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DA TE: **November 13, 2000**

FROM: Rosita Clarke-Moreno, SR-6J
U.S. EPA Region 5 - Five Year Review Coordinator

TO: Carol Bass, 5204 G
U.S. EPA - HQ

SUBJECT: **Transmittal of Five-Year Review Report for the *Lemberger Landfill Site* and *Lemberger Transport and Recycling Site***

The attached Five Year Review Report was prepared for the above sites: ***Lemberger Landfill Site*** **and** ***Lemberger Transport and Recycling Site*** as one (1) report because of the relationship these sites have. Although listed as two (2) sites, it is really one site and cleanup of these site(s) is being coordinated as a whole approach.

Region 5 approved this report for both sites. Should you have any questions or concerns, please contact me (312)886-7251.

cc: Mike Bellot, HQ (Email)
Darryl Owens, RPM

FIVE-YEAR REVIEW REPORT

Five-Year Review Report
for
Lemberger Landfill Site
and
Lemberger Transport and Recycling Site
Whitelaw, Franklin Township Wisconsin

September 2000

PREPARED BY:
Region 5
United States Environmental Protection Agency
Chicago, IL

Approved by:

Date:

William E. Muno, Director
Superfund Division
U.S. EPA Region 5

9/27/00

U.S. Environmental Protection Agency
Region 5
Five Year Review
Lemberger Landfill & Lemberger Transport &
Recycling Sites, Franklin Township, Wisconsin

I. Introduction

EPA Region 5 has conducted a five-year review of the remedial actions implemented at the Lemberger Landfill and Lemberger Transport and Recycling Sites in Whitelaw Wisconsin. This review was conducted from July 2000 through September 2000. This report documents the results of the review. The purpose of the five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of review are documented in five-year reports. In addition, five-year review reports identify deficencies found during the review, if any, and identify recommendations to address them.

This review is required by statute. EPA must implement five-year reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA 121 (c), as amended, states:

> If the Presidents 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.

The NCP part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

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

This is the first five-year review for these sites. The triggering action for this review is the initiation of remedial action at the sites which occurred on June 12, 1995. Due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unrestricted use and unlimited exposure, this five-year review is required.

II. Site Chronology

Table 1 lists the chronology of events for the Lemberger Landfill and the Lemberger Transport &

Recycling Sites.

Table 1: Chronology of Site Events

Lemberger Landfill Site Date	**Event**
1980	Intial Discovery of Problem
6/86	NPL Listing
9/23/91	RI/FS Complete
9/23/91	ROD Signature
6/01/92	Remedial Design Start
3/8/95	Remedial Design Complete
3/8/95	Remedial Action Start
9/9/96	Remedial Action Complete
3/17/97	Groundwater Treatment Plant Starts Operation
Lemberger Landfill Site Date	**Event**
1982	Initial Discovery of Problem
9/84	NPL Listing
7/15/93	Removal Action Start
9/29/94	No Further Action ROD Signature
10/22/96	Removal Action Complete

III. Background

The Lemberger Landfill (LL) Site and the Lemberger Transport and Recycling Site are former land disposal facilities located within one quarter mile of each other in Manitowoc County, Wisconsin. See the attached Figure 1 for the general location of the sites. The Branch River, which drains into Lake Michigan, is located less than one mile west of both sites. The river is used for recreational activities including fishing and canoeing.

The Branch River is designated as an exceptional resource water and is protected as a Great Lake aquatic community. It is noted for its annual Steelhead trout spawning runs and is managed as a smallmouth bass stream. The LL site consisted of about 21 acres which were used for waste disposal, while the LTR site consisted of 16 acres which were used for industrial landfilling. Both sites were unlined and portions of both sites cover areas that contained gravel quarries. Land in the vicinity of the sites is rural and agricultural. Four residences are located within 1000 feet of the sites. The groundwater is used by residents as a drinking water supply and for agricultural purposes.

There are two groundwater systems at the sites. Within the upper granular unit is a localized perched aquifer identified for this project as the Upper Groundwater System (UGS). The second groundwater system consists of a lower aquifer composed of dense sandy gravel and gravely sand which is hydraulically connected with the underlying bedrock. This is known as the Lower Groundwater System (LGS). A groundwater divide exists under the LTR site as a result of a bedrock ridge which runs northeast-southwest of the sites. This ridge causes groundwater downgradient of the sites to flow primarily to the northwest, with a component to the southeast on the southeast side of the LTR site.

Lemberger Landfill

Franklin Township used the Lemberger Landfill (LL) site as an open dump for approximately 30 years (1940-1969). In 1969, the Wisconsin Department of Natural Resources (WDNR) licensed the site as a sanitary landfill, meaning it could receive only municipal waste and power plant fly and bottom ash. Industrial waste was diverted to the nearby Lemberger Transport And Recycling (LTR) site. No leachate collection system was installed a the LL site. Past inspections have shown that fly ash and bottom ash were used as daily cover rather than being buried with general refuse. The quantity of municipal refuse disposed of is unknown and it is also unknown whether or how much hazardous or toxic substances were deposited.

When the license for operation of the LL site expired in 1976, the state required that it be properly closed; however, the state allowed the continued disposal of fly ash to bring the site to final grade. In 1980, following complaints by local residents west of the site that contaminated liquids, or leachate had seeped onto their properties, the WDNR ordered the site owners to conduct an investigation to address contamination problems at the landfill. A bankruptcy petition filed on behalf of Lemberger Landfill Inc. in 1983 resulted in termination of investigation activities. In June 1986, the LL site was added to the NPL, and U.S. EPA became the lead agency responsible for the remedial Investigation and Feasability Study (RI/FS).

Lemberger Transport & Recycling

The LTR site operated between 1970 and 1976 under the same license for the LL site. The site ceased operations in 1976 when the WDNR did not renew the license. The wastes were deposited in trenches excavated to a depth of approximately 5 feet. Records of the type and

quantities of wastes were maintained but no specific records were kept to indicate what types of wastes were deposited in each trench. No engineered liner or leachate collection system were installed at the LTR site. The LTR site is documented as having received industrial and hazardous wastes along with a variety of liquids, sludges and slurries between 1969 and 1977. Industrial wastes, including wood tar distillates, aluminum dust, and oil water mixtures were disposed at the site.

The WDNR had expressed concern that the site had not been covered properly, as indicated by wastes exposed at the site surface. Subsequently, in 1982, the WDNR entered into a consent order with Lemberger Landfills Inc. which operated both sites to investigate the extent of contamination at the LTR site.

In 1985, in response to complaints about water quality in area residential wells downgradient of the sites, the WDNR sampled several of the wells. Sample results indicted that the groundwater from these wells was contaminated with violatile organic compounds (VOCs) above water quality standards. Between 1985 and 1987, these wells were abandoned and replaced using Wisconsin's Well Compensation Program.

IV. Remedial Actions

A. Remedy Selection

A Record of Decision (ROD) was signed on September 23, 1991. The remedial action objectives were as follows:

- Prevent direct contact, ingestion and inhalation of site related contaminants.
- Provide source control of landfill contaminants to prevent further contamination of groundwater.
- Restore groundwater to State of Wisconsin Preventive Action Limits (PALs).

The remedy for the sites was divided into two operable units. The September 23, 1991 ROD addressed Operable Unit 1 which is a remedy for groundwater contamination from both sites and included a groundwater treatment system and also a source control for the LL site. The components of the OU 1 remedy are as follows:

- Installation of extraction wells and a groundwater treatment system to restore groundwater in the upper and lower aquifers.
- Construction of a Subtitle D landfill cap per State of Wisconsin landfill closure regulations for the LL site.

- Construction of a slurry wall around the perimeter of the LL site.

- Installation of leachate withdrawal wells in the interior of the LL site and a leachate storage system with transport of leachate to a Publicly Owned Treatment Plant (POTW).

- Construction of an outline pipe from the on-site groundwater treatment plant with final discharge to the Branch River.

- Long term groundwater monitoring.

A source control action for the LTR site was not included in the September 23, 1991 ROD because further characterization was required. It was found that the LTR site contained buried drums as well as landfill hotspots U.S. EPA and WDNR determined that condition at the LTR site warranted emergency removal actions to abate conditions that may have presented an imminent and substantial endangerment to the public. On July 15, 1993, U.S. EPA signed a administrative order on consent with the potentially responsible parties to perform removal activities at the LTR site. Removal activities required by the order included:

- Construct a site fence around the perimeter of the LTR site.

- Excavate and dispose of drums.

- Use soil vapor extraction to treat contaminated soils adjacent to the drums and identified landfill hotspots.

- Submit a workplan to install a vapor extraction system for further source removal and also, at a minimum, a Subtitle D landfill cap per State of Wisconsin landfill closure regulations.

U.S. EPA issued a September 29, 1994 ROD for the LTR site source control (Operable Unit 2) which recommended no further action at the site, because it was determined that once all activities required by the administrative order on consent were completed, there would be no further risk at the site.

B. Remedy Implementation

The PRP group, Lemberger Site Remediation Group (LSRG) entered into a Consent Decree with U.S. EPA and WDNR in 1992 to undertake remedial activities at the Lemberger sites. Remedial design for OU 1 was completed in March 1995. The main components of the OU 1 remedial action were construction of the landfill cap at the LL site and the groundwater extraction and treatment system.

The construction of the landfill cap portion of the remedial action began in July 1995. The landfill cap is composed of the following layers from ground surface downwards: a vegetative layer, a cover soil layer, a geotextile layer separating the cover soil layer and a sand drainage layer, the sand drainage layer to transmit water collected above the clay barrier layer, the clay barrier layer, a second geotextile layer, a sand gas control and foundation layer and a prepared subgrade. A gas venting system consisting of gas vents and slotted risers connects into the gas control and foundation layer which lies below the clay barrier.

Approximately 44,000 cubic yards of solid waste were also relocated from the fringes of the landfill into designated areas within the landfill. A slurry wall was constructed around the landfill perimeter and keys 3 feet into the underlying clay layer, whenever the clay layer was present. A leachate collection system was also constructed at the landfill with leachate collection wells and piping located just inside the slurry wall. The leachate system consists of a number of leachate extraction wells and leachate head wells which measure the height of leachate present in the landfill. The landfill cap and its associated components were completed in August 1996.

Construction of the groundwater extraction and treatment system began in 1996. The extraction wells were installed in both the UGS and LGS systems. Ground water quality is evaluated through a network of monitoring wells and residential wells. Observation wells were installed to assess the hydraulic effectiveness of the extraction wells. The extraction wells discharge to an air stripper type treatment facility. Effluent from the treatment facility is discharged to the Branch River and effluent quality is required to meet limits contained in the facility's Wisconsin Discharge Elimination System (WPDES) permit. Leachate storage tanks are also located at the treatment facility to receive leachate from the landfill leachate collection system. Leachate is trucked off-site for treatment and disposal.

A prefinal inspection was conducted for OU 1 on August 27, 1996 and a list of outstanding items was developed. The final inspection conducted on September 25, 1996 found that these items had substantially been completed. A Preliminary Closeout Report documenting construction at the site was signed on September 9, 1996.

Removal activities, pursuant to the July 15, 1993 Administrative Order on Consent (AOC), for OU 2 started in August 1993. A work plan for the excavation and removal of drums from the LTR site was approved by U.S. EPA in November 1993. On November 23, 1993, field activities related to the excavation and removal of the drums started. The excavation and classification of the drums was completed in April 1994. A total of 1380 drums were excavated and put into overpack drums. In addition, 180 laboratory-type jars and 226 gas cylinders were found during excavation activities. All drums, laboratory jars and cylinders were disposed of in a U.S. EPA approved facility.

Finally, as part of the AOC for OU 2, the LSRG submitted a workplan for the design and construction of a soil vapor extraction system and a subtitle D landfill cap. Prior to construction it was determined that the soil vapor cap would not be effective in removing VOCs from the

source and therefore the soil vapor extraction system was not constructed. As an alternative remedy, U.S. EPA, required a composite landfill cover be constructed. In order to provide a similar level of protection, the composite landfill cover was selected to provide for a greater reduction of infiltration through the source materials than would be afforded by a subtitle D landfill cap that would have been constructed as part of the soil vapor extraction remedy. A prefinal inspection was conducted on OU 2 in October 1996. A Preliminary Closeout Report for OU 2 was signed on October 22, 1996.

C. Systems Operations

The Operation and Maintenance Plan submitted by Malcolm Pirnie Inc. was conditionally approved by U.S. EPA, with concurrence by WDNR, on March 8, 1995 and finalized in April 1996. The Operation and Maintenance Plan was again modified in February 1997 by RMT Inc. system operation requirements include:

- After the first year of operation, a site inspection will be conducted semi-annually of landfill cover integrity, site fencing, the erosion control system, landfill gas venting system, leachate collection wells, gas probes and all site wells.
- Multiple frequency monitoring of residual wells, groundwater monitoring wells, gas monitoring probes and leachate quality.
- On going maintenance of the landfill cap and its components.
- For the first three years of operation, ecological monitoring of the Branch River including analysis of surface water, sediment monitoring and benthic macro invertebrates.
- Ongoing monitoring of treated effluent and Branch River surface water quality.

Cap system maintenance has generally been limited to mowings and erosion control repairs at both the LL and LTR sites. There has been an ongoing need to replace pumps/pump motors in the leachate withdrawal wells located within the LL site. In December 1999, the WDNR observed that the leachate withdrawal wells had been down a significant percentage of time and volume of leachate removal had consequently decreased. It was requested that LSRG develop a preventative maintenance plan to correct this situation. LSRG has concurred with WDNR's observation and will develop a preventative maintenance plan with an objective of increasing on-line efficiency to > 95 percent.

There have also been problems to a lesser extent with pumps in the groundwater extraction wells. A four month downtime occurred in one of the higher capacity groundwater extraction wells due to pump failure. The LSGR has been advised that a downtime of this duration is not acceptable. The groundwater treatment plant has been operating well with only routine type maintenance required.

Since the groundwater treatment and extraction system has only been in operation approximately 3 years, no clear trend in O&M costs has been established. Table 2 lists annual costs to date for the site. The O&M costs in Table 2 include monitoring, analytical, system repairs (landfill & groundwater system), utilities, operator salary and also all time expended for LSGRs consultants to prepare reports and provide general oversight of the facilities. It can be seen that the LSGR expends a substantial amount of money per year to maintain the remedy.

Table 2: Annual O&M Costs

Dates From	 To	Total Cost rounded to nearest $1000
3/97	12/97	$385,000
1/98	12/98	$713,000
1/99	12/99	$501,000
1/2000	7/2000	$236,000

V. Five Year Review Process

The Lemberger sites five year review was prepared by Darryl Owens, Remedial Project Manager for the Lemberger sites. Jennifer Huffman, P.G., Hydrogeolgist and Gary Edelstein, P.E., Engineer, with the WDNR also assessed in the review. The five year review consisted of the following activities: a review of relevant documents (see Attachment 1), interviews with LSGR's consultants, RMT Inc., interviews with treatment system operations personnel and a site inspection. The completed report will be available in the information repository. Notice of its completion will be placed in the local newspaper and local contacts will be notified by letter.

VI. Five Year Review Findings

A. Site Inspections

Representatives of U.S.EPA, WDNR and RMT on behalf of LSRG took part in a site inspection on September 13, 2000. The inspection evaluated the landfill caps on the Lemberger Landfill site and also the Lemberger Transport site, the groundwater treatment system, the surface water drainage system for the landfills, monitoring well and extraction well conditions and fencing around the landfill caps.

Conditions during the inspections were favorable with mild temperatures and no precipitation. There had been significant precipitation within the last 10 days. The landfill caps had been recently mowed which facilitated inspection on the caps. The landfill caps were found to be in good condition with no signs of erosion. The vegetative covers on the landfills were well established with no bare spots nor any tree or bush growth. The LL vegetative cap was better established than the LTR cap, however, the vegetative cap on the LTR was still acceptable. No noticeable depressions, cracks, leachate seeps or other indications of distress were noted. Wetlands adjacent to the LL cap were inspected for the presence of leachate seeps and none were found. The extensive drainage systems appeared to be working properly. One section of fence at the LTR was leaning. RMT indicated that a contractor who had been performing some work at the LTR site had hit this section of fence the previous week. Repair of the fence has been scheduled.

The air stripper type groundwater treatment system was found to be operating and functioning properly. No problems or odors were observed associated with the air stripper. Groundwater extraction well 4I was not in operation at the time of the inspection because a pump motor had been damaged by lighting. Parts have been ordered and the extraction well should be operational by October 2000. Extraction and monitoring well covers were intact and locked. Two monitoring well nests, (RM-4 and RM-5) adjacent to the LL cap had damaged surface seals which could possibly allow runoff to seep into the groundwater. RMT agreed to make these repairs.

During the inspection, the Agencies determined that samples collected to represent groundwater quality concentrations of the extraction wells were obtained from a sample tap in the treatment plant and could not at the well head. The approved O&M plan requires the samples to be collected at the well head. The approved O&M Plan requires the samples to be collected at the well head to obtain samples that more accurately reflect actual groundwater quality. RMT agreed to perform the sampling as required in the O&M plan.

B. Risk Information Review

Numerous standards were identified as applicable or relevant and appropriate requirements (ARARs) in the ROD for the Lemberger Landfill site. While numerous ARARs were identified,

the followir g are considered to be the most important:

- Standards for Landfill Cap Design (NR 504, Wis. Adm. Code)
- Safe Drinking Water Act(40 CFR Parts 141-146)
- Preventive Action Limits (PALs) and Enforcement Standards (ESs) for groundwater (NR 140, Wis. Adm. Code)
- Wisconsin Pollution Discharge Elimination System (WPDES) requirements of the Clean Water Act (402) and the Wisconsin Administrative Code (Chs. NR 102, NR 104, NR 106, NR 108 and NR 207)

The groundwater cleanup standards from the ROD are as shown on the attached Table 5 from the Lemberger Landfill ROD dated September 23, 1991. For each chemical, the cleanup standards are either Maximum Contaminant Limits (MCLs) from the Safe Drinking Water Act or State of Wisconsin PALs, whichever is more stringent. Where MCLs and PALs did not exist for a chemical, risk-based cleanup standards were used. Some standards for the contaminants of concern have changed and some standards have been added for new compounds since the signing of the ROD in 1991. The new MCL for Beryllium is less stringent and an MCL has been established for bis (2 ethyl hexyl phthalate) which is less stringent than the risk-based cleanup standard established in the ROD. All other applicable MCLs have remained the same.

There have been a number of changes in the PALs since the signing of the ROD. The PALs for 1,1 Dichloroethene, Trichloroethene, Tetrachloroethene, Toluene, Xylene, Barium, Chromium, Selenium and Vinyl Chloride have become less stringent. The PALs for 1,2 Dichloroethene (cis), Cadmium, lead and Methylene Chloride have become more stringent. A PAL has been added for bis (2 ethyl-hexyl) phthalate which is more stringent than a risk based standard in the ROD. Those contaminants that have PALs which have become more stringent or that have a new PAL are of greatest concern to the Agencies in evaluating the protectiveness of the remedy. In regard to the standards for the four contaminants that have become more stringent, and the one contaminant that has a new PAL, only 1,2 Dichloroethene (cis) would be considered to be a contaminant of primary concern for the site. While the other contaminants have groundwater cleanup standards, they are not found in site monitoring wells with the same frequency as 1,2 Dichloroethene (cis) nor are they of as high a concentration as 1,2 Dichloroethene (cis) has been found.

The PAL for 1,2 Dichloroethene (cis) has changed from 10 ug/l to 7 ug/l. The contaminant 1,2 Dichloroethene is not a carcinogen (cancer causing) but does have non-carcinogenic risks associated with it. Review of risk tables prepared by Region 3 of U.S.EPA indicated that a 1,2 Dichloroethene (cis) concentration of 61 ug/l would have a hazard index of 1. For non-carcinogenic contaminants, risk is quantified by calculating the hazard index which is the ratio of estimated exposure to the acceptable daily intake. A hazard index greater than 1 indicates that

adverse effects may be possible. Both the previous PAL of 10 ug/l and the current PAL of 7 ug/l are well below the 61 ug/l concentration that could present a risk. In addition, the risks of a concentration of 10 ug/l of 1,2 Dichloroethene (cis) and 7 ug/l would be approximately the same.

As noted above, although Lead, Cadmium, Methylene Chloride and bis (2ethyl-hexyl) phthalate either have new or more stringent PALs, they are not found with the same frequency nor as high a concentration as 1,2 Dichloroethene. A baseline sampling of groundwater was performed in 1996, prior to the start of groundwater pumping which represents the initial groundwater quality at the site. In the 1996 sampling, lead was found in monitoring wells at concentrations ranging from 1-10 ug/l. The current PAL for lead is 1.5 ug/l. During 1997 and 1998 sampling, lead was found less frequently and has not been found in 1999 or 2000 sampling events. Similarly, Methylene Chloride was found sporadically in monitoring wells from 1996 through 1998 at concentrations of approximately .5 ug/l which is the current PAL. Methylene Chloride has not been detected in monitoring wells in 1999 or 2000 sampling events. Bis (2 ethyl-hexyl) phthalate was also found sporadically during sampling events during 1996 through 1998. Some of the results had laboratory qualifiers indicating that reported quantities were estimated. Bis (2 ethyl-hexyl) phthalate was not found during 1999 or 2000 sampling events. Cadmium was not found in monitoring well sampling events from 1996 through 1999. During sampling events in 2000 Cadmium was detected at concentrations ranging from approximately .75 ug/l to 1.2. ug/l. The current PAL for Cadmium is .5 ug/l. It should be noted that the analytical results for Cadmium in 2000 had laboratory qualifiers and may not represent exact concentration. Given the absence of Cadmium in the prior site sampling, these Cadmium values may be somewhat questionable.

Based on the above discussion, U.S.EPA does not see the need to adopt the new (current) PALs as cleanup standards for the site for 1,2 Dichloroethene, Lead, Cadmium, Methylene Chloride or Bis (2 ethyl-hexyl) phthalate. U.S. EPA has determined that the current remedial actions at the site remain protective when evaluated against these new standards.

See Table 3 below for a comparison of site cleanup standards versus new (current) MCLS/PALS.

Table 3-Changes in Chemical Specific Standards

Contaminant	Media	Site Cleanup Level (ug/l)	Standard (ug/l)		Source
Beryllium	Ground-water	1 ug/l	Previous	1 ug/l	EPA MCL
			New	4 ug/l	EPA MCL
Bis (2ethyl-hexyl) Phthalate	Ground-water	2ug/l	Previous	2 ug/l	Risk-based
			New	0.6* ug/l	WDNR PAL

Methylene Chloride	Ground-water	15ug/l	Previous	15	WDNR PAL
			New	0.5 ug/l*	WDNR PAL
1,1 Dichloro-ethene	Ground-water	0.024ug/l	Previous	.024 ug/l	WDNR PAL
			New	0.7 ug/l	WDNR PAL
1,2 Dichloro-ethene	Ground-water	10 ug/l	Previous	10ug/l	WDNR PAL
			New	7ug/l*	WDNR PAL
trichloroethene	Ground-water	0.18ug/l	Previous	0.18 ug/l	WDNR PAL
			New	0.5 ug/l	WDNR PAL
tetrachloro-ethene	Ground-water	0.1ug/l	Previous	0.1 ug/l	WDNR PAL
			New	0.5 ug/l	WDNR PAL
toluene	Ground-water	68.6 ug/l	Previous	68.6 ug/l	WDNR PAL
			New	200 ug/l	WDNR PAL
xylene	Ground-water	124 ug/l	Previous	124 ug/l	WDNR PAL
			New	1 mg/l	WDNR PAL
barium	Ground-water	200 ug/l	Previous	200 ug/l	WDNR PAL
			New	400 ug/l	WDNR PAL
cadmium	Ground-water	1 ug/l	Previous	1 ug/l	WDNR PAL

			New	0.5 ug/l*	WDNR PAL
lead	Ground-water	5 ug/l	Previous	5 ug/l	WDNR PAL
			New	1.5* ug/l	WDNR PAL
chromium	Ground-water	5ug/l	Previous	5ug/l	WDNR PAL
			New	10 ug/l	WDNR PAL
selenium	Ground-water	1 ug/l	Previous	1 ug/l	WDNR PAL
			New	10 ug/l	WDNR PAL
vinyl chloride	Ground-water	.0015 ug/l	Previous	.0015 ug/l	WDNR PAL
			New	0.02 ug/l	WDNR PAL

* More Stringent PAL

The action-specific State of Wisconsin ARARs for landfill construction have not changed since the signing of the ROD and thus the landfill cap remains protective. In addition, the on-site treatment plant has been effective in removing volatile organic contaminants and is in compliance with its WPDES permit issued by the State of Wisconsin under the Clean Water Act.

C. Data Review

A review of records and semi-annual progress reports submitted by the LSRG through March 2000 indicates that approximately 366 million gallons of contaminated groundwater have been pumped and treated since startup in March 1997. Pumping rates have remained essentially constant. Data review was performed on a number of issues which are as follows:

Groundwater Extraction System

Trichloroethene (TCE), 1,1,1,trichloroethane (TCA) and 1,1 dichloroethene (DCE) are the volatile organic compounds (VOCs) found most commonly and at the highest concentrations. See attached Figure 2 delineating the current extent of the plume under pumping conditions as defined by TCE concentrations. In individual extraction wells, none of the compounds show a discernible long term trend in VOC concentrations. It should by noted that samples collected to date were obtained from a sample tap in the treatment plant and not at the extraction well head.

The results representing concentrations at the extraction wells could by altered by long travel distances from the well head to the sample tap in the treatment plant. Pressure changes and sample aeration along the route could cause a loss of VOCs and compromise data quality.

The lack of a discernable trend in VOC concentrations in the extraction wells is illustrated in two figures (Figure 13 and 15) from the March 2000 semi-annual progress report which show the concentrations of TCE and DCE in several extraction wells over time. Concentrations of VOCs are highest at the source area and lower at downgradient points.

In order to assess the effectiveness of the groundwater pumping, the LSGR tasked its consultants Malcolm Pirnie, Inc. to update the groundwater modeling dine during the design phase. Using the data to collected from an actual operation, a report was prepared in October 1998 which came to the following conclusions:

- The actual groundwater contaminant plume, as defined by groundwater monitoring over a 2 year period is smaller than the plume defined in the ROD and for which the groundwater recovery system was designed.

- Notwithstanding the fact that the groundwater plume is smaller than originally thought, the current recovery system (i.e., existing well locations and set-point pumping rates) is not capturing the entire (actual) plume.

Since the report showed that the plume was not being contained, the LSRG tasked RMT Inc. to perform additional modeling to evaluate alternatives to improve capture effectiveness. In June of 1999, LSRG submitted a report to the Agencies entitled "Groundwater Modeling Report and Plan for Recovery System Enhancements at the Lemberger Superfund Sites" recommending modifications to the present groundwater extraction system. The report considered two different courses of action or goals. The first was to increase pumping at the fringe of the plume to increase containment and the second was to increase pumping near the source of the contamination, thereby reducing contaminant mass. Increased pumping at the fringe of the plume would increase containment but would not recover significant containment mass because concentrations at the fringe of the plume are relatively dilute. Conversely, increasing the pumping near the source would significantly reduce containment mass, but would only marginally increase containment. However, by removing containment mass at the source, over a period of time, full containment could be achieved.

In evaluating the tradeoffs between the two goals, the LSRG chose the goal of increased pumping to remove containment source based on the following reasons:

- The extraction wells at the fringe of the plume are recovering relatively dilute concentrations of VOCs. No impacts are evident at water supply wells downgradient of these extraction wells. Thus, the system appears to be protective under the current pumping program.

- The pipelines from the wells on the fringe of the plume are of significant capacity to allow for the pumping of significant amounts of additional capacity. The wells are over a mile from the treatment facility and thus construction of new piping would be of considerable cost.

- A better use of resources would be to pump additional water from closer to the source and nearer to the treatment facility. This would accomplish a higher degree of mass removal, and would preclude the continued spreading of contaminants through the plume.

- In addition to constraining the spread of the plume, this approach leads to a reduction in the size of the plume. As the plume retracts, the need for pumping at the downgradient locations can be eliminated. This can be accomplished in less time when compared to the status quo or under additional downgradient pumping.

The Agencies concur that the concept of increased pumping near the source to remove greater contaminant mass is the best long term approach to achieve the goal of restoration of groundwater in the aquifer. The fact that, even under the current pumping system, downgradient water supply wells are not at risk is also important. Agency approval of the modification of the pumping system will require that these downgradient water supply wells continue to be monitored.

The June 1999 report contained computer modeling of a number of pumping scenarios. The recommended scenario if Scenario 1. The recommended scenario would include 2 new extraction wells, with one well (EW-6D) located at the boundary of the source area and the second well (EW-7D) located approximately 1200 feet downgradient of the source boundary. Current Extraction Well EW-5 would also be taken off line and a new monitoring well would be installed on the western edge of the plume for an accurate definition of groundwater conditions in this area.

See the attached figure 4 from the June 1999 report for the location and pumping effects of the new wells in Scenario 1. This can be compared against the attached Figure 3 from that report which is called the base case and represents the current pumping system. The addition of these 2 new extraction wells would increase the pumping rate of the entire system from the current 200 gallons per minute (gpm) to 300 gpm. The Agencies have asked LSRG to perform some refinement of the computer modeling in the June 1999 report in order to assure that the proposed modifications will be as appropriate as possible. These refinements are near completion and are not expected to change the recommended modifications. The final version of the June 1999 report will be placed in the local information repository for public review.

Leachate Levels in Leachate Head Wells

Review of the semi-annual progress reports has identified an additional issue at the Lemberger Landfill site regarding head levels in the leachate head wells. As part of the remedial action at the LL site, a slurry wall had been constructed around the perimeter of the landfill to contain contaminated ground water and leachate. Leachate withdrawal wells were also constructed adjacent to the slurry wall to remove leachate and to maintain an inward groundwater gradient for further prevention of contaminant migration. Leachate head wells were installed to measure the level of leachate within the slurry wall. The operation and maintenance plan approved in 1996 had specified a leachate compliance level in the head wells of 1 foot above the clay confining layer, and required contingency measures, such as converting existing head wells to leachate withdrawal wells, should leachate head levels become stable, increase or weren't decreasing at an acceptable rate. The concern was that if leachate pooled over the clay confining layer beneath the landfill, the leachate could migrate through the clay layer and further contaminate the groundwater in the lower aquifer.

The semi-annual progress reports indicate that leachate head levels have consistently and significantly exceeded the 1 foot criteria in many of the wells. In addition, the head levels in some of the leachate head wells were above landfill wastes. A meeting was held in March 2000 between the Agencies, LSRG and RMT Inc. to discuss the situation. LSRG/RMT expressed some concerns about converting the leachate head wells to leachate withdrawal wells. It had been planned that the head wells would be constructed to allow a conversion, if necessary, to leachate withdrawal wells. LSRG/RMT indicated that this had not actually occurred and that the landfill cap would have to be breached in order to construct new wells, if more interior leachate withdrawal was to be required. Additionally, LSRG indicated that the liquids in the wells might not be considered "leachate strength" in that sampling from the current leachate withdrawal wells on the perimeter of the landfill gas shown relatively low concentrations of VOCs. However, it was acknowledged that the leachate withdrawal wells draw some water from outside of the slurry wall, which could be diluting the samples.

It was agreed at the March 200 meeting that LSRG/RMT could sample the leachate head wells to determine the concentrations of contamination present in the wells and that the Agencies would consider these sampling results in making a final decision. The sampling of the leachate head wells occurred in July 2000. Preliminary indications from LSRG/RMT regarding the sampling results indicate that significant VOC contamination was detected. LSRG/RMT submitted a report on September 15, 2000 documenting sampling results and making recommendations for further action. The Agencies will now begin review of this report.

Residential Well Monitoring Program and Results

The long term groundwater monitoring program at the Lemberger Sites includes the sampling and analysis of groundwater from 23 residential wells serving 24 homes. The monitoring program consists of two subprograms including Group 1 and Group 2.

The wells included in Group 1 receive their groundwater supply from the Lower Groundwater System (LGS). These wells were determined to be at higher risk for contaminants from the Lemberger sites than Group 2 wells because they are shallower and are screened in the Lower Granular Unit (LGU) or upper portions of the bedrock aquifer. These wells are sampled quarterly and are currently analyzed for VOCs and basic field parameters. Group 1 includes wells GR13, GR14, GR15, GR16, GR27, GR31, GR33, and GR41. Sample results from all of the wells in this group, except GR13 and GR1, have not shown detectable concentrations of VOCs during the long term monitoring program. Results from wells GR13 and GR41 have consistently shown concentrations of 1,1,1-trichloroethane and 1,1-dichloroethane, however, results have been less than the Enforcement Standard (ES) found in NR 140, Wis. Adm. Code, during the long term monitoring program.

The wells in Group 2 also receive their groundwater supply from the LGS. However, these wells meet the construction requirements for new water supply wells constructed in the area of the groundwater contamination from the Lemberger sites. The construction of these wells includes a minimum casing length that requires the wells to be cased deeper into the bedrock aquifer and beyond the expected vertical extent of contamination from the Lemberger sites. These wells were determined tp be at lower risk for contamination from the Lemberger sites and are sampled annually. Samples are currently analyzed for VOCs and basic field parameters. Group 2 wells include GR08, GR09, GR10, GR11 (which supplies water to two residences), GR12, GR17, GR24, GR25, GR26, GR30, GR60R, GR62, GR63, GR64, and GR65. Wells GR08, GR09, GR10, GR11, GR12, GR17, and GR30 are replacement wells of the original water supply wells found to be contaminated in 1985. Well GR60R is as replacement well for GR60 which has abandoned and replaced during remedial design activities because of contamination from the Lemberger sites. Sample results for wells in Group 2 have not shown detectable concentrations of VOCs from the Lemberger sites. The owner of well GR17 has not allowed sampling of this well since September 1997.

Branch River Ecological Monitoring Program and Results

The Branch River is the receiving water body of treated effluent from the groundwater treatment plant for the Lemberger sites. To minimize potential impacts on the Branch River ecosystem, the treatment facility is required to meet discharge limits established by the WDNR. Surface water, sediment, and macro invertebrate samples are also collected as part of the Branch River Ecological Monitoring Program. The monitoring program is designed to assess chemical and biological changes in the water quality, river sediments, and benthic macro invertebrates over the first three years of operation of the groundwater treatment system. Based on results from samples collected to date during the ecological monitoring program, the discharge has not affected the water quality, sediment quality, or the macro invertebrate community in the Branch River.

Quarry Operations

An additional issue which may have an impact on the groundwater extraction system is the possible initiation of quarry operation on the western boundary of the LTR site. The WDNR advised the Town of Franklin, the local permitting authority, that blasting and mining during quarry operations could impact groundwater flow direction and potentially impact the ability of the groundwater extraction system to capture the contaminant plume. WDNR also expressed concern that quarry operations could generate contaminated water as part of any dewatering operations. The Town of Franklin has advised the party conducting the quarry operations that operations be stopped. The party was advised that no permit has been issued for excavation by the Board of Appeals and that it is in violation of the Zoning Ordinance. The party was advised that it must file the necessary applications to continue whatever project that it is intending to pursue.

VII. Assessment

The following conclusions support the determination that the remedy at the Lemberger sites is expected to be protective of human health and the environment upon completion.

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

- **Implementation of Institutional Controls and Other Measures:** Fencing around the LTR and LL sites is intact (one panel damaged) and successfully prevents trespassing. The issue of the proposed quarry adjacent to the LTR site is currently being evaluated by the Town of Franklin. The Agencies will await the outcome of this issue and take appropriate action, if necessary.

- **Remedial Action Performance:** The landfill cover systems have been effective in isolating wastes and preventing infiltration of rainwater into landfill wastes which could cause contaminant migration to groundwater. As previously discussed, some minor erosion has occurred but it does not effect the performance or integrity of the landfill cover systems. The current groundwater extraction system is not able to capture the entire contaminant plume. The LSRG has proposed the addition of 2 extraction wells located close to the contaminant source to provide greater source removal and containment of the entire contaminant plume. The level of leachate in the leachate head wells located in the LL landfill also appears to be above acceptable levels and the LSRG has recently submitted a report evaluating the leachate problem. The groundwater treatment plant is working well and has consistently met its effluent discharge requirements.

- **System Operations/O&M:** The O&M of the landfill covers has been satisfactory. The LSRG needs to implement its plan of keeping leachate

withdrawal wells operational at a level of at least 95% of the time. LSRG also needs to assure that there will not be any further significant downtimes for the groundwater extraction wells. The groundwater treatment plant is operating consistent with requirements.

- **Cost of System Operations/O&M**: As noted above, the LSRG is spending significant money to operate and maintain the system. Since the remedy has only been in operation for 3 years, an annual O&M budget trend has not been established.

- **Opportunities for Optimization**: The LSRG has recommended modifications to the groundwater extraction system which currently is not capturing the entire contaminant plume. The LSRG has recommended additional extraction wells located closer to the source (source removal) rather than the placement of additional extraction wells on the fringe of the plume (containment) as the best means of achieving the goal of groundwater restoration. Transport groundwater modeling was used to determine the optimum placement of the new extraction wells.

- **Early Indicators of Potential Remedy Failure**: As noted above, the current groundwater extraction system is not capturing the entire contaminant plume. While it still appears that groundwater extraction is an appropriate remedial action at the site, modification will be required to achieve the goal of groundwater restoration. The levels of leachate within the LL site may also require a modification to the leachate withdrawal system. Monitoring of leachate levels in the landfill and possible modification to the leachate withdrawal system if acceptable leachate head levels were exceeded, were provisions of the O&M Plan. Therefore, this situation was somewhat expected and was planned for during design efforts.

Question B: Are the assumptions used at the time of remedy selection still valid?

- **Changes in Standards and To Be Considered**: This five-year review identified MCLs and PALs that have been established since the RODs were signed. The remedy standards do not need to be revised, however, since the current remedy remains protective when compared against several new and more stringent PALs.

- **Changes in Exposure Pathways:** No changes in the site conditions that effect exposure pathways were identified as part of the five year review. If the proposed quarry adjacent to the site does receive approval from the Town of Franklin, the Agencies will have to evaluate what impacts this would have on exposure pathways. No new contaminants, sources, or routes of exposure were identified as part of this five year review. As discussed above, the contaminant levels in the

groundwater have not appreciably changed since pumping began and the present groundwater pumping system does not appear to be capturing the entire plume.

- **Changes in Toxicity and Other Contaminant Characteristics**: Toxicity and other factors for contaminants of concern have not changed.

- **Changes in Risk Assessment Methodologies**: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

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

No additional information has been identified that would call into operation the protectiveness of the remedy.

VIII. Deficiencies

Deficiencies were discovered during the five-year review and also the site inspection and are noted in Table 4. None of these are sufficient to warrant a finding of not protective as long as corrective actions are taken.

Several minor and/or temporary deficiencies were identified during the site inspection. Correction of all these deficiencies are planned in the near future. There are two issues involving the groundwater pumping system which are more major in nature. As discussed, the groundwater pumping system does not appear to be capturing the entire contaminant plume. The LSRG has submitted a report recommending modifications to the system to achieve full capture of the plume. The leachate headwells in the LL site have been found to have levels of leachate present which are above the levels in the approved O&M plan. The LSRG has performed some recent sampling of leachate concentrations in the head wells to better understand the nature of the leachate and has recently submitted a report documenting sampling results and making recommendations for future action.

Table 4: Identified Deficiencies

General Deficiencies	Currently Affects Protectiveness (Y/N)
Groundwater Pumping System System is not totally capturing contaminant plume	N
Leachate Head Wells High level of leachate present in wells	N

Deficiencies Noted at Site Inspection	
Damaged fencing panel	N
Extraction Well 4I temporarily out of operation	N
Sampling of Extraction Wells at treatment plant and not at well head	N
Damaged Surface seals at Monitoring Well Nests RM-4 and RM-5	N

IX. Recommendations and Follow-up Actions

Two major deficiencies have been identified in the operation of the groundwater extraction system for the sites. The groundwater pumping system does not appear to be capturing the entire contaminant plume. Also, the leachate head wells contain leachate above levels contained in the approved O&M plan. The LSRG has submitted recommendations to modify the groundwater pumping system to achieve full capture. The Agencies have requested some reanalysis of the groundwater modeling contained in that report. This reanalysis, in the form of an addendum to the report, was received as of the writing of the report. The LSRG also recently submitted a report with recommendations to address the excess leachate in the leachate head wells.

The site inspection conducted September 13, 2000 noted a few deficiencies which need to be corrected. These deficiencies were a damaged panel of fencing at the LTR Site, deteriorated surface seals at Monitoring Well Nests RM-4 and RM-5 and the temporary outage of Extraction Well 4I. LSRG/RMT are in the process of correcting the fencing and the Extraction Well 4I outage and agreed to repair the surface seals at Monitoring Well Nests RM-4 and RM-5. See Table 5 for a summary of recommendations and follow-up actions for the site deficiencies.

Table 5: Recommendations and Follow-up Actions

Deficiencies	Recommendations Follow-up Actions	Party Responsible	Oversight Agency	Mile-stone Date	Follow-up Action: Affects Protectiveness (Y/N)

Groundwater Pumping System	Begin construction of pumping system modifications	LSRG	EPA/WDNR	May 2001	N
Leachate Head Wells	Implement recommendations of report for leachate level reduction	LSRG	EPA/WDNR	To be determin -ed	N
Site Inspection Deficiencies					
Extraction well 4I temporarily out of operation	Replace pump	LSRG	EPA/WDNR	October 2000	N
Damaged fence panel	Repair fence	LSRG	EPA/WDNR	October 2000	N
Sampling of extraction wells in treatment plant and not at well head	Perform sampling at well head	LSRG	EPA/WDNR	Septemb er 2000 sampling event	N
Deteriorated surface seals at RM-4 and RM-5 well nests	Repair concrete	LSRG	EPA/WDNR	October 2000	N

X. Protectiveness Statements

The protection of human health and the environment by the remedial actions at the Lemberger Landfill site including a cap and the groundwater extraction and treatment system

(Operable Unit 1) and the Lemberger Transport and Recycling site which includes a cap (Operable Unit 2) are discussed below. Because the remedial action at the Lemberger Landfill site is expected to be protective of human health and the environment and the remedial action at the Lemberger Transport and Recycling site is protective of human health and the environment, the remedy for the sites is expected to be protective of human health and the environment.

Lemberger Landfill Site (Operable Unit 1)

The remedy at the Lemberger Landfill (OU 1) is expected to be protective of human health and the environment and immediate threats have been addressed. The landfill cap and slurry wall are effective at preventing infiltration of rainwater, preventing direct contact with soils and preventing the spread of contaminated groundwater. Fencing around the landfill is intact and prevents trespassing at the site. There is no evidence of wetland degradation. The air stripper groundwater treatment plant is operating well and is meeting its discharge permit limits. Surface water, sediment and macro invertebrate sampling of the Branch River demonstrates that the Branch River is not being degraded by the treatment plant discharge. Sampling of residential wells located downgradient of the site have not shown any contaminants above State of Wisconsin Enforcement Standards.

The existing groundwater extraction system is not capturing the entire contaminant plume at this time. The LSRG has proposed the installation of two additional extraction wells to achieve capture of the plume. The Agencies have generally concurred with this recommendation subject to the review and will issue a final approval of LSRG's recommendation after review of some additional background information the Agencies requested on the groundwater modeling which forms the basis of this recommendation. The leachate head wells in the LL currently have leachate levels above those specified in the site O&M plan. The LSRG has performed contaminant sampling of the leachate to provide additional information on this problem. The Agencies will review this analytical data and LSRG's recommendation as to further actions to be taken. As previously discussed, a few deficiencies were identified at the site inspection and will be corrected in the near future. The implementation of these recommendations will necessary to ensure long-term effectiveness of the remedy.

Lemberger Transport and Recycling Site (Operable Unit 2)

The remedy at the Lemberger Transport and Recycling site (OU 2) is protective of human health and the environment. The cap is effective at preventing infiltration of rainwater and preventing direct contact with soils. Fencing around the site is intact and preventing direct contact with soils. Fencing around the site is intact and prevents trespassing at the site. One panel of fencing was observed to be damaged during the site inspection but will be repaired in the near future.

II Next Review

The Lemberger Landfill and Lemberger Transport and Recycling sites are statutory sites that require ongoing five-year reviews. The next reviews will be conducted within five years of completion of this five-year review report. The completion date is the date of the signature shown on the signature cover attached to the front of this report.

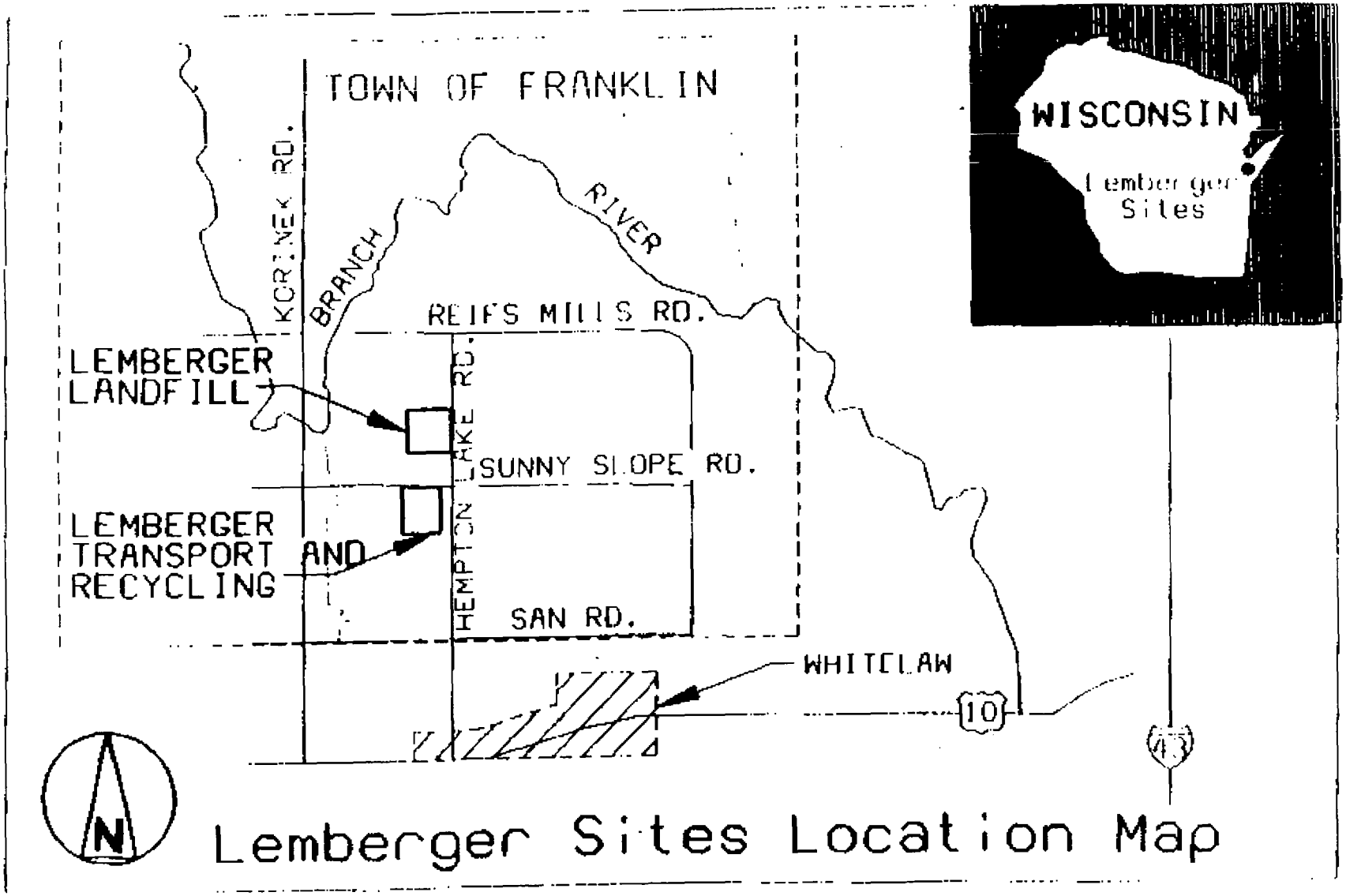

TOWN OF FRANKLIN
KORINEK RD.
BRANCH
RIVER
REIFS MILLS RD.
LEMBERGER LANDFILL
HEMPTON LAKE RD.
SUNNY SLOPE RD.
LEMBERGER TRANSPORT AND RECYCLING
SAN RD.
WHITELAW
10
43
N
WISCONSIN
Lemberger Sites
Lemberger Sites Location Map

Figure 1

Table 5
GROUND WATER CLEANUP STANDARDS

Contaminants of Concern	Cleanup Standards: Risk-Based Cleanup Goals	USEPA Max. Conaminant Level (a)	USEPA Max Contaminant Level Goal (a)	Wisconsin Enforcement Standard (b)	Wisconsin Preventive Action Limit (b)	Maximum Conc. Detected in Groundwater
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Methylene Chloride	5	5 (c)	0 (c)	150	15	5,000
Acetone	1,000	--	--	--	--	14,000
1,1-Dichloroethene	0.06	7	7	7	0.024	200
1,1-Dichloroethane	0.4	--	--	850	85	2,200
1,2-Dichloroethene	200	70 (c)	--	100	10	4,000
2-Butanone	500	--	--	--	--	21,000
1,1,1-Trichloroethane	900	200	200	200	40	3,200
Trichloroethene	3	5	0	5	0.18	510
4-Methyl-2-pentanone	100	--	--	--	--	2,400
Tetrachloroethene	0.7	5 (c)	0 (c)	1	0.1	200
Toluene	3,000	2,000 (c)	2,000 (c)	343	68.6	400
Xylene	1,000	10,000 (c)	10,000 (c)	620	124	480
Bis(2-ethylhexyl)phthalate	2	--	--	--	--	160
Heptachlor	0.008	0.4 (c)	0 (c)	--	--	0.1
Aldrin	0.002	--	--	--	--	0.46
Dieldrin	0.002	--	--	--	--	0.006
4,4-DDT	0.1	--	--	--	--	0.18
Arochlor-1248	0.005	0.5 (c)	0 (c)	--	--	2.7
Arochlor-1254	0.005	0.5 (c)	0 (c)	--	--	2.5
Barium	0.9	1,000	--	1,000	200	1,580
Cadmium	0.01	10	5 (c)	10	1	14.9
Chromium	0.002	50	--	50	5	53.6
Lead	6	50	0 (c)	50	5	8.9
Zinc	2,000	--	--	5,000(d)	2,500(d)	500
Arsenic	0.001	50	0 (c)	50	5	10.9
Beryllium	0.01	1	0 (c)	--	--	2
Manganese	2	--	--	0.05(d)	0.025 (d)	3,280
Mercury	3	2	2 (c)	2	0.2	1.9
Selenium	30	10	50 (c)	10	1	3.5
Silver	30	50	--	50	10	69.7
Chloroform	1.1	100	--	6	0.5	24
Carbon Tetrachloride	0.3	5	0	5	0.5	82
Vinyl Chloride	0.017	2	0	0.2	0.0015	28

(a) Code of Federal Regulations, Chapter 40, Part 241.

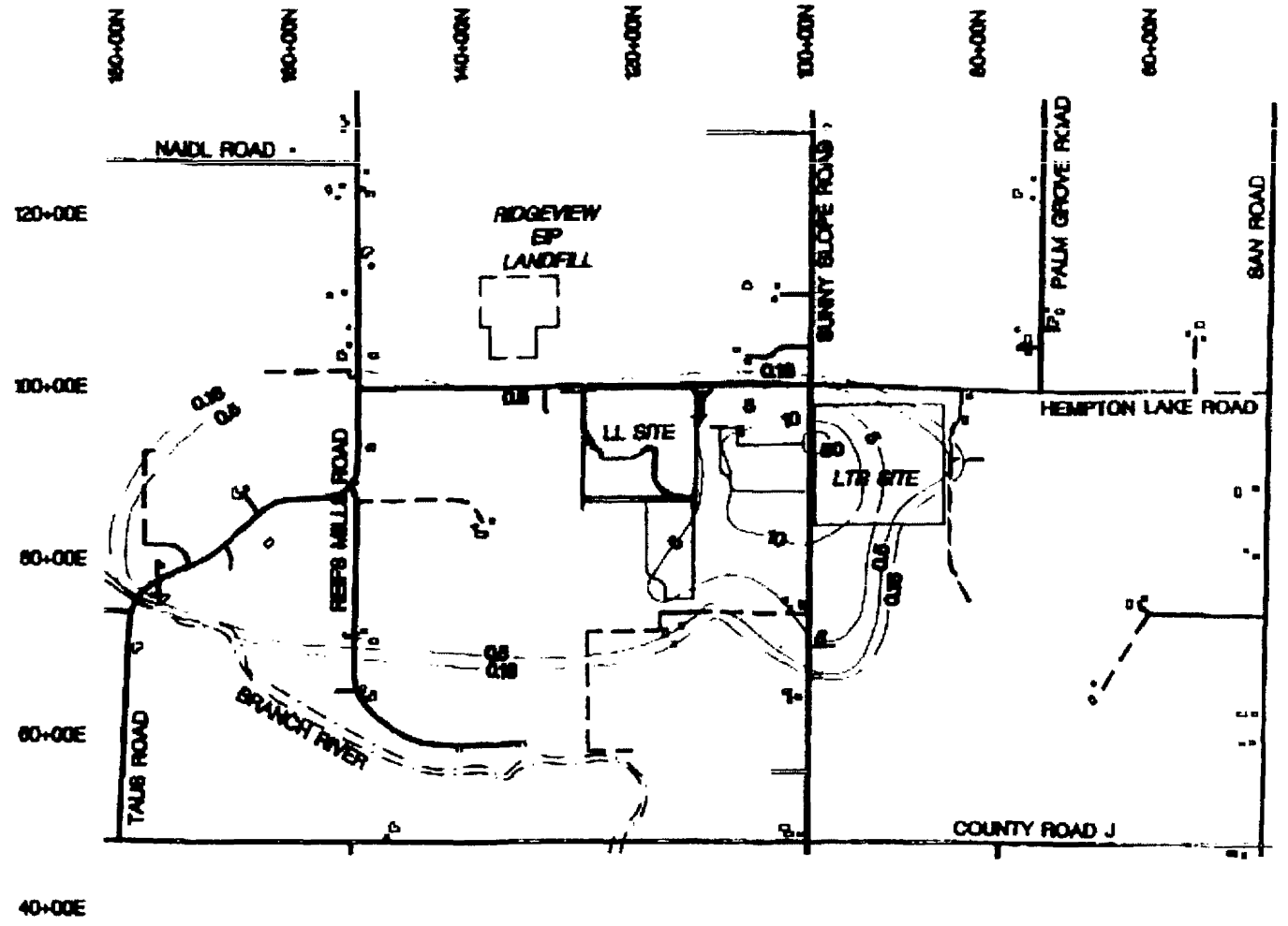
(b) Chapter NR 140, Wisconsin Administrative Code

(c) Proposed Standard.

(d) these standards are based only on public welfare, not public health.

-- indicates that no standard is provided.

Indicates cleanup standard for use for Lemberger sites remedial action

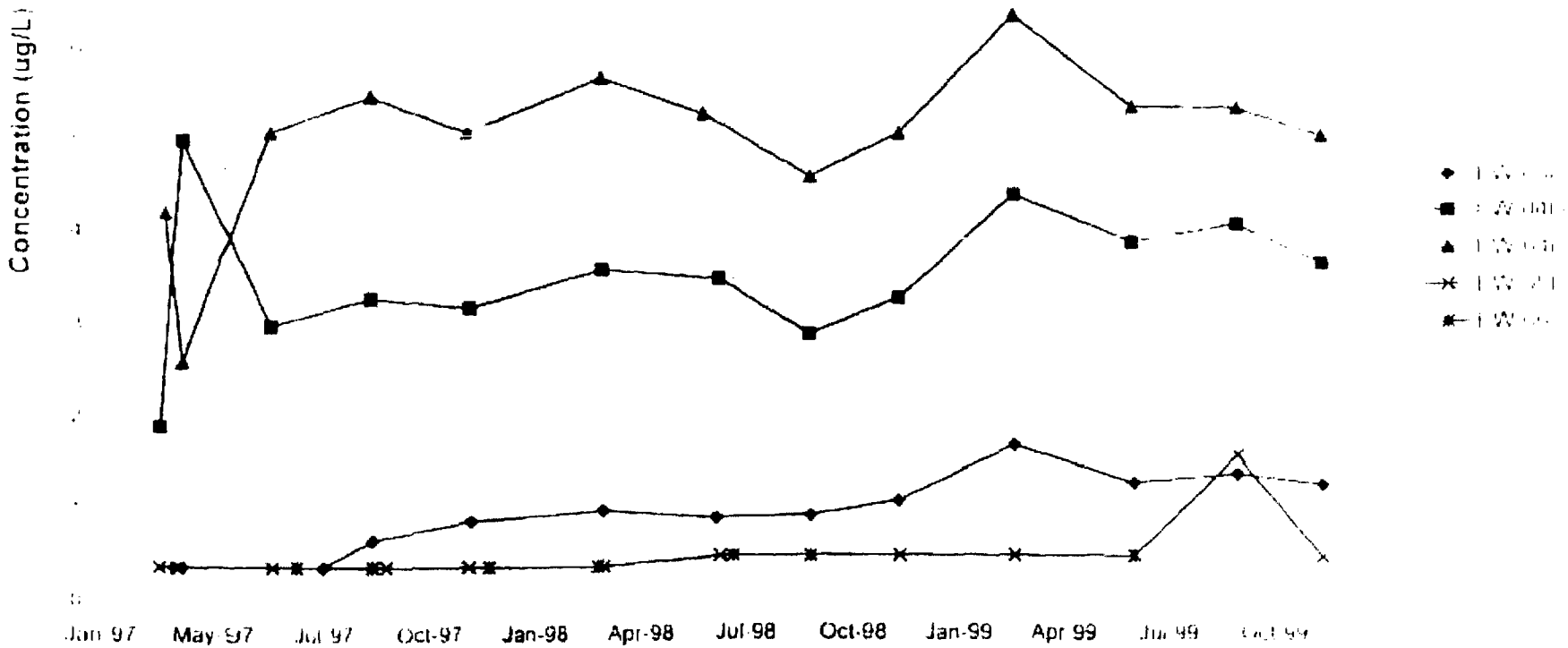


GROUNDWATER TCE PLUME LOCATION
MARCH 2000 (MICROGRAMS/LITER)
LEMBERGER LANDFILL SITE

FILE # 34491103.DWG

Figure 2

Trichloroethene vs. Time



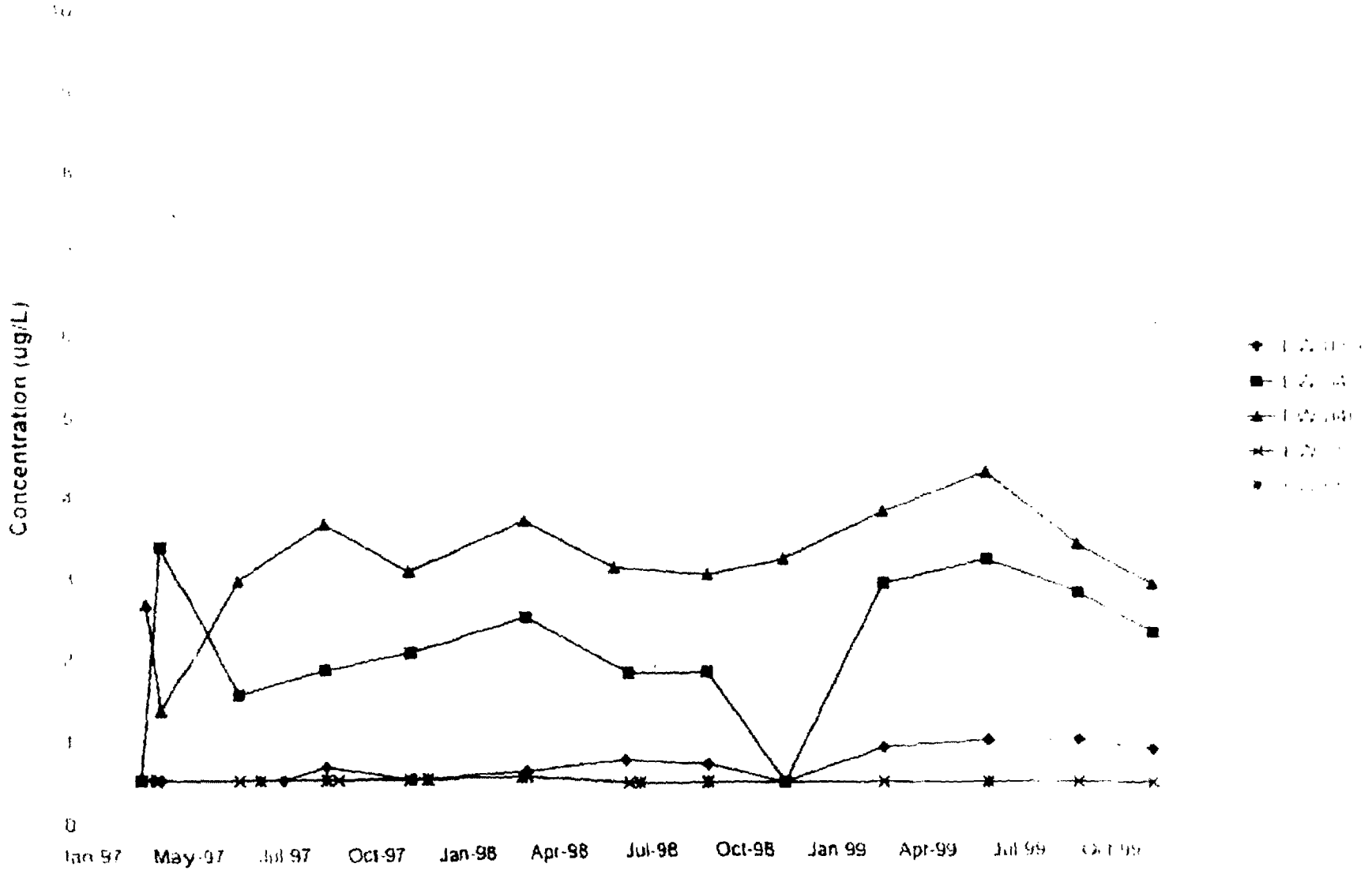
Date

(Pumping start date: March 17, 1997)

Figure 13

Prepared by RMT 3/13/2000

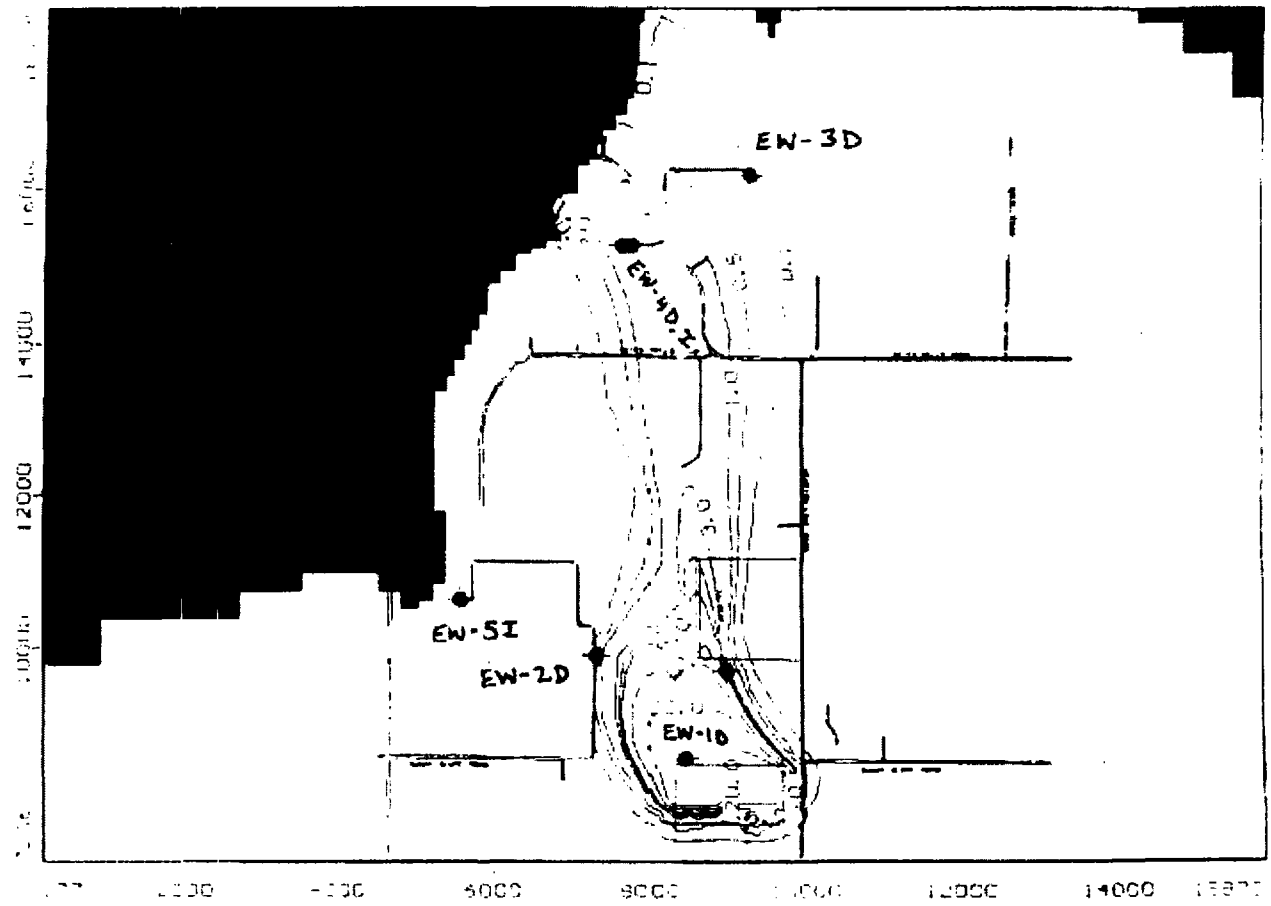
1,1-Dichloroethene vs. Time



(Pumping start date: March 17, 1997)

Figure 15

Prepared by RMT 3/13/2000



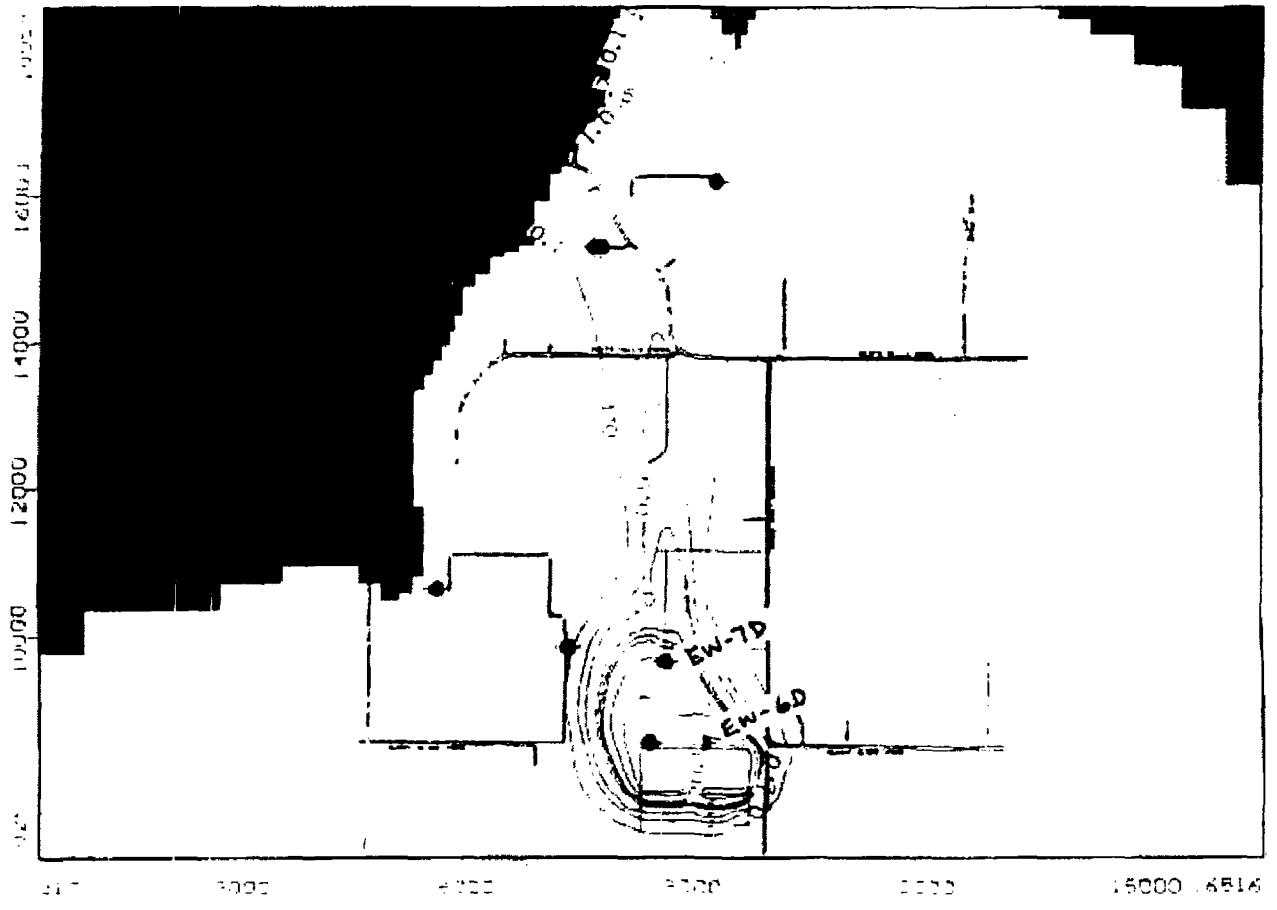
TCE contours in µg/L

RMT
Project Lemberger
Description lem49 ... 20 yrs
Modeller MBG
11 Mar 99

Visual MODFLOW v2.7.2, (C) 1995–1997
Waterloo Hydrogeologic, Inc.
NC 90 NR 110 NL 3
Current Layer 3

BASE CASE

FIGURE 3



TCE contours in µg/L

RMT
Project Lemberger
Description: lem47 (+ 15 yrs
Modeller M9G
9 Mar 99

Visual MODFLOW v2.7.2, (C) 1995–1997
Waterloo Hydrogeologic, Inc
NC 90 NR 110 NL 3
Current Layer: 3

SCENARIO 1

FIGURE 4