United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-88/066
June 1988

EPA

Superfund Record of Decision:

Long Prairie, MN

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-88/066	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Long Prairie, MN
First Remedial Action - Final

5. Report Date 06/27/88

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Long Prairie site, as defined by the extent of the plume of contaminated ground water, extends 2,100 feet by 1,000 feet in Long Prairie, Todd County, Minnesota. The Long Prairie River flows within 500 feet of the contaminant plume. In August and October 1983, routine municipal well monitoring by the Minnesota Department of Health (MDH) indicated contamination in two of five municipal wells. The MDH ordered the two wells shut down in October 1983, and in November 1983, issued an advisory to provide bottled water for area residents. About 50 of the area's 300 private wells were affected by the groundwater contamination. Since the advisory was issued, 39 of the 45 acre homes using contaminated ground water have connected to the municipal drinking water system. Well monitoring in 1984 implicated an area dry cleaning operation as the potential source of contamination. The primary contaminants of concern affecting 7,000,000 gallons of ground water and 3,800 yd^3 of soil are VOCs and include: DCE, PCE, and TCE.

The selected remedial action for this site includes: ground water pump and treatment using air stripping with discharge to the river; spill treatment using active soil venting; and ground water monitoring. The estimated capital cost for this remedial action is $680,000 with annual O&M of $290,000 for year 1 and $150,000 for years 2-5.
(See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision
Long Prairie, MN
First Remedial Action - Final
Contaminated Media: gw, soil
Key Contaminants: VOCs (DCE, PCE, TCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 63
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

EPA/ROD/R05-88/066
Long Prairie, MN
First Remedial Action - Final

16. ABSTRACT (continued)

The estimated present worth cost for this remedial action is $21,706,300 without pretreatment, or #23,078,200 including pretreatment, if necessary.

DECLARATION

SITE NAME AND LOCATION

Long Prairie Ground Water Contamination Site
Long Prairie, Minnesota

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Long Prairie Ground Water Contamination site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300).

This decision is based upon the contents of the administrative record for the Long Prairie Ground Water Contamination site. The attached index identifies the items which comprise the administrative record.

The State of Minnesota has selected and concurred with the remedy.

DESCRIPTION OF THE SELECTED REMEDY

The final ground water remedy for the site was developed to protect public health and the environment by preventing ingestion of contaminants found in the ground water, and by restoring the contaminated aquifer.

The major components of the selected remedy are as follows:

- Install ground water extraction wells in the contamination plume;
- Treat contaminated ground water with an air stripper;
- Discharge treated ground water from the air stripper to the Long Prairie River; and
- Treat contaminated soil with an active soil venting system.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will not result in hazardous substances remaining on-site above health-based levels, the five year facility review will not apply to this action.

6-27-88
Date

Valdas V. Adamkus
Regional Administrator
U.S. EPA, Region V

6-14-88
Date

Gerald L. Willet
Commissioner
Minnesota Pollution Control Agency

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

Long Prairie Ground Water Contamination Site
Long Prairie, Minnesota

I. SITE NAME, LOCATION, AND DESCRIPTION

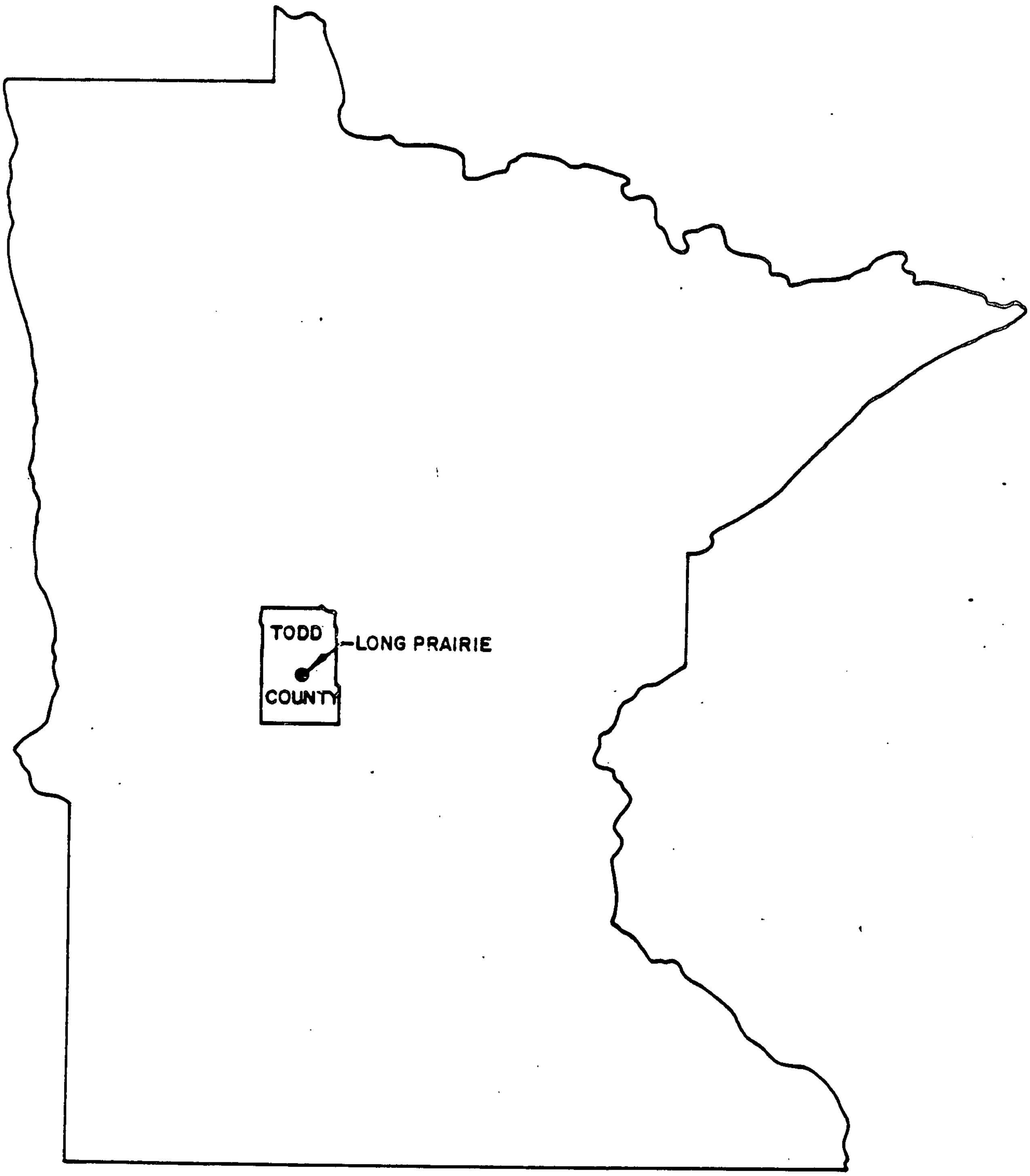
The City of Long Prairie, with a population of about 2,800, is the county seat of Todd County in central Minnesota about 120 miles northwest of Minneapolis/St. Paul (Figure 1). The Long Prairie Ground Water Contamination site (Long Prairie site), as defined by the extent of the plume of contaminated groundwater, extends from the business district in downtown Long Prairie approximately 2,100 feet to the northeast. (Figure 2). The Long Prairie River flows through the city and passes within about 500 feet of the contaminant plume. The city is situated at an elevation of approximately 1,300 feet on the sands and gravels of the Long Prairie sand plain which is a long, narrow glacial outwash plain. The glacial outwash plain is recharged by precipitation and inflow from the Long Prairie River. Surface soils consist of sand and gravel deposited by outwash streams with scattered, discontinuous clay layers. The surface formation is a water-bearing unit which ranges in thickness from 7 to 66 feet. Underlying the outwash deposits is glacial till composed of sandy clay with varying amounts of gravel. The till extends to a depth of at least 200 feet below ground level, and appears to be continuous beneath the site. The till is reportedly underlain by Precambrian igneous and metamorphic bedrock. The bedrock is not considered an aquifer. Generally, ground water flow at the site is toward the north-northeast, unless locally influenced by pumping. Ground water not withdrawn by production wells is eventually discharged to the Long Prairie River.

Prior to discovery of the ground water contamination, five municipal wells served approximately 2,400 people in Long Prairie. After the ground water contamination was detected, two wells were shut down and a new well was installed. In addition, prior to the contamination approximately 300 private wells served about 440 people in Long Prairie. About 50 of the private wells are located in the northeast quarter of the city which is affected by the ground water contamination. The wells are set in the glacial outwash sand and gravel and are screened at elevations ranging from 10 to 76 feet below ground surface.

Land use in the vicinity of the site consists of light industry and commercial establishments near the plume origin in downtown Long Prairie and residential dwellings throughout the rest of the plume.

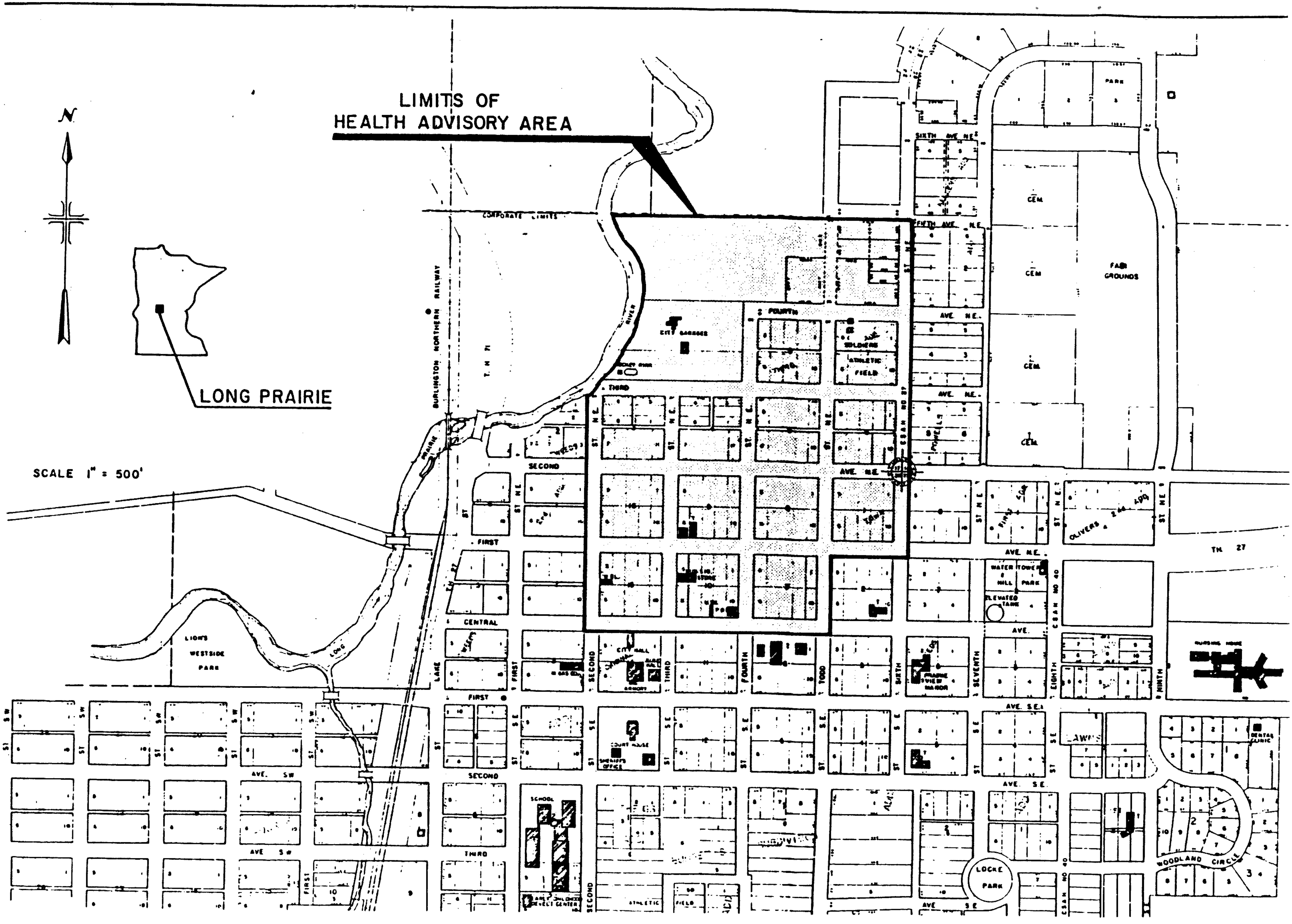
II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

In August and October of 1983, routine municipal well monitoring by the Minnesota Department of Health (MDH) indicated contamination in the Long Prairie municipal wells #4 and #5. 1,1,2,2-tetrachloro-ethylene (PCE) was found up to 26 ug/l, and 270 ug/l in wells #4 and



LOCATION OF LONG PRAIRIE

FIGURE 1



LONG PRAIRIE FEASIBILITY STUDY

GENERAL SITE LOCATION 2

#5, respectively. The PCE concentrations were above the U.S. Environmental Protection Agency (U.S. EPA) drinking water health-based concentrations for protection of human health (8.8 ug/l). 1,1,2-trichloroethylene (TCE) and dis-1,2-dichloroethylene (DCE) were also found in the contaminated wells.

In October 1983, the MDH recommended that municipal wells #4 and #5 be shut down due to the contamination. In 8 of the 21 residential wells sampled around the municipal wells, PCE ranged from 5 to 510 ug/l.

As a result of the analyses and because PCE, TCE and DCE are known or suspected carcinogens, on November 4, 1983 the MDH issued a drinking water advisory for a 15 block area of northeastern Long Prairie suggesting that the residents in the advisory area not use the water for drinking or cooking. The Minnesota Pollution Control Agency (MPCA) Commissioner issued a Determination of Emergency to permit the use of State Superfund monies to provide bottled water for residents in the advisory area. Water was supplied by the National Guard and City of Long Prairie. To supplant the bottled water, an activated carbon treatment system was installed and used on municipal wells #4 and #5 from June 1984 to October 1984.

In May 1984, a $600,000 U.S. Department of Housing and Urban Development grant was awarded to the city for a new municipal well to replace wells #4 and #5, transmission lines, and to upgrade the water treatment plant. The transmission lines were installed by November 2, 1984. The new municipal drinking water well, #6, was completed shortly thereafter. Since the time of the advisory, 39 of the 45 homes using contaminated ground water have connected to the municipal system. Several residents in the advisory area have been reimbursed by the Minnesota Hazardous Substance Injury Compenstion Board for the cost of connecting to City water.

Enforcement related activities began at the site in October 1983. The MPCA sent out eight Request for Information (RFI) letters to Long Prairie industries including three current and former owners of a Long Prairie dry cleaning establishment located at 243 Central Avenue in Long Prairie.

In February 1984, 15 monitoring wells were installed at 8 locations in Long Prairie. Sampling results from the monitoring wells and private wells further defined the plume which extended from central Long Prairie near the dry cleaners to municipal wells #4 and #5 about 2,100 feet away to the northeast. The source investigation then focused on the dry cleaning operation. In the summer of 1984 six chemical suppliers were contacted regarding sales to the Long Prairie dry cleaners. Three suppliers indicated selling approximately 2,200 gallons of PCE dry cleaning solvent to the dry cleaners from 1978 to mid 1984.

On April 24, 1985 depositions were taken from two of the former owners and one employee of the Long Prairie dry cleaners. The depositions indicated possible sources of PCE leakage or spillage; however, neither of the owners deposed nor the deposed employee stated any major spills occurred.

On May 20, 1985 certified letters were sent to the three former owners of the dry cleaners identifying them as potentially responsible parties (PRPs) and giving them the opportunity to conduct the RI/FS. One of three PRPs responded to the letter but did not admit to being responsible for the ground water contamination problem. General Notice letters were mailed out April 14 and May 4, 1988 to the three former dry cleaner owners. These notice letters demanded payment for the costs already incurred by the government, and informed the parties of the U.S. EPA and MPCA intent to undertake a Remedial Design/Remedial Action (RD/RA) at the site and the decision not to offer the opportunity for these parties to undertake the RD/RA because of their limited financial resources. It was learned after mailing out the notice letters that two of the three PRPs are now deceased.

In September 1984 the U.S. EPA and the MPCA entered into a Multi Site Cooperative Agreement (MSCA) for implementing a Remedial Investigation/Feasibility Study (RI/FS) at this site. The site was listed on the National Priorities List (NPL) in October 1984 with a Hazard Ranking System (HRS) score of 32. The final RI report for the Long Prairie site was submitted to the MPCA on October 15, 1987, and the FS report was completed on April 4, 1988.

III. COMMUNITY RELATIONS

Public interest in the ground water contamination in Long Prairie was highest during the period immediately following discovery of the contamination. Public interest in the Superfund RI/FS has been low.

As required, a public comment period for the FS and the recommended alternative began on April 7, 1988. Copies of the FS report, the Proposed Plan, a fact sheet detailing the alternatives evaluated and the recommended alternative, and the Administrative Record were made available to the community at that time. The Long Prairie City Hall served as the information repository for the documents. The MPCA issued a news release and placed a notice in the Long Prairie newspaper announcing the public comment period and outlining the alternatives evaluated and the recommended alternative.

The public meeting was held on April 19, 1988. No public comments were received. The public comment period ended on May 6, 1988. Although the MPCA did not receive any comments during the public comment period, the city provided comments on the draft FS prior to the comment period. Those comments are summarized in the attached responsiveness summary.

IV. SCOPE OF RESPONSE ACTION

This remedy represents the final remedial action for the Long Prairie site. As a result of this response action, the principal threat at the site, contaminated ground water will be mitigated.

V. SITE CHARACTERISTICS

The following discussion summarizes the nature and extent of contamination based on the findings of the RI.

As part of earlier site activities, sixteen monitoring wells were installed. During the RI, eight additional monitoring wells were installed to more clearly define the extent of ground water contamination. The location of these wells is shown on Figure 3.

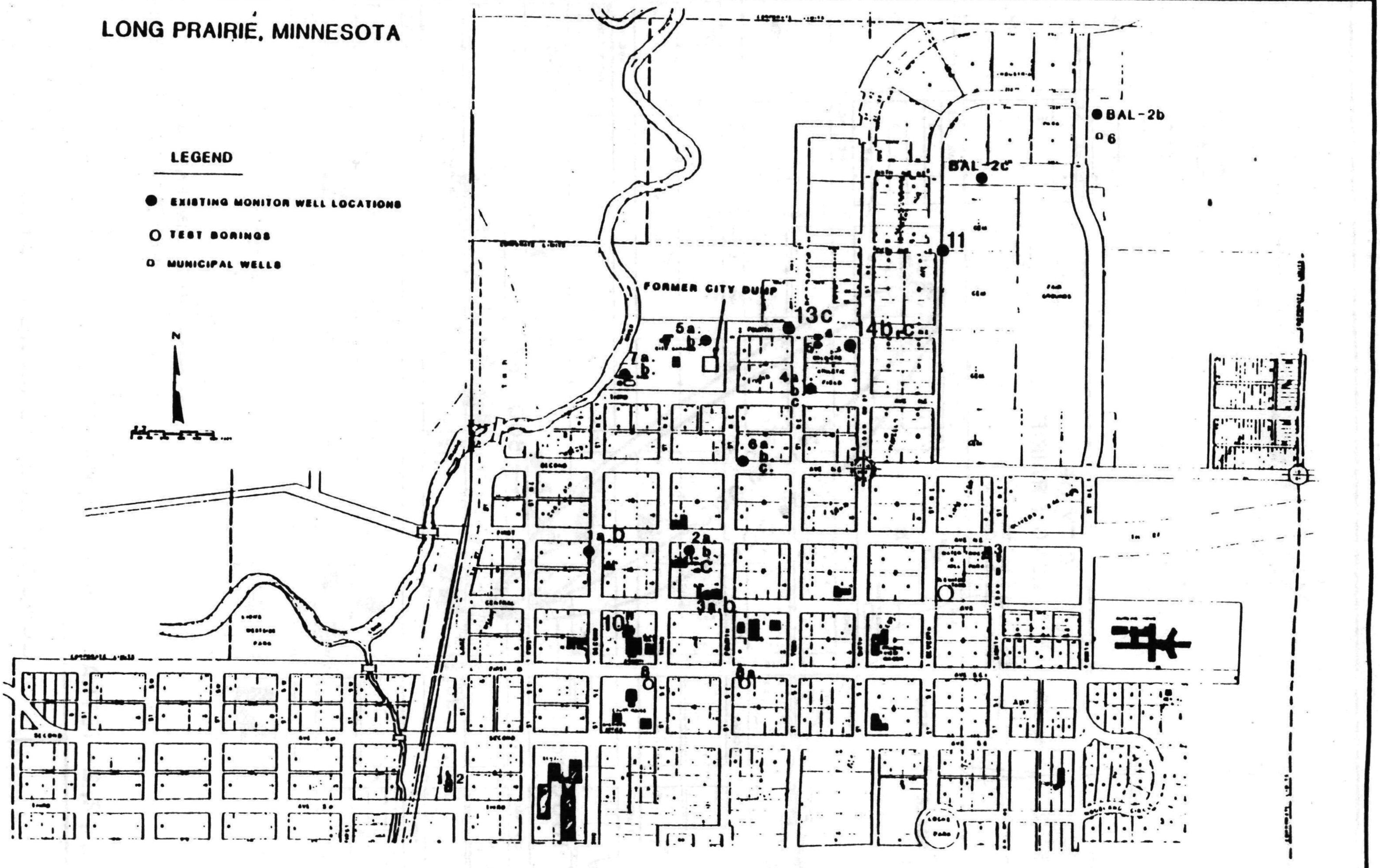
Ground Water

Samples collected during the RI indicate the presence of three volatile organic compounds (VOCs). Isoplots showing lines of equal concentration of PCE show an elongated plume extending along an axis from the center of the City to approximately Fourth Avenue, NE near municipal well #4. The contaminant plume was found to be approximately 2,100 feet long and up to 1,000 feet wide (see Figure 4. Contamination appears to extend throughout the saturated depth of the sand aquifer from the ground surface near the Armory to about 55 feet in depth near municipal well #4. The volume of contaminated ground water is estimated to be about 7 million gallons. The maximum and mean concentrations (in ug/l) of the three contaminants detected during sampling are as follows:

	Municipal Wells Max. (mean)	Private Wells Max. (mean)	Monitoring Wells Max.
1,1,2,2-Tetrachloroethylene	280 (136)	1000 (190)	22000
1,1,2-Trichloroethylene	11 (7)	220 (13)	45
Cis-1,2-Dichloroethylene	17 (8)	250 (22)	40

Vinyl chloride was detected in a few monitoring well samples at levels below method detection limits, but were not confirmed by duplicate or other sampling rounds.

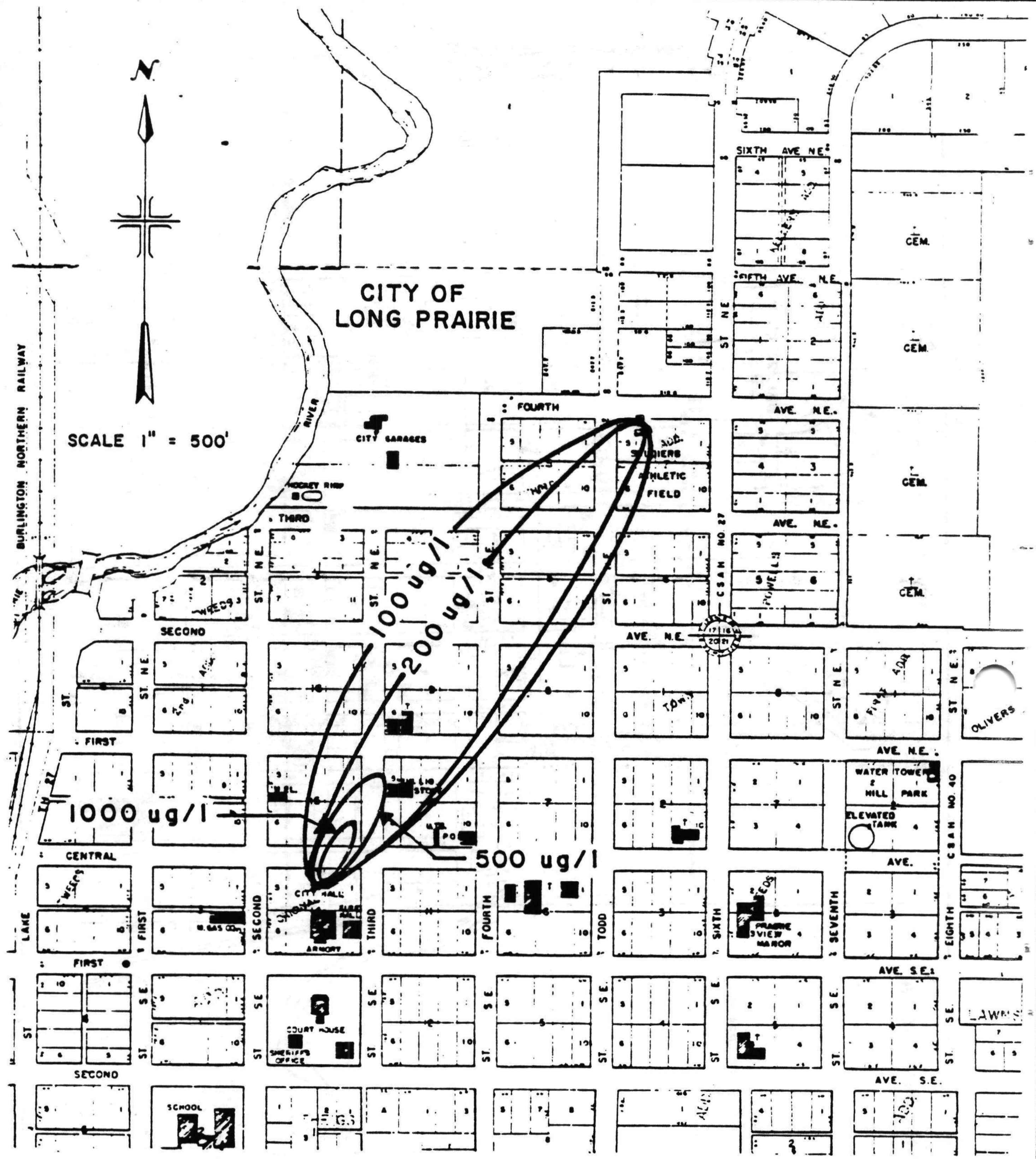
A pump test was conducted during the RI on municipal well #4. Information obtained from the pump test was used in a computer model which indicated that pumping municipal well #4 alone would not remove the ground water contaminants and that municipal well #6 probably would not be affected by the plume.



NEW AND EXISTING MONITOR WELL LOCATIONS

MALCOLM PIRNIE, INC.

FIGURE 3



LEGEND:

PCE CONCENTRATION CONTOUR

—100— CONCENTRATION OF PCE (ug/l)

1, 1, 2, 2- TETRACHLOROETHYLENE (PCE) ISOPLETHS - FEBRUARY 1987

LONG PRAIRIE FEASIBILITY STUDY

MALCOLM PIRNIE, INC.

FIGURE 4

SEPTEMBER 1987

Soils

Soil borings and surface samples were obtained within the source area in the alley parking lot behind the dry cleaners. All samples were analyzed for VOCs including PCE, TCE, DCE, and 26 other VOCs.

PCE was detected in 21 samples at 11 of the 14 sampling locations at concentrations ranging from 150 to 1,600,000 ug/kg. The maximum concentration was found in material from the partially buried barrel located 22 feet south of monitoring well 10, where the highest levels of ground water contamination was also found. The barrel contained approximately fifteen gallons of grey flour-like material which emitted a PCE odor. This material appears to be from the "muck cooker" used by the dry cleaner until late 1980. The muck cooker used diatomaceous earth material to filter and recycle used PCE in the dry cleaning machine. The material in the barrel appears to be a source, if not the only source, of contamination. TCE was detected in one sample at a concentration of 410 ug/kg. Trans-1,2-dichloroethylene was also detected in one sample at a concentration of 87 ug/kg. 1,1,1-trichloroethane was detected in two samples at concentrations of up to 93 ug/kg.

The results of the Toxic Characteristic Leaching Procedure (TCLP) test and analyses indicate the potential for additional leaching of PCE from contaminated soils to ground water. The data in Table 1 indicate that some of the soils in the back lot area leach PCE at high concentrations. Soil remediation is required to mitigate the source.

VI. SUMMARY OF RISKS

An evaluation was performed using monitoring data collected prior to and during the RI to estimate the potential impacts to human health and the environment assuming no remedial action is taken at the site.

The human exposure pathway of greatest concern is ingestion of contaminated ground water used for drinking and/or used in cooking. At Long Prairie, given the volatility of the chemicals and their low dermal absorption, bathing and routine washing activities do not appear to be viable exposure routes. Another human exposure pathway is ingestion of contaminated soil.

Risk Assessment

Carcinogenic potency factors based on oral exposure have been developed for PCE, TCE, DCE and vinyl chloride. Vinyl chloride was included in the municipal well calculations even though it was not detected above method detection limits. The carcinogenic risks are reported as excess lifetime cancer risks. Excess lifetime cancer risk is defined as the incremental probability of getting cancer compared to the probability if no exposure occurred. For example, a

TABLE 1

LONG PRAIRIE, MINNESOTA

RESULTS OF SOIL LEACHATE ANALYSES

DECEMBER 1987

LEACHATE CONCENTRATION (ug/L)

Soil Sample Location	Depth (feet)	1,1,2-Trichloroethylene (TCE)	1,1,2,2-Tetrachloroethylene (PCE)	Trans-1,2-Dichloroethlyene (DCE)	1,1,1-Trichloroethane (TCEA)
2C	10	ND (5.0)	290	ND (3.0)	ND (5.0)
3C	10	ND (0.5)	28	ND (0.3)	ND (0.5)
4B	5	ND (50)	29000	ND (30)	ND (50)
	10	ND (5.0)	380	ND (3.0)	ND (5.0)
	15	ND (5.0)	2800	ND (3.0)	ND (5.0)
Proposed Regulatory Level		70	100	None	None

Notes: ND = Not Detected at the detection limit enclosed by ( ).
Table 1-2 volatile organic analytes not listed above were not detected.
Regulatory level proposed in Federal Register, 13 June 1986, 34042-54

1×10^{-6} excess lifetime cancer risk represents an exposure that could result in one extra cancer case per million people exposed. The assumptions for calculating the cancer risk levels used ingestion of two liters per day of contaminated water for 70 years.

The cumulative excess lifetime cancer risk resulting from ingestion of chemicals of concern in the ground water are below:

Excess Lifetime Cancer Risk

Pathway	Advisory Area Private Wells		Municipal Wells #4 and #5	
	Average	Worst Case	Average	Worst Case
Ingestion of Water	6.5×10^{-4}	5.5×10^{-3}	3.8×10^{-4}	7.9×10^{-4}

The above risk calculations assume municipal wells #4 and #5 operating without treatment and without dilution from other municipal wells. The risk for the advisory area private wells were calculated using the maximum concentration detected in any well for the worst case, and the average concentration in each well for the average case. Currently, seven of the original 46 residences with private wells in the advisory area are not connected to municipal drinking water. Other exposures to the chemicals, such as inhalation and dermal contact, may increase these risks.

The maximum excess lifetime cancer risk for ingestion of PCE contaminated soil in the back parking lot by a 10 kg child ingesting 5 grams of soil per day for 5 years is currently about 7.9×10^{-6} excluding the buried barrel contents. The risk due to exposure to concentrations encountered at the barrel is 1.1×10^{-3}. The residual PCE concentration corresponding to an excess lifetime cancer risk of 1×10^{-6} is about 1,400 ug/kg.

Environmental Assessment

No pathway currently exists where environmental receptors (fish and other aquatic life) in the Long Prairie River may be exposed to contaminated ground water since the plume has not yet reached the river. However, ground water eventually flows to the Long Prairie River north of the contaminated area. None of the contaminants have been detected in the Long Prairie River. If the contaminants were to reach the Long Prairie River the concentrations would not be high enough to impact fish and other aquatic life when compared to aquatic life toxicity criteria. The Ambient Water Quality Criteria (AWQC) for freshwater organisms for PCE, TCE and DCE are compared to the average and maximum values observed in the plume as follows:

	Acute (96 Hour)	Chronic	Plume (Average)	Plume (Maxi[illegible])
PCE (ug/l)	5,280	840	190	22,000
TCE (ug/l)	45,000	21,900*	13	220
DCE (ug/l)	11,600	2,800*	22	250

* No actual chronic values available. TCE is behavioral response, DCE is for single test.

All the values in the plume are well below the AWQC except for the maximum level of PCE. The 22,000 ug/l PCE was detected at the source area, located about 1,500 feet from the Long Prairie River. This level is not representative of the plume. The next highest concentration of PCE detected was 1,000 ug/l, which would probably be diluted to below the chronic level. If no action is taken, PCE concentrations reaching the river are expected to be less than the 100 ug/l isopleth shown on Figure 4 due to dilution and attenuation if the plume were allowed to migrate.

Comparison to ARARs

The concentrations of contaminants found in the municipal, private and monitoring wells exceed Federal and State applicable or relevant and appropriate requirements (ARARs) or criteria that are to be considered as shown in Table 2.

The average and maximum concentrations of PCE exceed State and Federal "to be considered" criteria. The average and maximum concentrations of TCE exceed Federal ARARs and the "to be considered" criteria. The State criteria for DCE in private wells was exceeded.

ARARs are discussed in detail in Section X of this document.

VII. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes have been made since the publication of the FS and Proposed Plan.

VIII. DESCRIPTION OF ALTERNATIVES

The FS was initiated in November 1987 to evaluate alternative response actions for soil and ground water contamination at the Long Prairie site. Ground water and soils are the identified pathways for contaminant migration at the Long Prairie site. However, it is possible that other pathways may become measurably impacted during the implementation of a ground water or soils remedial action.

Therefore, objectives are presented for each of the potential contaminant migration pathways at the Long Prairie site.

TABLE 2

Comparison of Contaminant Concentrations in Ground Water to ARARs and other Criteria

(X denotes exceedance; all units in ug/l)

Contaminant	Well Type		Contaminant Concentration	ARARs MCLs	Other Criteria RAIs	Other Criteria AWQC
PCE				NA	6.6	0(0.88)
	Municipal	Max.	280		X	X
	Private	Max.	1000		X	X
	Monitoring	Max.	1200		X	X
	Municipal	Mean	136		X	X
	Monitoring	Mean	119		X	X
TCE				5	31.2	0(2.8)
	Municipal	Max.	11	X		X
	Private	Max.	110	X	X	X
	Monitoring	Max.	45	X	X	X
	Municipal	Mean	7	X		X
	Monitoring	Mean	6	X		X
DCE				NA	70	NA
	Municipal	Max.	17			
	Private	Max.	250		X	
	Monitoring	Max.	50			
	Municipal	Mean	8			
	Monitoring	Mean	6			
Vinyl Chloride	(No Exceedances)			2	0.15	0(2.0)

Notes:

MCLs - USEPA Maximum Contaminant Levels.
RAIs - Minnesota Department of Health Recommended Allowable Limits Corresponding to 10^{-5} carcinogenic risk level.
AWQC - USEPA Ambient Water Quality Criteria for the protection of human health. Adjusted for drinking water only as per USEPA (1986). Concentrations in parentheses correspond to the midpoint (10^{-6}) of the risk range for potential carcinogens.
NA - Not Available.
ND/NR - Not detected or not reported.

The two objectives for ground water remediation are:

- to provide a safe drinking water supply for present and future users of the Long Prairie Sand Plain aquifer; and

- to prevent the spread of contaminated ground water to wells presently unaffected, including the City of Long Prairie municipal supply well #6.

The primary objectives of soil remediation are:

- to prevent future impact on drinking water due to leaching migration of contaminants from soils to ground water; and

- to prevent ingestion/contact with contaminated soils.

The objectives of air and surface water remediation are:

- to prevent chronic and acute adverse impacts on human health during implementation of ground water and soil remedial technologies;

- to prevent adverse effect on aquatic organisms due to implementation of remedial action.

Table 3 is a compilation of ARARs and other criteria to be considered for the site contaminants in the various media.

The full range of technologies that would address remedial action goals were identified and then screened according to their ability to meet the site objectives in order to eliminate those that are not technically implementable at the site. These were evaluated and screened based generally on the technology's effectiveness, implementability, and cost.

A list of ten applicable alternative response actions remained after screening and were analyzed in detail using the nine evaluation criteria which are defined in Secion VIII of this document. The alternatives for evaluation included a range of choices. This range included:

- A no-action alternative.

- At least one alternative that involves containment of waste with little or no treatment, but provides protection of human health and the environment by preventing potential exposure or by reducing the mobility of the waste.

- Treatment alternatives ranging from one that would eliminate the need for long-term management (including monitoring) at the site to one that would use treatment as a principal element to reduce the toxicity, mobility, or volume of contaminants.

TABLE 3
LONG PRAIRIE, MINNESOTA

COMPARISON OF ARARS AND OTHER CRITERIA TO BE CONSIDERED

Pathway	ARARs	Contaminant	ARAR Concentration	Units	Other Criteria to be Considered			
Ground Water	MCLs			ug/L	RALs (10^{-5})	HA	10^{-6}CA RISK	AWQC (10^{-6})
		1,1,2,2-tetrachloroethylene (PCE)	NA		6.6	10	0.7	0.8
		1,1,2-trichloroethylene (TCE)	5.0		31.2	NA	3.1	2.7
		cis-1,2-dichloroethylene (DCE)	NA		70	70	NA	NA
		vinyl chloride	2.0		0.15	NA	NA	2.0
Soils	40 CFR 264.197			ug/kg	LEACH1	LEACH2	INGEST(10^{-6})	
		1,1,2,2-tetrachloroethylene (PCE)	NA		1200	10	1400	
		1,1,2-trichloroethylene (TCE)	NA		NA	NA	6400	
Air	NAAQS			ug/m^3	1% TLV	10^{-5}CA RISK	10^{-6}CA RISK	
		1,1,2,2-tetrachloroethylene (PCE)	NA		3350	0.69	0.069	
		1,1,2-trichloroethylene (TCE)	NA		2700	0.8	0.08	
Surface Water	NPDES			ug/L	AWQCs (10^{-6})	AWQC (Fish)	10^{-5}CA RISK	
		1,1,2,2-tetrachloroethylene (PCE)	NA		0.8	15	8.0	
		1,1,2-trichloroethylene (TCE)	NA		2.7	197	27	
		cis-1,2-dichloroethylene (DEC)	NA		NA	738	NA	
		vinyl chloride	NA		2.0	5.3	20	

Notes:

Nuclear Regulatory Commission (NRC) and Naturally Occurring and Accelerator-Produced Radioactive Material (NARM) radon and radionuclide emissions regulations are also ARARs for ground water, soils, and air pathways.

NA = Not Available
MCLS = Safe Drinking Water Act (SDWA) Maximum Contaminant Levels
RALS = Minnesota Department of health (MDH) Recommended Allowable Limits corresponding to a lifetime incremental cancer risk of 10^{-5}
HA = USEPA Lifetime Health Advisory for drinking water exposure
10^{-5},10^{-6}CA Risk = Concentration corresponding to a lifetime incremental cancer risk of 10^{-5} or 10^{-6}
AWQC (10^{6}) = USEPA Ambient Water Quality Criteria - drinking water and fish consumption
AWQC (Fish) = USEPA Ambient Water Quality Criteria - adjusted for fish consumption only
40CFR 264.97 = RCRA closure and post-closure decontamination and monitoring requirements (also Minnesota Rules Chapter 7045)
LEACH1 = Soils concentration which may leach PCE into ground water at a leachate concentration of 100 ug/L
LEACH2 = Soils concentration which may leach PCE at 6.9 ug/L
INGEST = Soils concentration which, if ingested by a child daily for 5 years, corresponds to an incremental cancer risk of 10^{-6}
NAAQS = National Ambient Air Quality Standard
TLV = Threshold Limit Value work-shift time-weighted average
NPDES = National Pollutant Discharge Eliminations System (also Minnesota Rules Chapter 7001 and Minnesota Statutes Chapters 115 and 116)
TML = 96-hour median tolerance limit

TABLE 4
LONG PRAIRIE, MINNESOTA

SUMMARY OF REMEDIAL ACTION ALTERNATIVES

Alternative	Goals	Features	Present Worth Cost
1 - No Action	No Action		$ 80,000
2A - Plume Diversion and Soils Capping	Contaminant containment	Divert ground water to Long Prairie River Cap soils in back lot area	980,000
2B - Plume Diversion and Excavation/Landfill	Meet site objectives with little or no treatment	Divert ground water to Long Prairie River Excavate soils in back lot area and landfill in off-site facility	1,600,000
3A - Activated Carbon (Ground Water)	Treat ground water to MCLs	Centralized carbon treatment	2,000,000
3B - Air Stripping (Ground Water)	Treat ground water to MCLs	Centralized air stripping treatment	1,700,000
3C - Air Stripping and Carbon (Ground Water)	Treat ground water to MCLs	Dual technology treatment	2,100,000
3D - Two Carbon or Air Stripping Units (Ground Water)	Treat ground water to MCLs	Use separate recovery/treatment system Provides treated effluent in back lot area	2,000,000 -2,200,000
3E - WWTP Treatment (Ground Water)	Treat ground water to MCLs	Discharge ground water to Long Prairie WWTP	1,100,000
3F - Active Soil Venting	Remove PCE from soils to acceptable level Protect ground water quality	Active gas collection in back lot area Carbon treatment of off-gas	300,000
3G - Soil Flushing	Protect ground water quality Remove PCE from soils to acceptable level	Flush PCE into ground water and recover Excavate hot spot soil areas	350,000

Seven of the ten alternatives involved treatment of ground water or contaminated soil. A list of the applicable alternatives and technologies is found in Table 4.

Alternative 1 - No Action

Capital Cost:	$ 0
Present Worth Cost:	$40,000
Annual O&M Cost:	$ 4,200
Time to Implement:	None

The no-action Alternative involves only long-term monitoring and the removal of monitoring wells not required for the long-term monitoring program. Under the no-action alternative, there would be little change in contaminant concentrations in the plume over the next ten years. The plume would be diluted and dispersed somewhat and would extend northward until it would discharge to the Long Prairie River. Private wells and municipal wells #4 and #5 would not be useable for at least ten years into the future. Contaminants would continue to leach from the soil into the ground water. This alternative is considered a baseline scenario to which other alternatives can be compared.

The following seven alternatives (2A through 3E) involve ground water extraction. The goal of the ground water extraction system is to stop the spread of the contaminant plume and remove contaminated ground water until Maximum Contaminant Levels (MCLs) or other applicable criteria are reached in the aquifer. The ground water modeling performed during the RI was used to develop a recovery network, consisting of five extraction wells, pumping a total of 260 gallons per minute (gpm) for five years for which alternative technologies can be compared. Additional modeling and field testing will be necessary during the design phase to determine the optimal number, location and pumping rates for the extraction system. For those ground water alternatives that employ treatment (3A through 3E), the water will be treated to meet ARARs.

Alternative 2A - Plume Diversion and Soils Capping

Capital Cost:	$500,000
Present Worth Cost:	$980,000
Annual O&M Cost:	$ 89,000
Time to Implement:	5 years (ground water) < 1 year (cap)

Alternative 2A consists of containment of contaminated soils by a multi-layer RCRA capping system to control infiltration, and diversion of contaminated ground water away from potential users by pumping and discharging to the Long Prairie River without treatment. This alternative will achieve ground water and soil site objectives. The useful life of the capping system is expected to be about thirty years, and the cap will require above ground long-term maintenance.

Penetration or erosion of the cap may cause contaminants to migrate from soils to ground water. A cap can be constructed within the back lot area, but will require above ground relocation of several underground utilities. The alternative would not meet the substantive National Pollution Discharge Elimination System (NPDES) permit requirements because the untreated dicharge does not employ best available technology (BAT).

<u>Alternative 2B - Plume Diversion and Soils Excavation and Off-Site Landfill</u>

Capital Cost:	\$1,200,000
Present Worth Cost:	\$1,600,000
Annual O&M Cost:	\$ 89,000
Time to Implement:	5 years (ground water) < 1 year (excavation)

Alternative 2B also requires ground water withdrawal and diversion as described above. However, the need for long-term monitoring at the site is eliminated by excavation of contaminated soils in the back lot area, and disposal of the soils in an off-site landfill facility in compliance with U.S. EPA's off-site policy. Excavation areas are backfilled with clean fill.

Alternative 2B involves soil removal. The volume of contaminated soil that needs to be removed was determined based on the threat to ground water due to leaching from the soil. The target cleanup level was determined based on results obtained from the proposed TCLP test performed on selected samples from the soils investigation. The proposed regulatory level for PCE in solid wastes (Federal Register, 13 June 1986, 34042-54) is 100 ug/l as measured in the leachate. Regression analysis and a safety factor of two was used to determine the target cleanup level of 1200 ug/kg in the soil. This leachate-based level is below the soil health-based ingestion level corresponding to a 10^{-6} incremental cancer risk (1400 ug/kg). The target cleanup level will be protective of public health and the environment. There are two distinct areas where soil remediation is necessary involving approximately 1,500 cubic yards of contaminated soil, over a 2,700 square foot area of the back lot, to a depth of approximately 15 feet.

Excavation of the back lot area requires removal of the asphalt and relocation of underground utilities. Excavation would proceed vertically about 15 feet to the ground water table. Shoring or sheet piling may be required to protect the structural integrity of buildings surrounding the back lot area.

Alternatives 3A through 3E are ground water treatment alternatives which eliminate the need for long-term management and employ permanent technologies which will reduce toxicity, mobility, or volume of site contaminants. These alternatives utilize combinations of three ground water treatment options.

Alternative 3A - Activated Carbon Adsorption

Capital Cost:	$ 870,000
Present Worth Cost:	$2,000,000
Annual O&M Cost:	$ 300,000
Time to Implement:	5 years

Ground water treatment consists of withdrawal and on-site treatment of contaminated ground water with granular activated carbon (GAC). Treated water is discharged to the Long Prairie River.

GAC is a demonstrated technology which results in the thermal destruction of contaminants during off-site carbon regeneration.

In granular activated carbon treatment, ground water is first pumped into an equalization tank. The equalization tank provides operating flexibility which can compensate for maintenance downtime at the withdrawal wells or carbon treatment units. The estimated concentration range and estimated average influent concentrations expected at the Long Prairie site and examples of removal efficiencies are shown below. The average influent concentration was calculated based on five extraction wells pumping at varying flowrates, for a total of 260 gpm.

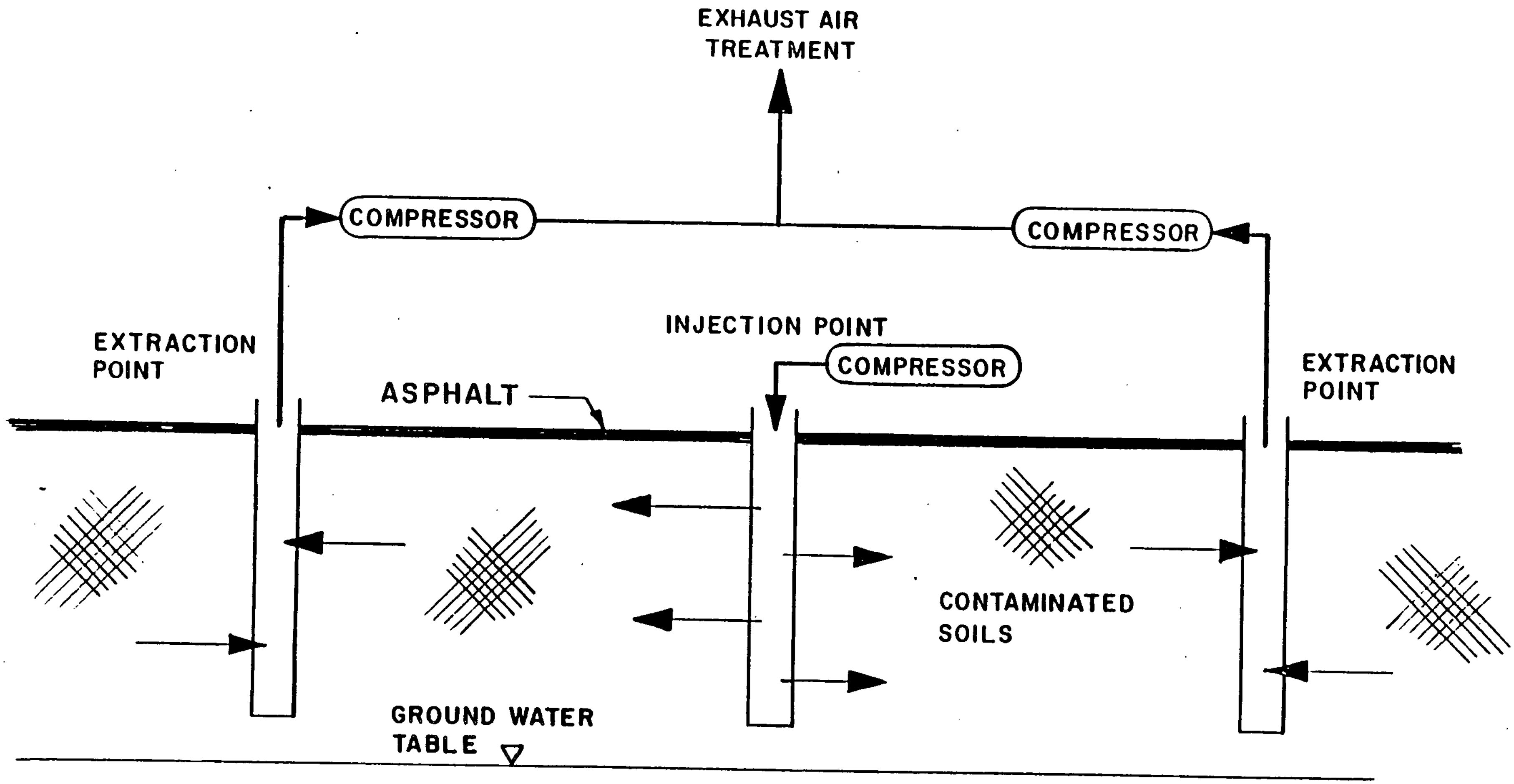
Organic Compounds in Water	Reference Influent Concentration Range	Reference Effluent Concentration Range	Estimated Concentration Range at Long Prairie	Estimated Average Influent Concentration
Tetrachloroethylene	5 ug/l-70,000 ug/l	<1 ug/l	400 ug/l-1,000 ug/l	700 ug/l
Trichloroethylene	5 ug/l-16,000 ug/l	<1 ug/l	8 ug/l-600 ug/l	200 ug/l
Cis-1,2-dichloroethylene	5 ug/l-4,000 ug/l	<1 ug/l	10 ug/l-48 ug/l	30 ug/l

Granular activated carbon treatment may be ineffective in removing vinyl chloride.

Alternative 3B - Air Stripping

Capital Cost:	$ 730,000
Present Worth Cost:	$1,700,000
Annual O&M Cost:	$ 250,000
Time to Implement:	5 years

The air stripping alternative consists of ground water extraction with on-site treatment using a packed column air stripping tower. Treated water is discharged to the Long Prairie River. The conceptual design criteria for this alternative were taken from previous pilot column tests.



	LONG PRAIRIE FEASIBILITY STUDY	ON-SITE SOILS TREATMENT IN-SITU AERATION	FIGURE 5 SEPTEMBER 1987

The design packed tower height is based on the removal of PCE. PCE is the controlling compound based on the concentration of the VOCs detected on-site. At the PCE design criteria (5 ug/l), all other compounds, including vinyl chloride, are removed to levels equal to or lower than MCLs. Treatment to meet ground water MCLs requires a stripping tower with a 4 foot diameter and 27.5 feet of packing.

The results of preliminary modeling using worst case data indicate that treatment of stripper emissions may not be required to meet site air criteria for PCE. Dispersion effects were modeled by U.S. EPA and MPCA. The worst case PCE, TCE, and vinyl chloride concentrations are expected to occur 20 meters from the air stripper at ground level. The total excess cancer risk at that location is 2.8×10^{-6}. Requirements for vapor phase treatment will be re-evaluated during the design phase of the project with the benefit of additional data. Generally, vapor phase treatment, if required, is accomplished by collecting tower emissions and forcing them through a GAC contactor. The spent GAC is periodically replaced with fresh carbon.

The GAC and packing material will be monitored for breakthrough of radon decay products. Radiation problems can originate with air stripping because some soil and ground water can contain substantial concentrations of radioactive radon and thoron. These are evacuated along with chemical contaminants during these operations, and may accumulate on the collection media. The costs include a contingency for vapor phase treatment.

<u>Alternative 3C - Combined Stripping and Adsorption</u>

Capital Cost:	$ 980,000
Present Worth Cost:	$2,100,000
Annual O&M Cost:	$ 300,000
Time to Implement:	5 years

Alternative 3C incorporates both stripping and adsorption technologies. Volatile compound concentrations are lowered by initial stripping treatment, then reduced to MCL levels by effluent polishing using adsorption technology. The advantage of combined technology is that a high quality effluent can be produced. The disadvantages of the combined technology are higher capital and operating costs.

The design is based upon a worst case assumption for an influent vinyl chloride concentration of 10 ug/l. This concentration for vinyl chloride was obtained by doubling the highest well concentration detected during the RI, 5.1 ug/l. Adsorption removal of vinyl chloride is not well-demonstrated, but vinyl chloride is the most easily stripped compound of the four contaminants of concern at the site. The initial stripping tower was designed for an effluent concentration of 2 ug/l, the vinyl chloride MCL.

The packing height required for vinyl chloride removal is about 6 feet. The corresponding removal of PCE, at a packing height of 6 feet and air to water ratio of 40, is about 65 percent. Stripping tower effluent PCE concentrations are therefore about 245 ug/l. Adsorption treatment is then used to lower the PCE concentration to the 5 ug/l criterion.

The adsorption units utilized for combined treatment are the same as those used under Alternative 3A. Volumetric loading ratio controls treatment vessel size, and influent flow rate has not changed. However, the influent contaminant concentration is lower, so the carbon usage is decreased. It is estimated that the requirements of carbon regeneration will be lowered by approximately one-half under the combined treatment alternative. The GAC and packing material will be monitored for radon.

Alternative 3D - Two Carbon or Stripping Units

Capital Cost:	\$ 850,000 - \$1,000,000
Present Worth Cost:	\$1,200,000 - \$2,200,000
Annual O&M Cost:	\$ 310,000 - \$ 320,000
Time to Implement:	5 years

Alternative 3D utilizes two separate withdrawal treatment systems instead of one centralized unit to effect ground water treatment to attain drinking water MCLs.

Treatment is by either two adsorption or two stripping systems.

The ground water plume was divided into two areas as follows:

1. A northern area characterized by high individual well pumping rates, lowered initial contaminant concentrations, and proximity to municipal well #4.

2. A southern area characterized by lower individual well pumping rates, high initial contaminant concentrations, and proximity to the back parking lot area.

Both adsorption and stripping systems benefit from lesser piping requirements to link recovery wells to remote treatment units. An additional capital cost savings for the carbon adsorption system is realized because the contactor size requirements are less under the lower flow rates. Stripper costs, however, virtually double because of little change in the packing height requirements for PCE removal to MCLs.

Use of either dual system would require the location of a treatment unit near the southern end of the ground water plume and the back lot area. The effluent from the southern treatment system would be utilized for (a) soil treatment; (b) reinjection; (c) discharged to the Long Prairie River; or (d) introduced into the Long Prairie municipal supply system near the existing water treatment plant.

Effluent from the remote northern treatment system would be introduced into the Long Prairie supply system at municipal well #4. The GAC will be monitored for radon.

Alternative 3E - Discharge to the City of Long Prairie Wastewater Treatment Plant

Capital Cost:	$ 520,000
Present Worth Cost:	$1,100,000
Annual O&M Cost:	$ 150,000
Time to Implement:	5 years

Under Alternative 3E, the ground water plume is withdrawn, collected and discharged into the City of Long Prairie Wastewater Treatment Plant (WWTP). Treatment is accomplished by air stripping and biological degradation in aeration units.

The City of Long Prairie operates an aerated lagoon system. There are no industrial pretreatment standards which would prevent the discharge of the recovered ground water into the WWTP collection system. However, the Long Prairie WWTP is currently hydraulically overloaded, and an expansion is not expected to be completed prior to October 1990.

The soil treatment technologies, Alternatives 3F and 3G, are active venting and flushing. Each treatment technology will be applied to the entire back lot area, from ground surface to the ground water table. The entire back lot area is treated to assure that contaminants are actually removed from the soil media, and not simply relocated to untreated central areas. This results in a greater volume of contaminated soil than what was estimated for the excavation alternative (2B) in order to ensure against contaminant migration. The following initial conditions are assumed:

- Surface area equal to 6,900 ft^2.
- Depth of treatment to 15 ft.
- Volume of contaminated soils: 3,800 yd^3.
- Average initial PCE concentration: 2,000 ug/kg.
- Two hotspot areas near the buried drum and grid location 1E.
- Hotspot areas are cylinders of 30 foot diameter and 15 foot depth.
- Average initial PCE concentrations in hotspots: 400,000 ug/kg.

For purposes of designing the treatment systems, the average initial PCE concentration was assumed to be twice the average PCE concentration at grid locations within the excavation area.

Alternative 3F - Active Soil Venting

Capital Cost:	$ 160,000
Present Worth Cost:	$ 300,000
Annual O&M Cost:	$ 140,000
Time to Implement:	1 year

Active soil venting involves aerating contaminated soils by forcing a subsurface airflow with compressors and vacuum extraction. Volatile organic contaminants are stripped from the soils by the air under similar transfer phenomena as those which occur in the ground water air stripping column. A schematic of the soil venting process proposed for the Long Prairie site is shown in Figure 5.

In general, an active soil venting system is most effective in sandy unsaturated soils such as those present in the back lot area. The system proposed for the Long Prairie soils begins with a compressor used to inject air through a perforated PVC tube placed at the center of the back lot area. Withdrawal wells are placed in all parts of the back lot area in order to avoid blowing contaminants, and possibly odors, into clean soils and basements. A second compressor is used to withdraw air from the subsurface and discharge into a vapor phase treatment system. The compressors act to create a subsurface air flow and strip volatile organics from contaminated soils. Withdrawn air is treated, if required, by carbon adsorption. Radiation problems can originate with active soil venting because soils can contain substantial concentrations of radioactive radon and thoron. Radon and thoron are evacuated along with the contaminants and may accumulate on the carbon. Thus, the GAC will be monitored for radon. The costs include the cost of carbon treatment.

Alternative 3G - Soil Flushing

Capital Cost:	$ 290,000
Present Worth Cost:	$ 350,000
Annual O&M Cost:	$ 61,000
Time to Implement:	4 years

Alternative 3G accomplishes soil treatment by flushing contaminated soils with treated ground water. Flushing utilizes the solubility of the volatile organic compounds present in the soils to carry contaminants into the ground water below the back lot area. The contaminated leachate is then recovered and treated along with the shallow ground water plume in the withdrawal well network. It is expected that at least one of the recovery wells will be located immediately downgradient of the infiltration area in the back lot.

The key parameters for flushing treatment are the infiltration capacity of site soils, contaminant concentration expected in the infiltration (flushing) waters, and residual contaminant concentration in soil for which treatment will no longer be effective. Infiltration capacity is estimated for sandy soils using regional precipitation data.

Based on regression analysis of observed concentration of PCE in leachate from the TCLP test, it is estimated that flushing waters will have a PCE concentration of 85 ug/l after infiltrating vertically through 15 feet of soils contaminated with PCE at a concentration of 2,000 ug/kg. Considering this value, the amount of

PCE to be removed from the soils, and the infiltration rate results in an estimated time for average soils remediation of 90 days using about 320,000,000 gallons of treated ground water. The volumetric loading is about 56 gallons of water per square foot of surface area per day. The infiltration water requires about 3 days to travel vertically to the ground water table, where it is withdrawn during ground water remediation.

Infiltration treatment will not be successful in remediating hot spot areas to soils criteria within a reasonable time period. Under similar assumptions for contaminant transfer rates from a starting PCE concentration of 400,000 ug/kg, it is estimated that 420 days and 3.2 million gallons of water will be required to leach PCE to soil criteria. After saturated conditions are removed, it is estimated that treated soils will continue to leach flushing water for up to 2 years. Accounting for cold weather interruptions, flushing may require up to 4 years (2 years of treatment plus 2 years of residual leaching) before contaminants are removed in withdrawal wells. Therefore, it is more cost and time efficient to excavate the hot spot at the buried drum and landfill it at an off-site facility. The estimated cost for flushing treatment includes excavation and off-site landfilling of about 60 cubic yards of contaminated soil near the buried drum.

Combinations of Interaction of the Alternatives

The response action at the Long Prairie site will require two alternatives, one source control and one management of migration process. Treated ground water from an air stripper or carbon system will provide safe drinking water to the public that meets Federal and State drinking water standards and will manage the migration of contaminants. Soil treatment, removal or containment would control the source. However, the public water supply cannot utilize the entire volume of treated water that would be generated therefore an alternative discharge to the river would be necessary.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the alternatives were evaluated using a number of evaluation factors. The regulatory basis for these factors comes from the National Contingency Plan and Section 121 of SARA (Cleanup Standards). Section 121(b)(1) states that, "Remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment. The offsite transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available." Section 121(b)(1) also states that the following factors shall be addressed during the remedy selection process:

(A) the long-term uncertainties associated with land disposal;
(B) the goals, objectives and requirements of the Solid Waste Disposal Act;
(C) the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents;
(D) short- and long-term potential for adverse health effects from human exposure;
(E) long-term maintenance costs;
(F) the potential for future remedial action costs if the alternative remedial action in question were to fail; and
(G) the potential threat to human health and the environment associated with excavation, transportation, and redisposal, or containment.

Section 121 of SARA requires that the selected remedy is to be protective of human health and the environment, cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Alternatives were evaluated using current U.S. EPA guidance, including: "Interim Guidance on Superfund Selection of Remedy" dated December 24, 1986 and "Additional Interim Guidance for FY'87 Records of Decision" dated July 24, 1987. In the July 24, 1987, guidance, the following nine evaluation factors are referenced:

1. Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate (ARARs) requirements of other environmental statutes and/or provide grounds for invoking a waiver.

3. Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. Reduction of toxicity, mobility, or volume is the anticipated performance of the treatment technologies a remedy may employ.

5. Short-term effectiveness involves the period of time needed to achieve protection and any adverse impact on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. Implementability is the technical and administrative feasibility of a remedy, including the availability of goods and services needed to implement the chosen solution.

7. Cost includes capital and operation and maintenance costs.

8. State Acceptance indicates whether, based on its review of the RI/FS and Proposed Plan, the MPCA concurs, opposes, or has no comment on the preferred alternative.

9. Community Acceptance indicates the public support of a given remedy. This criteria is discussed in the Responsiveness Summary.

A summary of the relative performance of the alternatives with respect to each of the nine criteria is provided in this section. Included are Tables 5 and 6 which provide a comparison of alternatives and the nine criteria. All calculations regarding alternative performance were based on the worst case situation which usually consisted of taking two times maximum observed concentration. Based on this conservative approach each alternative is expected to perform better rather than at or below projections. Therefore, those cases which appear to be borderline on meeting criteria are expected to perform satisfactorily during implementation.

Overall Protection of Human Health and the Environment

The no-action alternative does not provide adequate protection of human health and the environment since it would result in an extended exposure via the ground water pathway, continued ground water contamination from soil, and potential for exposure through disturbance of contaminated soil.

Each of the alternatives containing activated carbon and/or air stripping or treatment at the Long Prairie WWTP can be effective in protecting human health and the environment. The health risk assessment performed by the U.S. EPA and MPCA utilized computer modeling results of several scenarios and determined that there would be a calculated total excess cancer risk of less than 2.8×10^{-6}. Based on these results, air stripping will not require vapor phase treatment of emissions in order to achieve air quality criteria and to protect human health.

Plume diversion may not be environmentally protective. Ground water would be discharged without treatment and contaminants would be transferred to surface waters at levels which may exceed ambient water quality criteria (AWQC) during low flow conditions in the river. The Long Prairie River is not classified for drinking water use, but recreational exposure is possible.

All soil remediation methods are protective to varying degrees. Excavation to target cleanup levels and offsite disposal of contaminated soil will provide adequate protection of human health and the environment at the site. The long-term management of the soil will be the responsibility of the offsite land disposal facility. If properly operated and maintained, a cap over the

TABLE 5

LONG PRAIRIE, MINNESOTA

NINE CRITERIA EVALUATION

ALTERNATIVE 1 EVALUATION

Description: No Action

Criteria	Evaluation
1. Short-Term Effectiveness	Not effective. Protection against ground water contaminants not achieved. 30-year monitoring period.
2. Long-Term Effectiveness and Permanence	Not effective. Ground water contaminants remain at levels which exceed MCLs. Back lot soils will continue to leach to ground water.
3. Reduction of Toxicity, Mobility, and Volume	No reduction.
4. Implementability	Not applicable.
5. Cost	Capital: $40,000 Annual operations, maintenance, and monitoring: $4,200 for 30 years Present worth value: $80,000
6. Compliance with ARARs	Noncompliance with ground water and soils ARARs.
7. Overall Protection of Human Health and the Environment	Not protective since contamination remains in soil and ground water. Potential risk to human health and the environment.
8. State Acceptance	Not Acceptable.
9. Community Acceptance	Not acceptable.

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 2A EVALUATION

Description: Withdraw ground water to MCL criteria if technically practicable, discharge untreated ground water to Long Prairie River, and cap soils in back lot area.

Criteria	Evaluation
1. Short-Term Effectiveness	Somewhat effective. Impacts surface water quality in the Long Prairie River. 5-year implementation for ground water withdrawal; 30-year monitoring of cap. Short-term impact during construction.
2. Long-Term Effectiveness and Permanence	The long-term effectiveness of cap systems is unknown. Long-term impact on surface water quality depends on monitoring and maintaining the integrity of the cap. Potential for failure of the cap and threat to human health and the environment remain indefinitely. Not a permanent remedy.
3. Reduction of Toxicity, Mobility, and Volume	Reduces toxicity of ground water contaminants by dilution and volatilization. Reduces mobility of soil contaminants by reducing infiltration.
4. Implementability	Technically feasible. Untreated discharge to Long Prairie River will likely be denied by permitting authorities.
5. Cost	Capital: $500,000 Annual operations, maintenance, and monitoring: $89,000 for 5 years; $15,000 for 30 years Present worth value: $980,000
6. Compliance with ARARs	Noncompliance with NPDES BAT requirement for surface water discharge. Complies with ground water, air, and soils ARARs.
7. Overall Protection of Human Health and the Environment	Questionable. Requires further data on the effect of contaminant discharge on the Long Prairie River. Residual incremental cancer risk at the completion of pumping = 10^{-5}.
8. State Acceptance	Not acceptable.
9. Community Acceptance	No objection

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 2B EVALUATION

Description: Withdraw ground water to MCL criteria if technically practicable, discharge untreated ground water to Long Prairie River, excavate soils in back lot area, and remove to off-site RCRA - Complaint landfill.

Criteria	Evaluation
1. Short-Term Effectiveness	Questionable. Impacts surface water quality in the Long Prairie River for 5-year pump and discharge period. Soil excavation in back lot area may release volatiles in populated area. Monitoring is performed during construction to minimize potential affects.
2. Long-Term Effectiveness and Permanence	Effective. Removes contaminants from site soils and ground water. Threat is transferred to soil disposal facility and Long Prairie River.
3. Reduction of Toxicity, Mobility, and Volume	Reduces toxicity of ground water contaminants by dilution. Relocates soil contaminants to off-site landfill facility. There is no treatment of the contaminants to reduce toxicity, mobility, volume.
4. Implementability	Questionable. Soils disposal may be subject to landfill ban on organic solvents. Untreated discharge to Long Prairie River will likely be denied by permitting authorities.
5. Cost	Capital: $1,200,000 Annual operations, maintenance, and monitoring: $59,000 for 1 year; $89,000 for 5 years Present worth value: $1,600,000
6. Compliance with ARARs	Noncompliance with surface water ARARs. Complies with ground water, air, and soils ARARs.
7. Overall Protection of Human Health and the Environment	Questionable. Requires further data on the effect of contaminant discharge on the Long Prairie River. Residual incremental cancer risk at the completion of pumping = 10^{-5}.
8. State Acceptance	Not acceptable.
9. Community Acceptance	No objection

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3A EVALUATION

Description: Withdraw contaminated ground water, treat by granular activated carbon adsorption, and discharge to the Long Prairie River and/or use treated water for public supply.

Criteria	Evaluation
1. Short-Term Effectiveness	Effective. Minimal impact to community and workers during 5-year period of remedial action. Residual incremental cancer risk at carbon effluent about equal to 10^{-5}.
2. Long-Term Effectiveness and Permanence	Effective. Residual incremental cancer risk at the completion of ground water pumping is about 10^{-5} at receptors. Permanent ground water remedy.
3. Reduction of Toxicity, Mobility, and Volume	Contaminants destroyed during carbon regeneration process. May be ineffective in vinyl chloride removal.
4. Implementability	Demonstrated and reliable technology. Minimal permitting requirements. Several established vendors. Monitoring required to assure adequate removal.
5. Cost	Capital: $870,000 Annual operations, maintenance, and monitoring: $300,000 for 5 years Present worth value: $2,000,000
6. Compliance with ARARs	Complies with all ground water, surface water, air, and soils ARARs.
7. Overall Protection of Human Health and the Environment	Protective for ground water since it eliminates the threat to human health and the environment.
8. State Acceptance	Acceptable but not preferred.
9. Community Acceptance	Negative initial reaction to use of street right-of-way for ground water collection piping.

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3B EVALUATION

Description: Withdraw contaminated ground water, treat by air stripping, and discharge to Long Prairie River and/or use treated water for public supply.

Criteria	Evaluation
1. Short-Term Effectiveness	Effective. Use of vapor phase carbon treatment minimizes potential impact to community and workers during 5-year period of remedial action. Residual incremental cancer risk at stripper effluent about equal to 10^{-5}.
2. Long-Term Effectiveness and Permanence	Effective. Residual incremental cancer risk at the completion of ground water pumping is about 10^{-5} at receptors. Permanent ground water remedy.
3. Reduction of Toxicity, Mobility, and Volume	Contaminant toxicity reduced by dispersion of air stripping tower emissions. Contaminants destroyed if vapor phase carbon treatment utilized. Monitoring required to assure adequate removal.
4. Implementability	Demonstrated and reliable technology. Several established vendors.
5. Cost	Capital: $730,000 Annual operations, maintenance, and monitoring: $250,000 for 5 years Present worth value: $1,700,000
6. Compliance with ARARs	Complies with all ground water, surface water, soils, and air ARARs.
7. Overall Protection of Human Health and the Environment	Protective for ground water since it eliminates threat to human health and the environment.
8. State Acceptance	Acceptable but not perferred.
9. Community Acceptance	Negative initial reaction to the use of street right-of-way for ground water collection piping.

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3C EVALUATION

Description: Withdraw contaminated ground water, treat by air stripping and activated carbon, and discharge to Long Prairie River and/or use treated water for public supply.

Criteria	Evaluation
1. Short-Term Effectiveness	Effective. Minimal impact to community and workers during 5-year period of remedial action. Residual incremental cancer risk at treatment effluent about equal to 10^{-5}.
2. Long-Term Effectiveness and Permanence	Effective. Residual incremental cancer risk at the completion of ground water pumping is about 10^{-5} at receptors. Permanent ground water remedy.
3. Reduction of Toxicity, Mobility, and Volume	Some contaminants destroyed during carbon regeneration period. Other dispersed to atmosphere. Monitoring required to assure adequate removal.
4. Implementability	Demonstrated and reliable technology. Minimal permitting requirements. Several established vendors.
5. Cost	Capital: $980,000 Annual operations, maintenance, and monitoring: $300,000 for 5 years Present worth value: $2,100,000
6. Compliance with ARARs	Complies with all ground water, surface water, air, and soils ARARs.
7. Overall Protection of Human Health and the Environment	Protective for ground water since it eliminates threat to human health and the environment.
8. State Acceptance	Combined technology is impractical.
9. Community Acceptance	Negative initial reaction to use of street right-of-way for ground water collection piping.

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3D EVALUATION

Description: Withdraw contaminated ground water, treat by either two air stripping or two carbon units, and use treated water for public supply or surface water discharge.

Criteria	Evaluation
1. Short-Term Effectiveness	Effective. Possible impact to community and workers due to treatment unit located in the downtown area. 5-year period of remedial action. Residual incremental cancer risk at treatment effluent about equal to 10^{-5}.
2. Long-Term Effectiveness and Permanence	Effective. Residual incremental cancer risk at the completion of ground water pumping is about 10^{-5} at receptors. Permanent ground water remedy.
3. Reduction of Toxicity, Mobility, and Volume	Contaminants destroyed during carbon regeneration or dispersed to the atmosphere. Monitoring required to assure adequate removal.
4. Implementability	Demonstrated and reliable technology. Minimal permitting requirements. Several established vendors.
5. Cost	Capital: $850,000 - $1,000,000 Annual operations, maintenance, and monitoring: $320,000 for 5 years Present worth value: $2,000,000 - $2,200,000
6. Compliance with ARARs	Complies with all ground water, surface water, soils, and air ARARs.
7. Overall Protection of Human Health and the Environment	Protective for ground water since it eliminates threat to human health and the environment.
8. State Acceptance	Negative aspects made this undesireable.
9. Community Acceptance	Negative initial reaction to use of street right-of-way for ground water collection piping.

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3E EVALUATION

Description: Withdraw contaminated ground water and discharge to municipal wastewater treatment plant.

Criteria	Evaluation
1. Short-Term Effectiveness	Questionable. Possible impacts to treatment plant workers during implementation. Possible impact on Long Prairie River due to WWTP effluent.
2. Long-Term Effectiveness and Permanence	Effective. Residual incremental cancer risk at the completion of ground water pumping and treatment is about 10^{-5} at receptors.
3. Reduction of Toxicity, Mobility, and Volume	Contaminants removed by air stripping and possible biodegradation. Possible concentration of organics in waste activated sludge.
4. Implementability	Not immediately implementable. Long Prairie WWTP is at hydraulic capacity, and expansion is not expected prior to 1990.
5. Cost	Capital: $520,000 Annual operations, maintenance, and monitoring: $150,000 for 5 years Present worth value: $1,100,000
6. Compliance with ARARs	Compliance status with surface water criteria is unknown. Complies with ground water, air and soils ARARs.
7. Overall Protection of Human Health and the Environment	Unknown. May transfer risks from ground water to surface water pathways.
8. State Acceptance	Not Acceptable due to WWTP capacity.
9. Community Acceptance	Negative reaction due to WWTP capacity

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3F EVALUATION

Description: Install active soil venting system in back lot area, strip volatiles from contaminated soils, and treat vapor phase with activated carbon.

Criteria	Evaluation
1. Short-Term Effectiveness	Effective. Possible impacts to workers and community during soil venting system installation. Minimal operations impacts during less than 1 year period of remediation. Monitoring to assure no risk to workers and community.
2. Long-Term Effectiveness and Permanence	Probably effective. Should achieve residual levels for leachate and ingestion criteria. Permanent soil remedy.
3. Reduction of Toxicity, Mobility, and Volume	Contaminants destroyed during regeneration of carbon.
4. Implementability	Demonstrated technology with innovative applicable. Minimal permitting requirements.
5. Cost	Capital: $160,000 Annual operations, maintenance, and monitoring: $140,000 for 1 year Present worth value: $300,000
6. Compliance with ARARs	Complies with all ground water, surface water, air and soils ARARs.
7. Overall Protection of Human Health and the Environment	Protective.
8. State Acceptance	Yes.
9. Community Acceptance	Minimal impact to present land usage in the back lot area.

TABLE 5
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

ALTERNATIVE 3G EVALUATION

Description: Flush soils in back lot area with clean water, recover flush waters in ground water withdrawal network.

Criteria	Evaluation
1. Short-Term Effectiveness	Questionable. Ties up land usage in the back lot area for a lengthly period.
2. Long-Term Effectiveness and Permanence	Probably effective. Should achieve residual levels for leachate and ingestion criteria. Permanent soil remedy.
3. Reduction of Toxicity, Mobility, and Volume	Contaminants recovered during ground water treatment. Reduction in contaminant volume and long-term mobility.
4. Implementability	Long period of remediation. Requires landfill disposal of residual hotspots after flushing treatment. May require variance on reinjection.
5. Cost	Capital: $290,000 Annual operations, maintenance and monitoring: $61,000 for 1 year Present worth value: $350,000
6. Compliance with ARARs	Complies with all ground water, surface water, soils and air ARARs.
7. Overall Protection of Human Health and the Environment	Protective.
8. State Acceptance	Not Acceptable due to negative physical aspects and timeframe.
9. Community Acceptance	Potential negative reaction to loss of land usage in the back lot area.

TABLE 6
LONG PRAIRIE, MINNESOTA
NINE CRITERIA EVALUATION

COMPARISON AMONG ALTERNATIVES

Evaluation Criteria	Alternative 1	2A	2B	3A	3B	3C	3D	3E	3F	3G
Short-Term Effectiveness										
Protection of Community	-		-	+	+	+			+	+
Protection of Workers		+	-	+	+	+	+			+
Environmental Impacts	-	-	-	+		+			+	+
Time	-								+	-
Long-Term Effectiveness										
Magnitude of Residual Risks	-	+	+	+	+	+	+	+		+
Adequacy of Controls	-	+	+	+	+	+	+	+	+	+
Reliability of Controls	-	-	-	+	+	+	+	+	+	+
Reduction of Toxicity, Mobility, Volume	-	+		+	+	+	+	+	+	+
Implementability										
Technical Feasibility		+	+	+	+	+	+	-	+	
Administrative Feasibility		-	-	+		+	+		+	-
Availability of Services and Materials		+	-	+	+	+	+	-	+	-
Cost		+	-		+	-	-	+		
Compliance with ARARs	-	-	-	+	+	+	+		+	+
Overall Protection of Human Health & Environment	-			+	+	+	+		+	+
State Acceptance	-	-	-	+	+	+	-	-	+	-
Community Acceptance	-	+	+	+	+	+	-	-	+	-

Notes: +: generally favorable in comparison to other alternatives
-: generally unfavorable in comparison to other alternatives
blank space: neither favorable nor unfavorable

contaminated soil will provide adequate protection of public health and the environment. Future migration of contaminants to ground water or volatilization may occur if the cap is damaged.

Soil treatment using active soil venting or soil flushing provides adequate protection of human health and the environment since target cleanup levels are met at the site and the contaminants are permanently removed from the soil.

All alternatives, except no-action and direct discharge, provide varying degrees of protection, although they do so through different combinations of treatment or containment. The greater the degree of treatment, the less reliance there is on assuring the alternative's protectiveness through maintenance.

Compliance with ARARs

All protective alternatives are designed to attain the applicable or relevant and appropriate requirements of Federal and State environmental laws. The following alternatives or portions of alternatives will not meet ARARs.

The no-action alternative will not meet ARARs. Also, it is inconsistent with the U.S. EPA groundwater protection strategy. The contaminated groundwater will continue to migrate at levels that exceed MCLs and other health based risk levels.

The plume withdrawal and direct discharge portion of Alternative 2B will not meet the requirements for best available technology (BAT) treatment. It also may exceed ambient water quality criteria.

The reinjection portion of Alternatives 3G may require a special waiver from the State of Minnesota. The State has approved infiltration, but not injection unless potable water is used and injection waters are recaptured in a downgradient withdrawal network. The waiver would be required to define treated ground water as drinking water.

Short-Term Effectiveness

The alternatives involving ground water treatment using GAC and/or air stripping (3A through 3D) provide a high degree of short-term effectiveness by protecting the workers, community and the environment while having no adverse impact from implementation of the remedy.

The ground water alternatives involving ground water extraction and direct discharge without treatment (2A and 2B) provides a lesser degree of short-term effectiveness since the contaminants are being transferred to the river.

The ground water alternative involving discharge to the Long Prairie WWTP (3E) has questionable short-term effectiveness, since there are potential adverse impacts to the treatment plant workers during implementation and subsequent discharge to the Long Prairie River.

The implementation time for all ground water extraction alternatives is the same (five years).

The alternative involving capping (2A) provides short-term effectiveness by eliminating direct contact threats and reducing the threat of contaminant migration to the ground water. The alternative involving soil excavation and offsite disposal (2B) provides short-term effectiveness since direct contact and groundwater contamination threats from the site are removed. However, there are negative short-term impacts resulting from waste handling. Considerable quality control and technical ability is necessary to protect workers and the surrounding community during implementation. Risks to the community also exist due to the offsite transport necessary for 1,500 cubic yards of material.

The alternatives involving soil treatment (3F and 3G) present some short-term threats to the community and workers during implementation. The soil venting system will include treatment for off-gas to prevent exposure to the community. Possible short-term effects due to the intended introduction of contaminants into the ground water from the soil will be mitigated by the accompanying ground water treatment in Alternative 3G. The soil technologies will function equally well only if the hot-spots are excavated for offsite disposal for the soil flushing alternative. The time to implement 3F is approximately one year and 3G is approximately four years.

Long-term Effectiveness

The no-action alternative provides no degree of long-term effectiveness. The unacceptable long-term release of PCE from the soil continues and the contaminated ground water continues to migrate.

Each ground water extraction alternative has the capability to remediate ground water to the target cleanup levels and provide similar degrees of long-term effectiveness and permanence. Alternatives 2A and 2B have some unfavorable long-term effects when compared to the other ground water alternatives. Plume diversion achieves site objectives for ground water. However, there is no treatment of the ground water and it is directly discharged to the surface water. This provides no permanent treatment.

The capping alternative (2A) is a containment remedy and its long-term effectiveness is dependent on maintaining the integrity of the cap. It provides a lesser degree of permanence since the contaminants remain at the site. The excavation and offsite disposal remedy (2B) provides long-term effectiveness at the site but is not a permanent remedy since the risk is transferred to an offsite disposal facility. Both soil treatment alternatives (3F and 3G) are effective over the long-term. Since the contaminants will be treated prior to release to the atmosphere or surface water, they are permanent remedies.

The State will make an effort to get private well users within the advisory area connected to the municipal system prior to implementation. Residents using the municipal system are not presently or in the near future expected to be at risk from contaminated ground water from the Long Prairie site. Ground water monitoring will be conducted throughout the remedial action to assess effectiveness. If after five years of remediation the goals have not been obtained and the efficacy of response action is in question, the technical feasibility of meeting the cleanup goals will be reassessed. Once the cleanup goals are reached, monitoring will continue for at least five years after remediation to verify long-term effectiveness and to assure the remedy successfully cleaned up the aquifer.

Reduction of Mobility, Toxicity, or Volume

The no-action alternative does nothing to reduce mobility, toxicity or volume (MTV). Capping has the disadvantage that the soil contaminants remain in place with only the mobility reduced. Active venting has an advantage over flushing since the contaminants will be thermally destroyed during regeneration of carbon resulting in a decrease in MTV.

All of the plume diversion and extraction alternatives (2A through 3E) will reduce the concentration of contaminants in the aquifer. The residual contamination in the aquifer is the same for all extraction alternatives and will be dependent on the technical feasibility of meeting MCLs. Alternative 3A, 3C and 3D are the only treatment alternatives which result in contaminant destruction since the carbon is thermally regenerated. Treatment of ground water at a WWTP will reduce the toxicity of the contaminants. Plume diversion transfers contaminants from groundwater to surface water where volatilization and biological degradation decrease the MTV. For all other ground water treatment alternatives, there will not be an overall reduction of toxicity, mobility and volume of hazardous constituents beyond those occurring naturally through dilution, dispersion, adsorption, biological, degradation, and ultra violet radiation.

Implementability

The implementability of each alternative is based on technical feasibility, administrative feasibility and the availability of services and material for the alternative. All of the alternatives

TABLE 7
LONG PRAIRIE, MINNESOTA

COST ANALYSIS

Alternative	Capital Cost	O&M Cost	Period	Total Present Worth
1 - No Action	$ 40,000	$ 4,200	30 years	$ 80,000
2 - Plume Diversion	430,000	89,000	5 years	770,000
2A - Soils Capping	70,000	15,000	30 years	210,000
2B - Excavate/Landfill	790,000	59,000	1 year	850,000
3A - Activated Carbon	870,000	300,000	5 years	2,000,000
3B - Air Stripping	730,000	250,000	5 years	1,700,000
3C - Air Stripping and Carbon	980,000	300,000	5 years	2,100,000
3D1 - Two Carbon Units	850,000	310,000	5 years	2,000,000
3D2 - Two Air Stripping Towers	1,000,000	320,000	5 years	2,200,000
3E - WWTP Treatment	520,000	150,000	5 years	1,100,000
3F - Active Soil Venting	160,000	140,000	1 year	300,000
3G - Soil Flushing	290,000	61,000	4 years	350,000

Note: A discount rate of 10 percent is used to calculate the present worth of annual O&M costs. The present worth factor is as follows: 30 years - 9.43, 5 years - 3.79.

are technically feasible. Ground water extraction is common place and the treatment technologies applied to the pump-out water have a demonstrated performance record for these contaminants. Alternative 3E, wastewater treatment plant, was not feasible due to hydraulic overloading.

Alternatives 2A and 2B entail administrative requirements which compare unfavorably with the other alternatives e.g., BAT requirements, land ban for excavated soils, problems with relocation of utilities and difficulties associated with accessibility and constructability. Alternative 3G has the disadvantages of a long implementation/treatment period, the potential necessity for special measures to protect adjacent buildings, and uncertainties associated with land disposal of soil from hot spot areas. The RCRA Land Ban Regulations for treatment prior to land disposal may apply resulting in serious implementability issues for Alternatives 2B and 3G. Thus in-situ treatment is preferred, if technically feasible.

Cost Criteria

The estimated present worth value of each remedial alternative is listed in Table 7. No-action and plume diversion are the lowest estimated cost ground water remediation alternatives. Discharge to the City of Long Prairie wastewater treatment plant is the least expensive ground water remedial alternative that utilizes treatment. However, the estimated cost does not include any capital costs to increase the hydraulic capacity of the treatment plant.

Air stripping costs are estimated to be lower than activated carbon costs. Costs for single treatment facilities are less than those for multiple facilities or combined air stripping and activated carbon treatment technologies yet provide equivalent protection.

Discharge costs are incurred if treated ground water is reinjected into the Long Prairie Sand Plain aquifer or routed to the City of Long Prairie wastewater treatment plant.

The estimated cost for soils remediation by excavation and off-site disposal or flushing are higher than soil capping or active soil venting due to transportation and landfill charges. Active soil venting costs are comparable to capping containment costs.

Community Acceptance

Community response to the alternatives is presented in the responsiveness summary.

State Acceptance

The State of Minnesota (MPCA) is the lead Agency for the site.MPCA has selected the remedy presented below.

IX. SELECTED ALTERNATIVE

Based on current information, the U.S. EPA and the MPCA select Alternatives 3B and 3F as the most appropriate final remedy for the Long Prairie Ground Water Contamination site. The significant features of this remedy are as follows:

- o Install ground water extraction wells in the contamination plume;
- o Treat contaminated ground water with an air stripper;
- o Discharge treated ground water from the air stripper to the Long Prairie River; and
- o Treat contaminated soil with an active soil venting system.

Target Cleanup Levels

For carcinogens, U.S. EPA generally considers risks of 10^{-4} to 10^{-7} unit cancer risk as acceptable and generally protective of human health and the environment. The total potential risk at the site ranges from an average of 3.8 X 10^{-4} to a worst case of 5.5 X 10^{-3} for ingestion of contaminated ground water. Since the potential risks from the site are greater than 10^{-4}, the target cleanup level for the remedial action will be health driven. Protection will be provided to the 3.3 X 10^{-5} risk level at the potential receptor under estimated worst case conditions and the 8.8 X 10^{-6} risk level under average conditions. Further discussion of the method of determining these levels is in the FS.

Listed below are the Target Cleanup Levels (TCL's) that need to be reached for each contaminant to achieve the worst case or average risk level. These concentrations are based on ground water data from the private wells in the advisory area. However, during the remedial action, the TCL's may not be achievable. If that becomes the case, alternate concentration levels may need to be considered.

Although it is not now being proposed, if the treated ground water were to be used in the municipal drinking water system, the potential risk would be 2.3 X 10^{-5} without mixing with other clean municipal wells or receiving additional treatment in the existing iron removal system.

The maximum potential cancer risk for ingestion of PCE contaminated soil in the back parking lot by a 10 kg child ingesting 5 grams of soil per day for 5 years is currently about 7.9 X 10^{-6} excluding the barrel contents. The residual PCE concentration corresponding to an increased cancer risk of 1 X 10^{-6} is about 1,400 ug/kg. Soil ingestion is presenting an unlikely exposure pathway given the location and the fact that it is a paved parking lot. The 10^{-6}

incremental risk is acceptable since it falls within the generally allowed range of the EPA of 10^{-4} to 10^{-7}. To prevent future ground water contamination through continued leaching, the soils will be treated to a 1,200 ug/kg level. This is protective since it is below the 10^{-6} risk level. In addition, the leachate produced is expected to be about 100 ug/l PCE, based on the TCLP tests run on the site soil. Although the leachate will be greater than TCL's in ground water, this leachate will be extracted and treated along with the ground water until ARARs are reached in the aquifer if technically practicable.

The potential cancer risk through inhalation of PCE, TCE and vinyl chloride is estimated to be 2.8 X 10^{-6} from MPCA and MDH air quality modeling of the air stripper, without vapor phase treatment. This risk level is estimated to occur 20 meters southeast of the air stripper. The nearest residence is greater than 100 meters from the proposed air stripper location. U.S. EPA also conducted an assessment on the risk from the air stripper. The risk from exposure to the VOCs from the stripper was calculated to be 3 X 10^{-8}. Both calculated potential risk levels are protective of human health. Therefore, no off-gas treatment will be required for the air stripper.

Discharge of treated ground water to the Long Prairie River with a PCE concentration of 5 ug/l is expected to result in a worst case potential cancer risk level of about 1.6 X 10^{-7} based on drinking water ingestion and fish or aquatic organism consumption and about 1.5 X 10^{-8} for fish or aquatic organism consumption alone. The assumptions and ARARs considered are below.

- Discharge of treated ground water with 5 ug/l PCE at 260 gpm (0.58 cfs) mixing completely with;
- Long Prairie River seven consecutive day once-in-ten year low flow (7Q10) of 21.2 cfs which yields a river concentration of 0.13 ug/l PCE.

PCE	Discharge Concentration	River Concentration	AWQC 10^{-6} Water & Fish	Risk Level Fish Only
	5 ug/l	0.13 ug/l	0.8 ug/l	8.8 ug/l

According to Minnesota Water Quality Classification and Rules, the Long Prairie River is not classified for use as drinking water. Therefore, fish consumption is the only likely route of exposure to contaminants. Minnesota criteria for fish consumption only is 15 ug/l PCE for local species.

Remedial Action and Operations and Maintenance

The U.S. EPA will pay 90 percent of the construction costs and the State of Minnesota will pay 10 percent. According to Section 104 of the Superfund Amendments and Reauthorization Act (SARA), treatment or other measures to restore ground water are considered remedial action for a period of up to 10 years. Therefore, U.S. EPA will pay 90 percent and the State will pay 10 percent of the operations and maintenance (O&M) cost of the extraction wells, air stripper and ground water monitoring until cleanup levels are reached or for 10 years whichever comes sooner. After that, the State will assume full responsibility for O&M.

X. STATUTORY DETERMINATIONS

A. Protection of Human Health and the Environment

The selected remedy provides protection of human health for future users through extraction and treatment of contaminated ground water using an air stripper and treatment of contaminated soils using active soil venting. The aquifer restoration will prevent the public from ingestion of contaminant concentrations in the water that are contaminated by carcinogens posing a lifetime excess cancer risk for all contaminants of 3.3×10^{-5} for worst case and 8.8×10^{-6} for average conditions. It is estimated that the ground water will be restored to MCLs or health-based risk levels in 5 years.

In addition, the remedy will prevent the ingestion of contaminated soil posing an undue risk of cancer greater than 10^{-6}. The potential leaching from the soil into the ground water will be adequately reduced to protect human health and the environment. It is estimated that the soils will be treated in one year.

The remedy is also protective since the risk from exposure to contaminants from the air stripper will have a total excess

cancer risk for all contaminants of less than 2.8×10^{-6}. Air stripping will be done in time frame of approximately 5 years during ground water treatment.

This discharge to the Long Prairie River will be protective of human health and the environment since the cumulative excess cancer risk of 1.5×10^{-8} will be accomplished.

B. Attainment of Applicable or Relevant and Appropriate Requirements

A combination of alternatives 3B and 3F will meet the following Federal and State ARARs:

1. Resource Conservation and Recovery Act (RCRA); 40 CFR Part 260 and Part 264

2. Clean Water Act (CWA); 40 CFR Parts 122, 125

3. Safe Drinking Water Act (SWDA); 40 CFR Parts 141-146.

4. Minnesota Rules Chapter 7001 and Minnesota Statutes 115 and 116.

5. Minnesota Rules Chapter 7050

6. Minnesota Statute 116.07 Subd. 4.2

7. Minnesota Statute Chapter 105

1. Clean Air Act

The Clean Air Act is not an ARAR, since the U.S. EPA does not have air quality regulations for the release of volatile organic compounds to the atmosphere that would cover the action proposed here. Minnesota Statute 116.07 Subd. 4.2 is relevant because it requires air quality permits which regulate air emissions of toxic pollutants.

2. Resource Conservation and Recovery Act (RCRA)

40 CFR Part 260.10 defines tanks, which could apply to the buried barrel in the alley parking lot. This could cause RCRA tank closure regulations to be relevant and appropriate for this site. The buried barrel and contents will be removed from the site.

40 CFR Part 264.197 requires the removal and decontamination of all waste residues, contaminated system components, contaminated soils and structures/equipment contaminated with hazardous waste. It, therefore, is an ARAR. RCRA has not defined the level of decontamination required. U.S. EPA guidance regarding the level of decontamination requires that any contaminants left in the subsoils will not impact any environmental media and that direct contact will not result in a threat to human health and the environment. The active soil venting system will decontaminate the soils so that leaching from them will not impact other environmental media (ground water) and so that direct contact (i.e., ingestion by humans) will not result in a threat to human health.

3. Clean Water Act (CWA)

The CWA is an ARAR since treated site ground water will be discharged to a surface water body (Long Prairie River) near the site. Ambient Water Quality Criteria (AWQC) are established for the protection of freshwater aquatic organisms and the protection of human health from potential carcinogenic effects due to exposure through ingestion of contaminated water and contaminated aquatic organisms. AWQC will be met by the discharge and the requirements of an NPDES permit will be met for this discharge.

4. Safe Drinking Water Act (SWDA)

The SDWA specifies MCLs for drinking water contaminants at public water supplies. The SDWA is applicable since regulated volatile organic compounds exceed MCLs in the community drinking water supply aquifer. There is no MCL for PCE or DCE. The target cleanup level for TCE is expected to be below the MCL.

5. Minnesota Statutes and Minnesota Rules

The following Minnesota Statutes and Minnesota Rules regulate the recommended remedial alternative to be performed at the Long Prairie site.

a. Minnesota Statute 166.07 Subd. 4.A. - regulates air emissions through permits and requires that toxic and or carcinogenic pollutants attain appropriate levels at the receptor which dispersion modeling indicates would be most impacted.

b. Minnesota Statutes 115 and 116 and Minnesota Rules Chapter 7001 - regulate the discharge to surface water under NPDES permits.

c. Minnesota Rules Chapter 7050.021 - regulates water quality permits which require that discharges to surface water attain 10 percent of the acute toxicity (96 hour threshold limit value) for toxics and 10^{-5} risk level for carcinogens.

d. Minnesota Rules Chapter 7050.0220 - requires that discharges to ground water which will be used for consumption attain MCLs and State Recommended Allowable Limits (RALs) for drinking water, generally at the 10^{-5} risk level for carcinogens.

e. Minnesota Statute Chapter 105 - requires the Minnesota Department of Natural Resources to develop and manage water resources to assure a supply adequate to meet long range seasonal requirements for domestic, municipal and other uses from surface or ground water sources. Water appropriation permits are required for extraction.

Where State ARARS are more stringent than Federal ARARS, the State requirements will be met at the completion of the remedial action. No permits will be obtained for onsite activities. The substantive permit requirements will, however, be met.

C. Cost-Effectiveness

The selected remedy is effective in restoring the ground water and soils in a short time period (five years) while protecting human health and the environment. The selected remedy is the least expensive of the alternatives which meets site cleanup goals and treats the contaminants.

D. Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

MPCA and U.S. EPA have determined that this remedy is the most appropriate solution for meeting the remedial action goals at the Long Prairie site. All of the ground water extraction alternatives (2A through 3E will remediate the ground water in about the same time and will provide adequate protection of public health with respect to the ground water. Alternatives 2A, 2B and 3E may not be protective of the environment since contaminants may be released to the surface water. Alternatives 3A through 3D will provide similar levels of treatment to the discharged ground water and air. Of these, Alternative 3B is the most cost-effective since it meets site objectives for the least cost. No-action will not protect human health and the environment for potential future users and will not result in municipal Wells #4 and #5 being usable in the near future.

Alternative 2A, capping, does not use treatment to reduce the volume or toxicity of the soil contaminants and would require long-term maintenance to ensure the integrity of the cap in order to reduce contaminant mobility. Alternative 2B, excavation/ offsite landfill, transfers the risk to another location without treatment and is the most costly of the soil alternatives. Alternative 3F is the least costly of the remaining alternatives and will treat the soil contaminants to reduce the mobility, toxicity and volume in a shorter period of time than 3G. Alternative 3F may also be more convenient to the local businesses than 3G.

Extraction of the contaminated ground water will permanently restore the aquifer. Air stripping is the most appropriate type of treatment. Active soil venting provides an adequate degree of treatment in a shorter time period for less cost. Therefore, the selected remedy provides the best balance among the nine criteria. This is a permanent solution that uses alternative treatment technologies (air stripping, active soil venting and GAC off-gas treatment) to the maximum extent practicable.

E. Preference for Treatment as a Principal Element

The statutory preference for remedies that employ treatment which permanently and significantly reduce the toxicity, mobility or volume of hazardous substances as a principal element is satisfied since the contaminants from the soil will be thermally destroyed during regeneration of the GAC.

Although treatment of the extracted ground water with an air stripper reduces the volume of contaminated water, the mobility and toxicity of the contaminants will not be permanently reduced beyond that which will occur naturally since the air stripper transfers contaminants from water to air. There is no need for GAC off-gas treatment based on health effects. Treatment of the soil with a soil active venting system with GAC off-gas treatment reduces the toxicity, mobility and volume of contaminated soil in the back parking lot area.

Schedule

The following are key milestones for implementation of the remedial action:

Approve Remedial Action (Execute ROD)	June 1988
Initiate Remedial Design	September 1988
Complete Remedial Design	September 1989
Initiate Remedial Action (Award Contract)	January 1990

4/5/88

mpc 4/5/88

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
	1	86/11/19	Notification to adressee that soil borings will be performed on their property.	Mark Lantinen-MPCA	Ryan-Dept.MilitaryAffairs	Correspondence
	4	00/00/00	Letter to all residents informing those that live in the affected area should not consume their well water.	Sandra Gardebring-MPCA	All residents	Correspondence
	29	83/12/02	Results of private weel sampling at twenty-nine separate residences.	Michael Convery-MPCA		Correspondence
	2	83/12/06	Results of private well sampling at the Reinhardt and Lamprecht residences.	Michael Convery-MPCA	see title	Correspondence
	2	83/12/07	Letter regarding Long Prairie Water Supply System	Larson-Peterson&Assoc.	City of Long Prairie	Correspondence
	19	83/12/30	Results of private well water sampling at fifteen separate residences.	Michael Convery-MPCA		Correspondence
	1	84/01/23	Letter on the health risk criterion and actual level of contamination by TCE and PCE.	Sandra Gardebring-MPCA	James Hodgson-Regn.Dev.Co	Correspondence
	6	84/02/23	Results of private well water sampling at six separate residences	Michael Convery-MPCA		Correspondence
	2	84/02/23	Results of private well water sampling and an advisory not to use the water for consumption.	Michael Convery-MPCA	Ms. Catherine Carsten	Correspondence
	8	84/03/06	Results of private well	Michael Convery-MPCA		Correspondence

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
			sampling at eight seperate residences			
	2	84/04/03	Results of private well water sampling at the Pederson and Pepin residences.	Michael Convery-MPCA	See title	Correspondence
	5	84/04/18	Results of private well water sampling at five seperate residences and recommendation that they completely discontinue the use of the wells.	David Gray-Mn. Dept. of Health		Correspondence
	7	84/08/20	Results of private well water sampling at seven seperate residences.	Michael Convery-MPCA		Correspondence
	110	84/10/12	Request for Information by the MPCA along with avaliable responses.	C.Bruce Wilson-MPCA		Correspondence
	3	84/11/15	Results of private well water samplin at Mosl Plumbing & heating, Timothy Willey's and at Mrs. Grecula's.	Michael Convery-MPCA	See title	Correspondence
	2	84/11/21	Results of preivate well water sampling.	Michael Convery-MPCA	D. Verdoorn & M.Illies	Correspondence
	1	84/11/27	Results of private well water sampling.	Michael Convery-MPCA	Mrs. Ione Perish	Correspondence
	2	85/05/06	Request for assistance by the MPCA to the current owner/operator of the dry cleaning facility at 243 Central Ave.	Michael Convery-MPCA	D.Verdoorn-D&F Cleaners	Correspondence
	4	85/05/20	Letter to PRP regarding clean-up and other related responsibilities of PRPs	G.Pulford,MPCA	J.Chyba,Jr.	Correspondence
	4	85/05/20	Letter to PRP regarding responsibilities as PRP	G.Pulford,MPCA	P.Paulsen	Correspondence

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
	12	85/05/20	MPCA letter giving the former owners of the dry cleaners an opportunity to conduct the RI/FS.	Gary A. Pulford-MPCA	Paulsen,Chyba,etal.	Correspondence
	18	85/06/11	Results of private well water sampling at six seperate residences.	Michael Convery-MPCA		Correspondence
3		86/01/13	Letter commenting on review of SOP for VOC analysis	CH2M Hill	USEPA	Correspondence
	3	86/01/13	Review of SOP submitted by Pace Laboratory, Inc. VOC's.	Ronald Wen-CH2M Hill	Dave Payne-USEPA	Correspondence
	10	86/04/07	Results of private well sampling at seven seperate residences.	Mark Lahtinen-MPCA		Correspondence
	9	86/06/23	Desriptions of the medical monitoring programs in use by the Project Team	P.Cangialosi-MPCA	Mary Tyson-USEPA	Correspondence
	7	86/07/03	Summary of findings of PE samples analyzed by Pace Labs.	Ronald Wen - CH2M Hill	Dave Payne-USEPA	Correspondence
	5	86/08/29	Notification that it will be necessary to install monitoring well upon city property with attached access agreement.	Mark Lahtinen-MPCA	D.Venekamp-CityofLongPra.	Correspondence
	4	86/10/13	Letters to for residents: Sundberg,Harren,Niedhart & Warner informing them that their wells will be sampled.	Mark Lahtinen-MPCA	See title	Correspondence
	4	86/11/12	Notification to the First National Bank of Long Prarie and to East West Realty that mit is necessary to install monitoring wells upon their property.	Mark Lahtinen-MPCA	See title	Correspondence
	3	86/11/20	Letter regarding additional	Malcom Pirnie	MPCA	Correspondence

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE, MINNESOTA

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
			borings, rates and samples-Longrarie Remedial Investigation			
	3	86/11/20	Costs of drilling work and authorization of a shallow well and review of soil boring results.	P.Cangialosi-Malcom Pirnie	Mark Lantinen-MPCA	Correspondence
	9	86/12/22	Resulta of private well water sampling at nine separate residences.	Mark Lantinen-MPCA		Correspondence
	2	87/04/27	Results of the soil boring and well monitoring on East West Realty property.	Mark Lantinen-MPCA	R.Brophy-East West Realty	Correspondence
	4	87/05/12	Notification to residents Lamcrecht, Peterson, Werlinger and Kilmer of upcoming residential well water sampling.	Mark Lahtinen-MPCA	See title	Correspondence
	3	88/01/15	Proposed state Applicable or Relevant and Appropiate Requirements for the Long Prairie Groundwater Contamination Site,	Mark Lantinen-MPCA	Mary Tyson-USEPA	Correspondence
	3	00/00/00	Superfund Program Fact Sheet: Long Prairie ground water contamination.	MPCA		Fact Sheet
	4	00/00/00	The Long Prairie Ground Water Contamination Problem, In Brief.	MPCA		Fact Sheet
2		85/05/21	Fact Sheet "The Long Prairie Ground Water Contamination Problem"	MPCA		Fact Sheet
	4	87/10/00	Superfund Program Fact Sheet: Long Prarie Ground Water Contamination Remedial Investigation Report.	MPCA		Fact Sheet
	2	00/00/00	Sampling points of private	Michael Convery-MPCA	File	Memorandum

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
			and monitoring wells tested on 4/23/85.			
	9	83/11/01	Agenda Item Control Sheet for the meeting to be held at the MPCA on 12/20/83 to request authorization to conduct an RI/FS.	B.Wilson & S.Lee-MPCA		Memorandum
	7	84/02/10	MPCA Agenda Item Control Sheet to obligate funds for a temporary Water Treatment System.	Bruce Wilson-MPCA	MPCA	Memorandum
	3	84/10/01	Inspection report on the PND Cleaners, 243 Central Ave.	Michael Convery-MPCA	File	Memorandum
	2	84/10/04	Memo on interview with Mr. Pathi L. Dharni.	Wilson & Convery-MPCA	File	Memorandum
	1	85/05/06	Locations of watermain extensions in northeastern Long Prairie.	Michael Convery-MPCA	File	Memorandum
	1	85/05/09	Discussion of Naptha Base or Petroleum-Distillate Solvent.	Michael Convery-MPCA	File	Memorandum
	2	86/09/17	Memo of site visit to check water levels. Also discussed actual ownership of land, and discovery of a partially buried barrel.	Dale Thompson & Mark Lahtinen-MPCA	File	Memorandum
	1	87/10/14	News Release: MPCA To Hold Meeting In Long Prairie	Elizabeth Gelbmann-MPCA		News Release
	1	86/10/10	News. Art. "Perpich lobbies Reagan on Superfund".	Tribune		Newspaper Article
	3	83/12/09	Agenda for the MPCA Regular Board Meeting to be held on 12/20/83.	MPCA		Other
	5	84/02/17	Agenda for the MPCA Regular Board Meeting to be held on 2/28/84.	MPCA		Other

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
	1	87/10/26	Agenda for public meeting on Long Prairie ground water contamination held on 10/26/87 at 7:00 p.m.	MPCA		Other
	4	83/11/04	MPCA Director's Determination of Emergency	Sandra Gardebring-MPCA		Pleadings/Orders
	2	85/05/15	News Release "MPCA Finds Source of Long Prairie Ground Water Pollution"	MPCA		Press Release
	1	86/10/15	News Release "Superfund Investigation of Long Prairie Ground Water Contamination to Begin"	MPCA		Press Release
	7	00/00/00	Community Relations Plan Long Prairie Ground Water Contamination			Reports/Studies
	67	00/00/00	Multi-Site Cooperative Agreement Minnesota Pollution Control Agency Quarterly Progress Report	MPCA	EPA	Reports/Studies
	7	83/12/20	Request for Authorization to Contract for RI and FS necessary for correction of Municipal Well Contamination	MPCA		Reports/Studies
	14	84/03/16	Potential Hazardous Waste Site Inspection Report	E.Jurczak,Ecology&Environ.	USEPA	Reports/Studies
	14	84/03/16	Site Inspection Report	Ellen Jurczak-Ecol. & Envir.	USEPA	Reports/Studies
	22	84/06/14	Hazardous Ranking System Scoring Package	Ellen Jurczak-E&E	USEPA	Reports/Studies
	6	84/12/27	Potential Hazardous Waste Site Preliminary Assessment	D.Partner,MPCA	USEPA	Reports/Studies

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

HE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
	6	84/12/27	Preliminary Assessment	D.Portner-MPCA	USEPA	Reports/Studies
	34	85/09/18	RI/FS Work Plan Scope of Work	Malcom Pirnie	MPCA	Reports/Studies
	45	85/10/14	Site Management Plan/Status Report			Reports/Studies
	8	86/06/30	Quarterly Progress Report to USEPA - Technical Status - FY 1986, 3rd Quarter.	MPCA	USEPA	Reports/Studies
	118	86/07/00	RI/FS Work Plan	Malcolm Pirnie	MPCA	Reports/Studies
	187	86/07/00	Qualkity Assurance Project Plan(QAPP) - Vol. I: Appendices A-C.	Malcom Pirnie	MPCA	Reports/Studies
	263	86/07/00	Quality Assurance Project Plan(QAPP) - Vol. II: Appendices D-H.	Malcom Pirnie	MPCA	Reports/Studies
	95	86/07/00	Quality Assurance Project Plan (QAPP)	Malcom Pirnie	MPCA	Reports/Studies
	7	86/07/03	Letter transmitting summary of findings of Performance Evaluation (PE) samples analyzed for Long Prairie Project	R.Wen	USEPA	Reports/Studies
	6	86/12/31	Quarterly Progress Report to USEPA-Technical Status- FY 1986, 1st Quarter.	MPCA	USEPA	Reports/Studies
	67	87/03/31	Quarterly Progress Report to USEPA- Technical Status- for FY's 1985 1st Quarter to 1987 2nd Quarter.	MPCA		Reports/Studies
	6	87/03/31	Quarterly Progress Report to USEPA-Technical Status-	MPCA	USEPA	Reports/Studies

ADMINISTRATIVE RECORD INDEX

LONG PRAIRIE,
MINNESOTA

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
			FY 1987.			
	6	87/06/30	Quarterly Progress Report To USEPA - Technical Status - FY 1987, 3rd Quarter.	MPCA	USEPA	Reports/Studies
	44	87/07/02	Site Management Plan/ Status Reports from 10/14/85 to 7/2/87.	USEPA		Reports/Studies
	206	87/10/00	Final Remedial Investigation Report	Malcolm Pirnie	MPCA	Reports/Studies
	232	87/10/00	Remedial Investigation Final Report	Malcom Pirnie	MPCA	Reports/Studies

ADMINISTRATIVE RECORD INDEX UPDATE
LONG PRAIRIE GROUNDWATER CONTAMINATION SITE
CITY OF LONG PRAIRIE, MINNESOTA

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
	198	88/04/05	Feasability Study Report	Malcom Pirnie, Inc.	MPCA	Reports/Studies