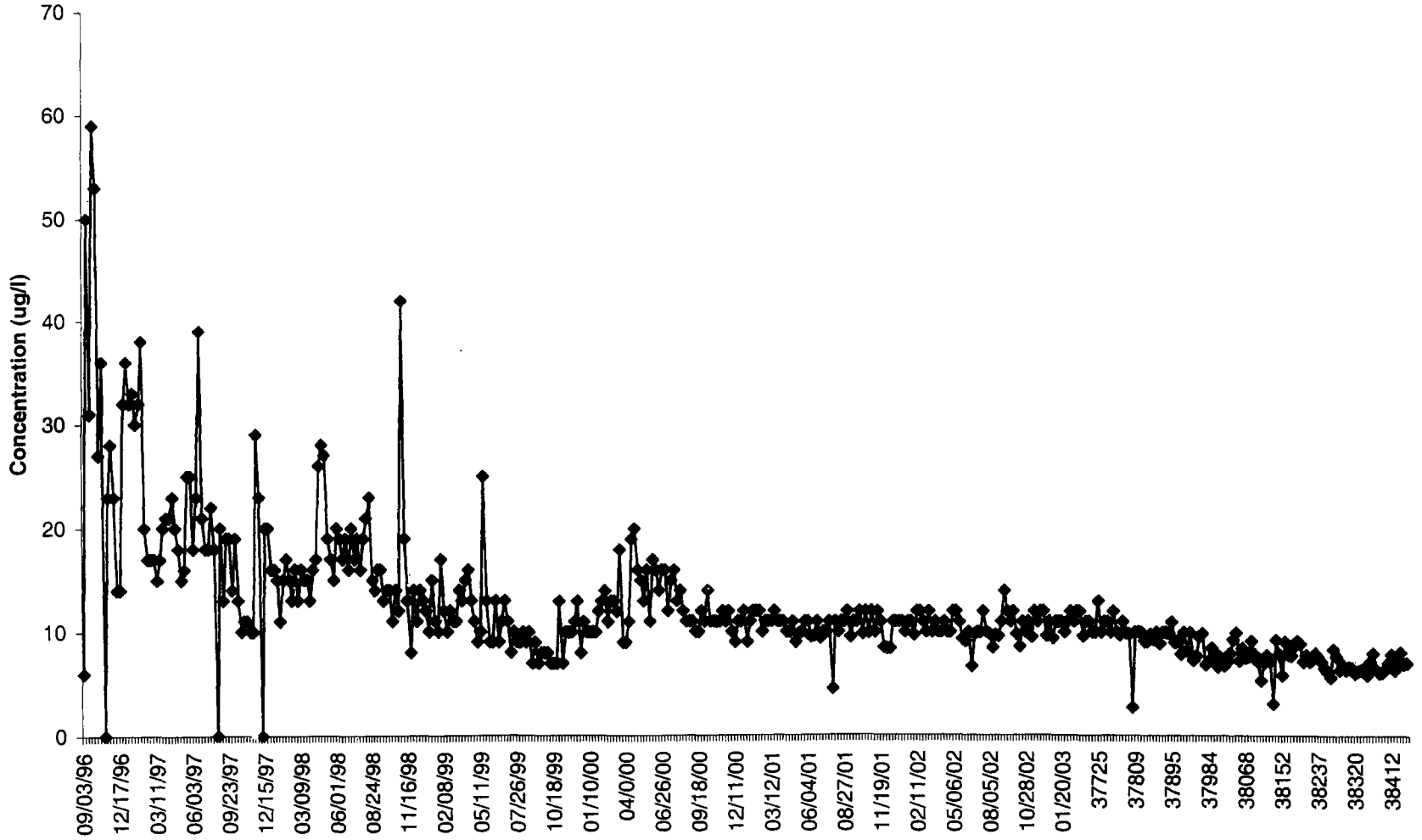


Figure 18. Concentration of PCE in Influent to Air Stripper

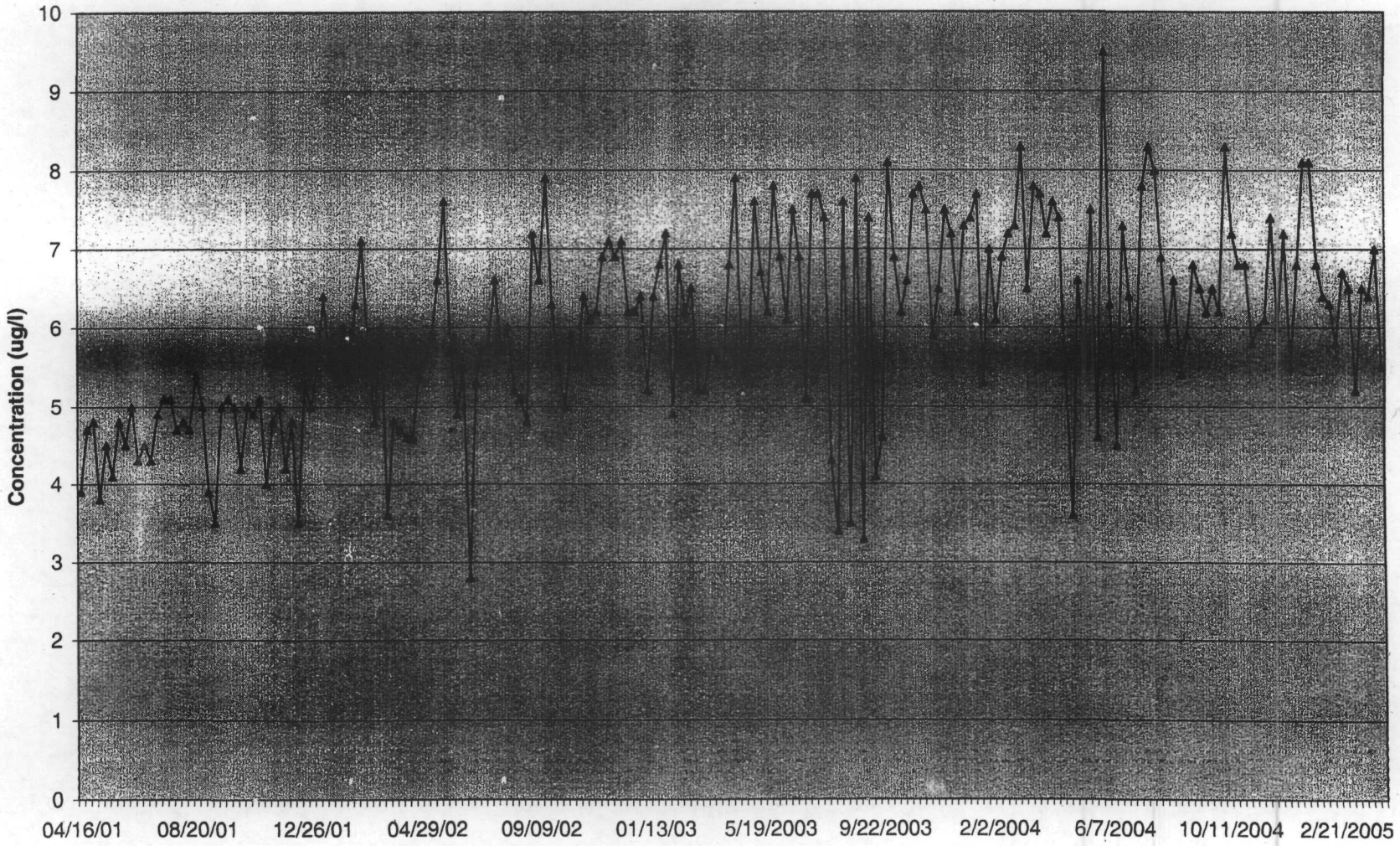


Figure 19. TCE in Influent to Air Stripper

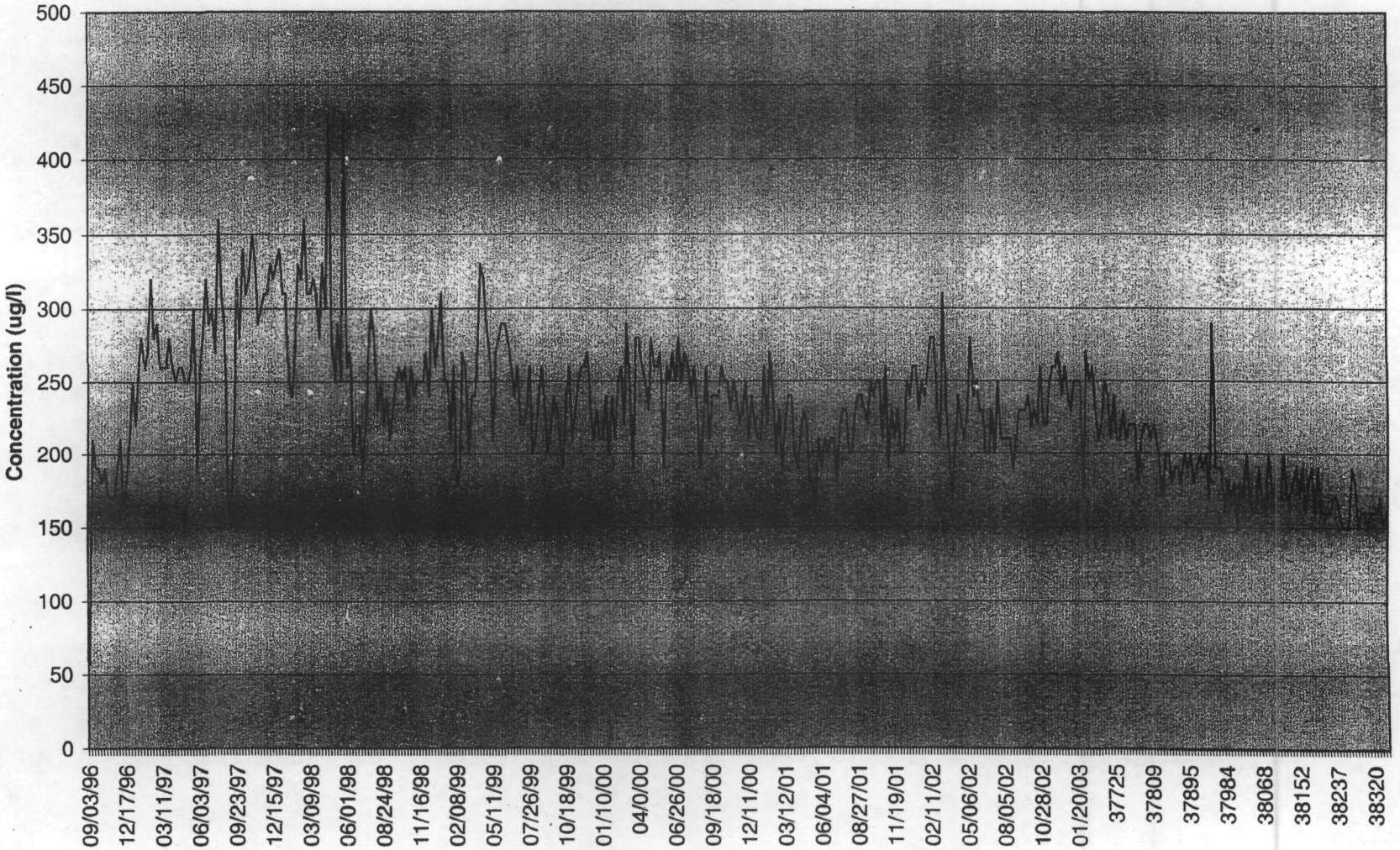
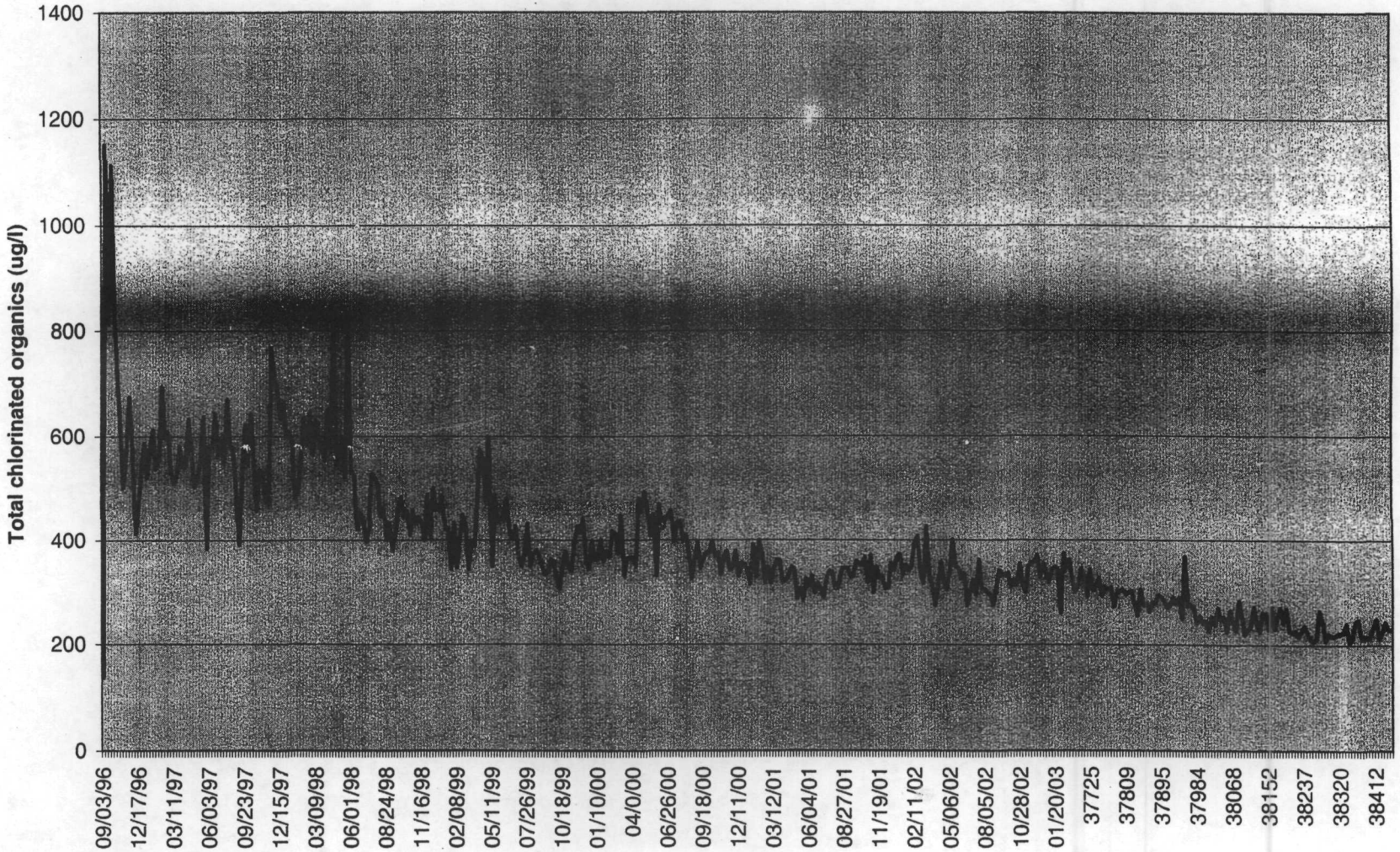


Figure 20. Concentration of Total Chlorinated Organics in Influent to Air Stripper



ATTACHMENT 11

U.S. Environmental Protection Agency

September 2005

KYSOR INDUSTRIAL SITE
CLEANUP STATUS OF ALL MONITORING WELLS FOR VOCs of CONCERN

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
K-6S	Y	Since start (1996)	Y	As of 10/98	Y	Since start (1996)	Y	Since start (1996)	Y	As of 9/02	Y	Only as of 9/04
K-11	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	In compliance 1998-2003
K-13	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	**N**	In compliance 1998-2003
K-22	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	Y	As of 6/97
DNR-11	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	Y	As of 12/99
F-1S	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.2 ug/l in 2004	Y	All years in compliance except 2003
F-5	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)
FWMW-9	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	**N**	Out of compliance 02 & 04 only
FWMW-16	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	Y	Since start (1996)	**N**	5.5 ug/l in 2004	**N**	Rounds in compliance: 99 & 02 only
GW-9S	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 6/97
GW-10S	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	3.3 ug/l in 2004	Y	As of 9/02

KYSOR INDUSTRIAL SITE
CLEANUP STATUS OF ALL MONITORING WELLS FOR VOCs of CONCERN

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
GW-11	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)
GW-14S	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1998	Y	As of 6/97
SLW-9	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.8 ug/l in 2004	**N**	Lowest conc. of 15 ug/l in 9/04
SLW-23	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	Y	Since start (1996)
SLW-25	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.8 ug/l in 2004	**N**	21 ug/l in 2004
SLW-31	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 12/99
S-1	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 2002	Y	As of 12/99
S-2	Y	Only as of 2004	Y	Only as of 2003	Y	Only as of 2004	Y	Only as of 2003	**N**	8.6 ug/l in 2004	**N**	34 ug/l in 2004
S-3	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Only as of 2004
S-4	Y	As of 1999	Y	As of 2000	Y	As of 1999	Y	As of 1997	**N**	8.5 ug/l in 2004	**N**	57 ug/l in 2004
S-5	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	4 ug/l in 2004	Y	Only as of 2003

KYSOR INDUSTRIAL SITE
CLEANUP STATUS OF ALL MONITORING WELLS FOR VOCs of CONCERN

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
S-6	Y	Since start (1996)	Y	Since start (1996)	Y	As of 2001	Y	Since start (1996)	Y	As of 2000	Y	As of 9/01
K-16D	**N**	(in compliance from 9/97 to 9/03)	**N**	[In compliance 8/96-9/02]	**N**	[In compliance 10/98-12/01]	Y	Since start (1996)	**N**	Out of compliance since start	**N**	30x increase to 3200 ug/l in 2004
DNR-14D	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.7 ug/l in 2004	Y	As of 11/01
F-1D	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)
F-3	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)
F-6	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 3/03 [also from 4/99-9/02]	Y	As of 3/03; only out of compliance 2 out of 33 rounds
F-7	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	In compliance 6/97-12/03
CMS-5W	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 2/00; 12/99 only round out of compliance
GW-14D	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 12/99	Y	As of 6/97
GW-17	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	26 ug/l in 2004

KYSOR INDUSTRIAL SITE
CLEANUP STATUS OF ALL MONITORING WELLS FOR VOCs of CONCERN

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
MW-8	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 12/00	Y	As of 9/02
SLW-34	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 6/03 [also from 6/97-3/00]	Y	As of 3/02; only out of compliance once since 4/98
SLW-35	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)
I-1	Y	Only as of 2004	Y	Since start (1996)	**N**	[In compliance 8/96-9/97]	Y	Only as of 2004 [also 9/96-12/00]	**N**	Highest conc. of 2.6 ug/l in 9/97	**N**	140 ug/l in 2004
I-2	Y	As of 1997	Y	Since start (1996)	**N**	[In compliance in 8/96]	Y	As of 10/98	**N**	Highest conc. of 2.6 ug/l in 4/97	**N**	270 ug/l in 2004
I-3	Y	Since start (1996)	Y	Since start (1996)	Y	As of 2002	Y	Since start (1996)	**N**	Highest conc. of 7.8 ug/l in 9/04	**N**	100 ug/l in 2004
I-4	Y	As of 1999	Y	As of 9/03	Y	Only as of 9/04	Y	As of 12/99	**N**	Highest conc. of 6.1 ug/l in 6/97	**N**	62 ug/l in 2004
I-5	Y	Since start (1996)	Y	Since start (1996)	Y	As of 9/02	Y	As of 10/98	**N**	Highest conc. of 40 ug/l in 9/03	**N**	160 ug/l in 2004
I-6	Y	As of 1999	Y	As of 12/00	Y	As of 12/99	Y	As of 10/98	**N**	Highest conc. of 20 ug/l in 4/97	**N**	24 ug/l in 2004
I-7	Y	As of 11/96	Y	Since start (1996)	Y	As of 12/99	Y	Since start (1996)	Y	As of 9/02	**N**	100 ug/l in 2004

KYSOR INDUSTRIAL SITE
CLEANUP STATUS OF ALL MONITORING WELLS FOR VOCs of CONCERN

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
I-8	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)
I-9	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 6/97	**N**	5.4 ug/l in 2004; in compliance 12/00-9/03
I-10	Y	Since start (1996)	Y	As of 9/01	**N**	In compliance 8/96-4/97	Y	As of 10/98	**N**	Highest conc. of 16 ug/l in 4/97	**N**	330 ug/l in 2004
I-11	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	Highest conc. of 8.7 ug/l in 9/04	**N**	72 ug/l in 2004

KYSOR INDUSTRIAL SITE
NON-COMPLIANT WELLS

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
K-11	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	In compliance 1998-2003
K-13	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	**N**	In compliance 1998-2003
F-1S	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.2 ug/l in 2004	Y	All years in compliance except 2003
FWMW-9	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	**N**	Out of compliance 02 & 04 only
FWMW-16	Y	Since start (1996)	Y	Since start (1996)	Y	As of 1997	Y	Since start (1996)	**N**	5.5 ug/l in 2004	**N**	Rounds in compliance: 99 & 02 only
GW-10S	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	3.3 ug/l in 2004	Y	As of 9/02
SLW-9	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.8 ug/l in 2004	**N**	Lowest conc. of 15 ug/l in 9/04
SLW-25	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.8 ug/l in 2004	**N**	21 ug/l in 2004
S-2	Y	Only as of 2004	Y	Only as of 2003	Y	Only as of 2004	Y	Only as of 2003	**N**	8.6 ug/l in 2004	**N**	34 ug/l in 2004
S-4	Y	As of 1999	Y	As of 2000	Y	As of 1999	Y	As of 1997	**N**	8.5 ug/l in 2004	**N**	57 ug/l in 2004
S-5	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	4 ug/l in 2004	Y	Only as of 2003

KYSOR INDUSTRIAL SITE
NON-COMPLIANT WELLS

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
K-16D	**N**	(in compliance from 9/97 to 9/03)	**N**	[In compliance 8/96-9/02]	**N**	[In compliance 10/98-12/01]	Y	Since start (1996)	**N**	Out of compliance since start	**N**	30x increase to 3200 ug/l in 2004
DNR-14D	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	1.7 ug/l in 2004	Y	As of 11/01
F-7	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	In compliance 6/97-12/03
GW-17	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	26 ug/l in 2004
I-1	Y	Only as of 2004	Y	Since start (1996)	**N**	[In compliance 8/96-9/97]	Y	Only as of 2004 [also 9/96-12/00]	**N**	Highest conc. of 2.6 ug/l in 9/97	**N**	140 ug/l in 2004
I-2	Y	As of 1997	Y	Since start (1996)	**N**	[In compliance in 8/96]	Y	As of 10/98	**N**	Highest conc. of 2.6 ug/l in 4/97	**N**	270 ug/l in 2004
I-3	Y	Since start (1996)	Y	Since start (1996)	Y	As of 2002	Y	Since start (1996)	**N**	Highest conc. of 7.8 ug/l in 9/04	**N**	100 ug/l in 2004
I-4	Y	As of 1999	Y	As of 9/03	Y	Only as of 9/04	Y	As of 12/99	**N**	Highest conc. of 6.1 ug/l in 6/97	**N**	62 ug/l in 2004
I-5	Y	Since start (1996)	Y	Since start (1996)	Y	As of 9/02	Y	As of 10/98	**N**	Highest conc. of 40 ug/l in 9/03	**N**	160 ug/l in 2004
I-6	Y	As of 1999	Y	As of 12/00	Y	As of 12/99	Y	As of 10/98	**N**	Highest conc. of 20 ug/l in 4/97	**N**	24 ug/l in 2004

KYSOR INDUSTRIAL SITE
NON-COMPLIANT WELLS

	1,1,1-TCA		1,2-DCE		1,1-DCE		1,2-DCA		PCE		TCE	
	200		*70*		*5*		*5*		*1*		*5*	
Well	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates	In compliance?	Dates
I-7	Y	As of 11/96	Y	Since start (1996)	Y	As of 12/99	Y	Since start (1996)	Y	As of 9/02	**N**	100 ug/l in 2004
I-9	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	As of 6/97	**N**	5.4 ug/l in 2004; in compliance 12/00-9/03
I-10	Y	Since start (1996)	Y	As of 9/01	**N**	In compliance 8/96-4/97	Y	As of 10/98	**N**	Highest conc. of 16 ug/l in 4/97	**N**	330 ug/l in 2004
I-11	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	Y	Since start (1996)	**N**	Highest conc. of 8.7 ug/l in 9/04	**N**	72 ug/l in 2004

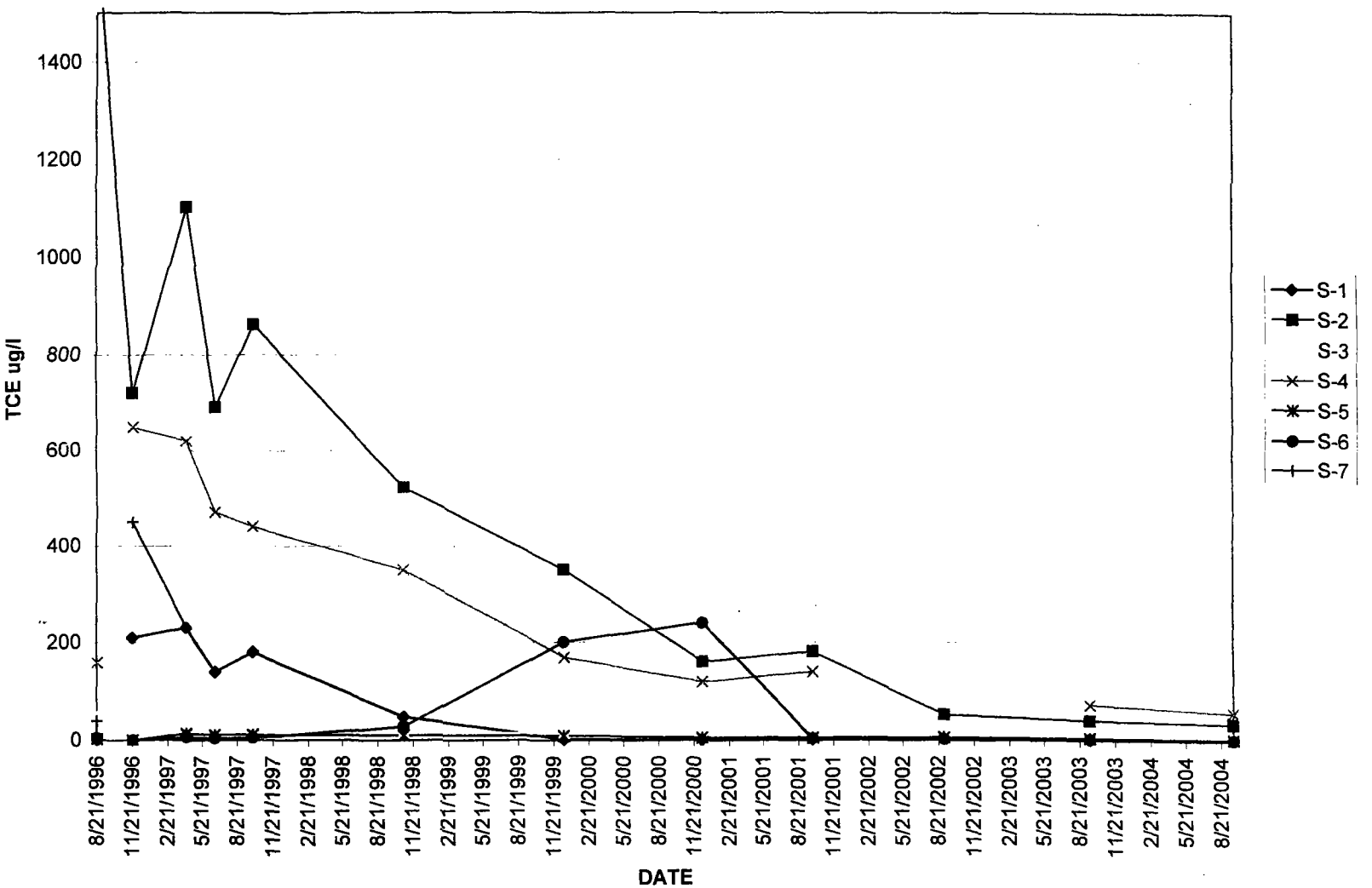
KYSOR INDUSTRIAL SITE
NON-COMPLIANT WELLS for PCE and TCE

	PCE		TCE	
	Target Cleanup Level = 1 ug/l		*Target Cleanup Level = 5 ug/l*	
Well	In compliance?	Dates	In compliance?	Dates
K-11	Y	Since start (1996)	**N**	In compliance 1998-2003
K-13	Y	As of 1997	**N**	In compliance 1998-2003
F-1S	**N**	1.2 ug/l in 2004	Y	All years in compliance except 2003
FWMW-9	Y	As of 1997	**N**	Out of compliance 02 & 04 only
FWMW-16	**N**	5.5 ug/l in 2004	**N**	Rounds in compliance: 99 & 02 only
GW-10S	**N**	3.3 ug/l in 2004	Y	As of 9/02
SLW-9	**N**	1.8 ug/l in 2004	**N**	Lowest conc. of 15 ug/l in 9/04
SLW-25	**N**	1.8 ug/l in 2004	**N**	21 ug/l in 2004
S-2	**N**	8.6 ug/l in 2004	**N**	34 ug/l in 2004
S-4	**N**	8.5 ug/l in 2004	**N**	57 ug/l in 2004
S-5	**N**	4 ug/l in 2004	Y	Only as of 2003
K-16D	**N**	Out of compliance since start	**N**	30x increase to 3200 ug/l in 2004
DNR-14D	**N**	1.7 ug/l in 2004	Y	As of 11/01
F-7	Y	Since start (1996)	**N**	In compliance 6/97-12/03
GW-17	Y	Since start (1996)	**N**	26 ug/l in 2004
I-1	**N**	Highest conc. of 2.6 ug/l in 9/97	**N**	140 ug/l in 2004
I-2	**N**	Highest conc. of 2.6 ug/l in 4/97	**N**	270 ug/l in 2004
I-3	**N**	Highest conc. of 7.8 ug/l in 9/04	**N**	100 ug/l in 2004
I-4	**N**	Highest conc. of 6.1 ug/l in 6/97	**N**	62 ug/l in 2004

	PCE		TCE	
	Target Cleanup Level = 1 ug/l		*Target Cleanup Level = 5 ug/l*	
Well	In compliance?	Dates	In compliance?	Dates
I-5	**N**	Highest conc. of 40 ug/l in 9/03	**N**	160 ug/l in 2004
I-6	**N**	Highest conc. of 20 ug/l in 4/97	**N**	24 ug/l in 2004
I-7	Y	As of 9/02	**N**	100 ug/l in 2004
I-9	Y	As of 6/97	**N**	5.4 ug/l in 2004; in compliance 12/00-9/03
I-10	**N**	Highest conc. of 16 ug/l in 4/97	**N**	330 ug/l in 2004
I-11	**N**	Highest conc. of 8.7 ug/l in 9/04	**N**	72 ug/l in 2004

ATTACHMENT 12

TCE IN SHALLOW AQUIFER
MONITORING CONCENTRATION TREND
2004 ANNUAL PERFORMANCE MONITORING REPORT
NORTHERNAIRE/KYSOR SITES



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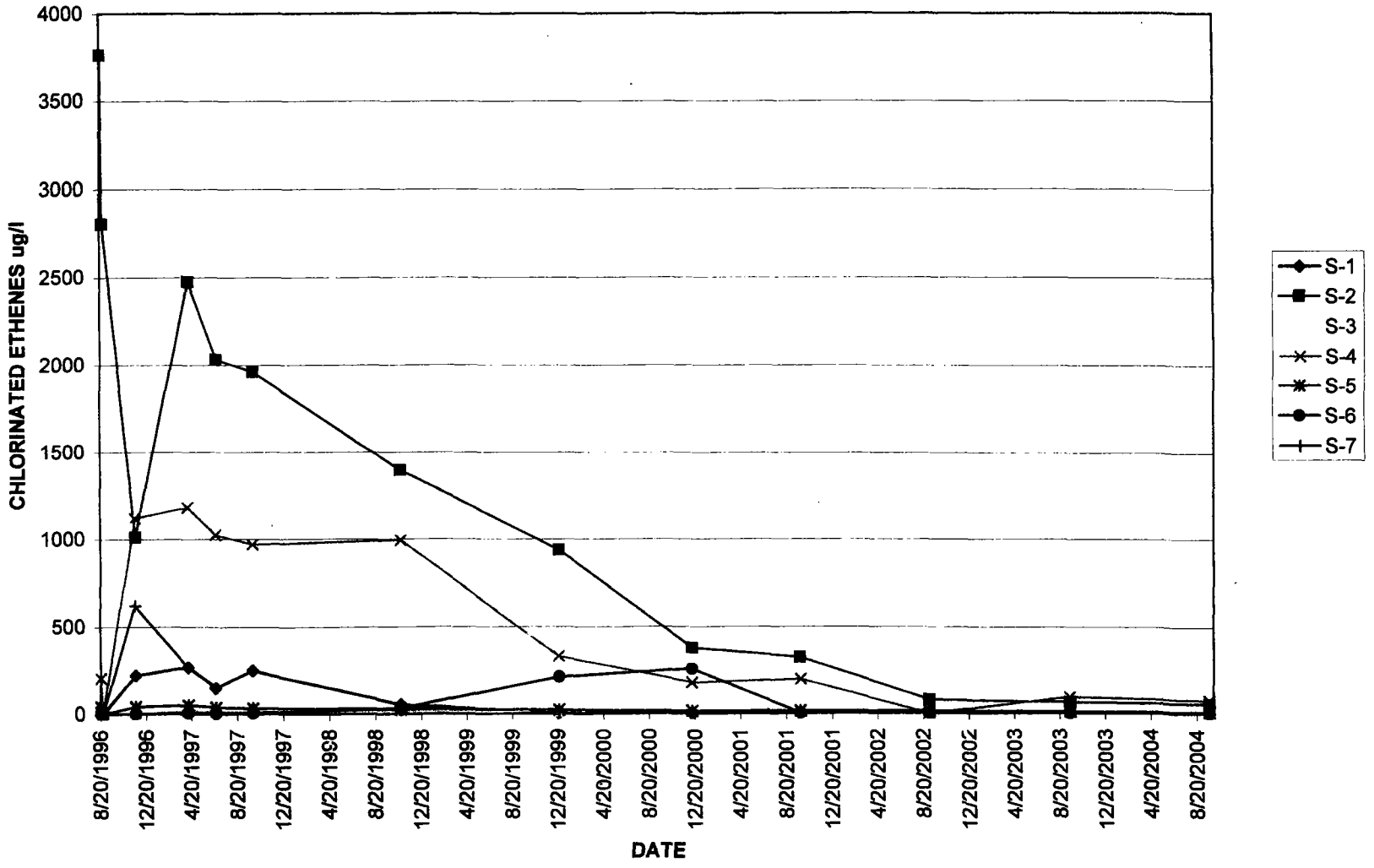
DRB 4/27/05

CHLORINATED ETHENES IN SHALLOW AQUIFER
MONITORING CONCENTRATION TREND
2004 ANNUAL PERFORMANCE MONITORING REPORT
NORTHERNAIRE/KYSOR SITES



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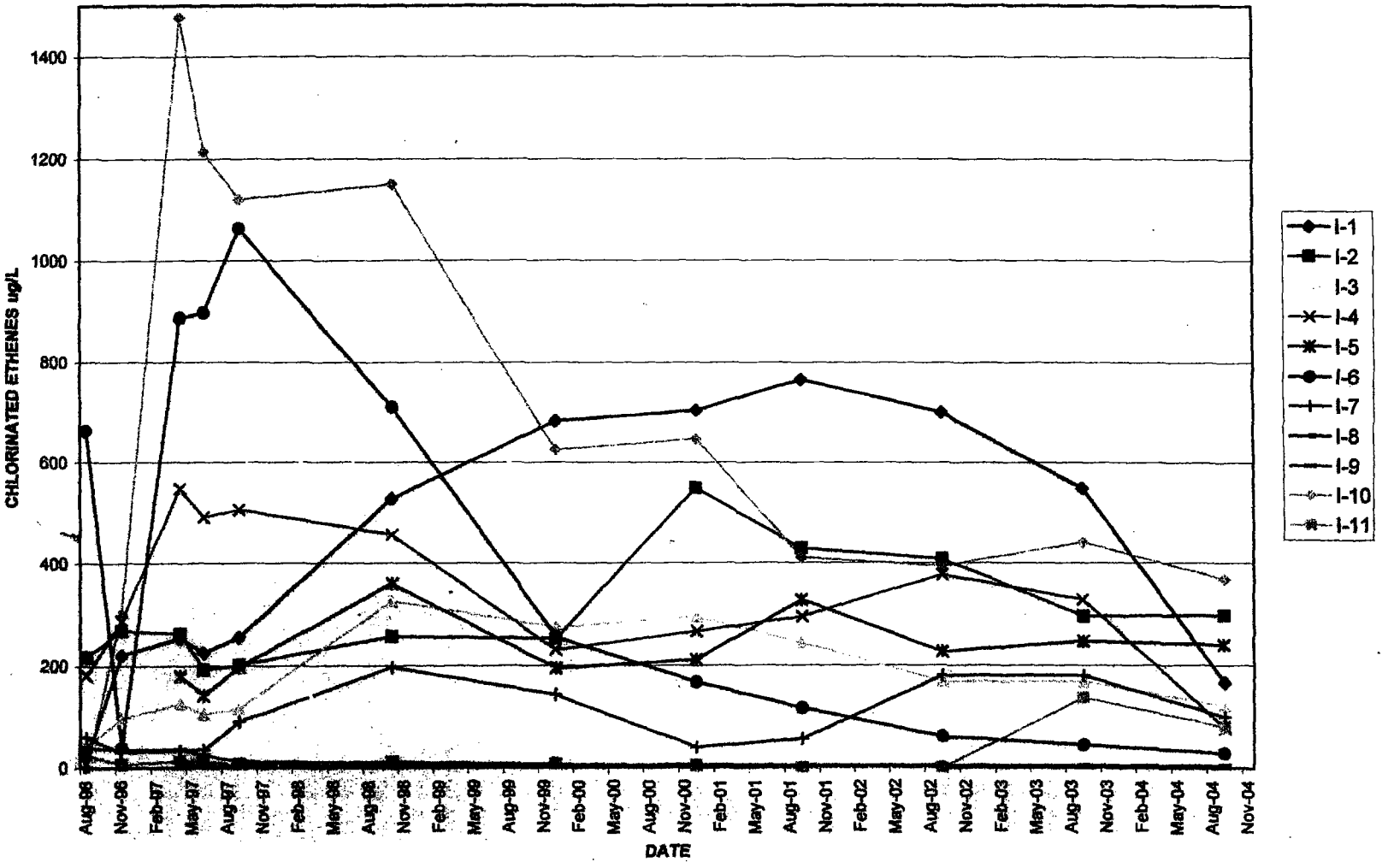
DRB 4/27/05

CHLORINATED ETHENES IN INTERMEDIATE AQUIFER
MONITORING CONCENTRATION TREND
2004 ANNUAL PERFORMANCE MONITORING REPORT
NORTHERNAIRE/KYSOR SITES



ATTACHMENT 13

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

I. SITE INFORMATION

Site name: NORTHERNAIRE/KYCOR	**Date of inspection:** APRIL 26/27, 2005
Location and Region: Cadillac, MI, R5	**EPA ID:** MID043681840 (Kysor) MID0[illegible]883609 (Northernaire)
Agency, office, or company leading the five-year review: U.S. EPA	**Weather/temperature:** Sunny, 50°

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other SVE
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** LARRY CAMPBELL (Name) UTILITIES DIRECTOR (Title) 4/27/05 (Date)
   Interviewed ☒ at site ☒ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached Carbon disconnected (eg. carbon) (for Cr) → petitioned to stop feeding and adjustment; No other problems; proactive maintenance; NaOH/sulfuric acid emptied in 2000

2. ~~**O&M staff**~~ PETE STALKER (Name) CITY MANAGER (Title) 4/27/05 (Date)
   Interviewed ☐ at site ☒ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____
   ~~telemetry (radio-based) - used to be interrupted by semi-truck which was blocking signal~~

Routine Maintenance
oil; check belts; check packing, heat tape, check for freezing; coal dust from next door clogs up roof-top heating unit (for bldg heat)

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; ☐ Report attached _____

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

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

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

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

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

1. **O&M Documents**

☐ O&M manual - office & plant	☒ Readily available	☐ Up to date	☐ N/A
☐ As-built drawings " "	☒ Readily available	☐ Up to date	☐ N/A
☐ Maintenance logs LDFA	☒ Readily available	☐ Up to date	☐ N/A

Remarks Daily bench logs // Daily = all @ LDFA

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
☐ Contingency plan/emergency response plan ☒ Readily available ☐ Up to date ☐ N/A
Remarks RMP = Risk Mgmt Program; Utility Office

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks OSHA training at plant (in-house)
& 8 hr incident responder training

4. **Permits and Service Agreements**
☐ Air discharge permit ☒ Readily available ☐ Up to date ☐ N/A
☐ Effluent discharge/NPDES ☒ Readily available ☐ Up to date ☐ N/A
☐ Waste disposal, POTW ☒ Readily available ☐ Up to date ☐ N/A
☐ Other permits ☐ Readily available ☐ Up to date ☐ N/A
Remarks Waste mgmt permit fee = haven't disposed any waste yet

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☐ Up to date ☐ N/A
Remarks Recent records in Larry's office; historical data at LDFA

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☐ N/A
☐ Water (effluent) ☒ Readily available ☐ Up to date ☐ N/A
Remarks

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☐ N/A
Remarks Locked bldg; locked fence.

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place

Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

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

Describe costs and reasons: Replacing valve
Well failures/may have to replace pump

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

A. Fencing

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

Remarks SVE fenced, wells in pits below grade/locked

B. Other Access Restrictions

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

Remarks_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A

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

Type of monitoring (*e.g.*, self-reporting, drive by) Large production wells/drinking wells | Drinking wells

Frequency

Responsible party/agency City of Cadillac | MDPH

Contact | Victoria ~~Weiser~~ Wietzel

Name	Title	Date	Phone no.
Larry Campbell			231. ~~775~~. 9942

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 Would like to see City ordinance to cover entire city but not realistic.

D. General

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

Remarks

2. **Land use changes on site** ☒ N/A

Remarks New industrial fac

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

Remarks New industrial facilities in area (but same use)

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

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

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

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

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

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

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

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

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

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

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

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

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

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

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

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

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

D. Cover Penetrations ☐ Applicable ☐ N/A

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

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

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

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

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

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☑ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☐ N/A
Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____ N/A

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

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

4. **Discharge Structure** ☐ Functioning ☐ N/A
Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Performance Monitoring** Type of monitoring_____
☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching
Head differential_____
Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A

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

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks one shallow well not op. (S7)
S1/S2 powered by bldg

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks ~~15~~ - direct pipeline to plant
17 will enter via same pipeline

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

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

1. **Collection Structures, Pumps, and Electrical**
☒ Good condition ☐ Needs Maintenance
Remarks_____

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

120V - ~~replaced~~ w 480 ~~phase~~ volt 3-phase } pumps from below air strippers } wellhead doc's Kysor bldg.

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

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☒ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping ☒ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent)_____
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually ~2.7 million gal/day (check budget doc)
☐ ~~Quantity of surface water treated annually~~_____
Remarks Check ROD for shut-down criteria for chrome trtmt.

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks_____

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance
Remarks_____

4. **Discharge Structure and Appurtenances**
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks_____

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

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

D. Monitoring Data

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

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

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____

X. OTHER REMEDIES

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

Well maintained system

B. Adequacy of O&M

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

C. Early Indicators of Potential Remedy Problems

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

D. Opportunities for Optimization

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