RMT INC

RMT, Inc.
Suite 124
1406 East Washington Ave
Madison, WI 53703-3009
Phone 608-255-2134
FAX 608-255-0234

A-E QUALITY CONTROL SUMMARY REPORT FOR THE SOIL GAS SURVEY

AT THE

NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
FRIDLEY, MINNESOTA

FEBRUARY 1988

CONTRACT NO. DACA45-86-C-0015
MODIFICATION NO. P00003

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Thomas P. Kunes

Date 2-16-88 Registration No. 013728

Thomas P. Kunes, P.E.
President, Northern Region

Robert R. Stanforth

Robert R. Stanforth, Ph.D.
Applied Chemist

Eric Gredell

Eric Gredell, P.E.
Project Manager

1332.50 139:RTA:frid0111

TABLE OF CONTENTS

Title	Page
1. INTRODUCTION	1-1
1.1 Background	1-1
1.2 Purpose and Scope	1-6
1.3 Advantages and Limitations of Soil Gas Monitoring	1-7
2. FINDINGS AND CONCLUSIONS	2-1
2.1 Methodology	2-1
2.2 Results	2-1
2.3 Conclusions	2-2
3. RECOMMENDATIONS	3-1
4. SAMPLING PROGRAM	4-1
4.1 Initial Sampling Procedures Plan	4-2
4.2 Problems Encountered and Corrective Actions Taken - Sampling Procedures	4-2
4.2.1 Pore Gas Probe Method	4-2
4.2.2 Sample Analysis	4-6
4.3 Problems Encountered and Corrective Actions Taken - Sample Locations	4-8
4.4 Comparison of Sampling and Analysis Methods	4-9
4.4.1 Sampling Methods	4-10
4.4.2 Analytical Methods	4-11
4.4.3 Comparison of Headspace and Probe Analysis of the Same Sampling Point	4-12
4.4.4 Selected Sampling and Analytical Methods in Phase II	4-14
4.5 Final Sampling Plan	4-14
4.5.1 Pore Gas Sampling Method	4-14
4.5.2 Sampling Locations	4-20
4.5.3 Daily Quality Control Reports	4-21
5. ANALYTICAL QUALITY CONTROL	5-1
5.1 Replicate Sampling	5-3
5.2 Replicate Analyses	5-5
6. RESULTS AND DISCUSSION	6-1
6.1 Background and Area 1 - Former TCE Tank Area	6-1
6.2 Area 2 - Former Disposal Area	6-5
6.2.1 General Survey	6-5
6.2.2 Trench and Decontamination Pad Area	6-8
6.2.3 Water Main Excavation Area	6-18
6.3 Present TCA Tank Area	6-20
7. REFERENCES	7-1

TABLE OF CONTENTS (CONT'D)

List of Figures

Figure 1-1 - General Vicinities Map..... 1-2
Figure 1-2 - Map of NIROP Facility..... 1-4
Figure 1-3 - TCE Concentrations in Shallow Ground Water at Site..... 1-5
Figure 4-1 - Portable GC Versus HNU Readings on the Same Sample..... 4-7
Figure 6-1A - Soil Gas Sampling Locations for all Areas and TCE & DCE Concentrations in all Areas Except for Trench Area 6-2
Figure 6-1B - Soil Gas Sample Location Numbers in Trench Area..... 6-3
Figure 6-2 - Area 2 - TCE & DCE Concentration in Soil Gas Samples in Trench Area.....6-11
Figure 6-3 - Area 2 - Trichloroethylene Concentrations in Soil Gas Samples in Trench Area.....6-14
Figure 6-4 - Area 2 - Cis-Dichloroethylene Concentrations in Soil Gas Samples in Trench Area.....6-15
Figure 6-5 - Area 2 - Trans-Dichloroethylene Concentrations in Soil Gas Samples in Trench Area.....6-16
Figure 6-6 - Area 2 - Trichloroethylene to Cis-Dichloroethylene Ratio.....6-17
Figure 6-7 - Approximate Water Main Trench Area.....6-19

List of Tables

Table 4-1 - TCE and DCE Concentrations in Tedlar® Sampling Bags After Various Numbers of Clean Air Purges.. 4-4
Table 4-2 - Comparison of Sample Pore Gas Quality Collected Using Two Methods of Filling the Tedlar® Bag..... 4-5
Table 4-3 - Comparison of Headspace and Pore Gas Analysis of the Same Sampling Point.....4-13
Table 4-4 - Field Data Form Soil Gas Investigation.....4-18
Table 4-5 - Locations Sampled and Method used on Each Day of the Field Work.....4-22
Table 5-1 - Summary of GC Runs, Broken Down by Date and Run Category..... 5-2
Table 5-2 - Results of GC Analysis on Replicated Samples.... 5-4
Table 5-3 - Results of Analytical Duplicate Runs on GC..... 5-6
Table 6-1 - Soil Gas Results for Background and Area 1 - Former TCE Tank..... 6-4
Table 6-2 - Soil Gas Results for Area 2 - General Survey.... 6-7
Table 6-3 - Results of Pore Gas Sampling in Trench and Decontamination Pad Areas (Area 2)..... 6-9
Table 6-4 - Results of Pore Gas Sampling in Water Main Trench Area (Area 2).....6-21
Table 6-5 - Soil Gas Results for Area 3 - New TCA Tank.....6-22

TABLE OF CONTENTS (CONT'D)

List of Appendices

Appendix A - Initial Soil Gas Sampling and Analysis Plan
Appendix B - Telephone Logs for Conversations Relating to Pore Gas Sampling
Appendix C - Actual Site Location Descriptions Using Landmarks at the NIROP Site
Appendix D - Daily Quality Control Reports for Pore Gas Sampling Period November 2-25, 1987
Appendix E - Results of Soil Gas Analyses November 1-25, 1987
Appendix F - Field Notes by MPCA Personnel During Inspection of Water Main Trench - October 29, 1987

1. INTRODUCTION

This report presents results of a survey of near-surface soil in selected areas at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota. The survey was intended to investigate potential areas of high volatile organic carbon (VOC) concentrations in surficial soil in selected areas at the NIROP facility. Both soil pore gas and soil headspace analyses were performed, using portable instruments so that analysis on site could be done. On-site work provides rapid analytical turn-times, and facilitates rapid data analysis and modification of the field investigation as appropriate. In addition, analysis on-site and use of portable equipment results in a considerable cost savings over regular laboratory analysis. The work was done as part of Contract Number DACA45-86-C-0015, Modification Number P00003, between the Omaha District of the Army Corps of Engineers and RMT, Inc., of Madison, Wisconsin.

1.1 Background

The Naval Industrial Reserve Ordnance Plant (NIROP) is a government-owned, contractor-operated facility. The plant is operated by the Northern Ordnance Divison of FMC Corporation. The NIROP manufactures advanced naval weapons systems. The NIROP is located in the northern portion of the Minneapolis/St. Paul, Minnesota metropolitan area within the city limits of Fridley, Minnesota (see Figure 1-1). It is situated approximately one-half mile east of the Mississippi River and less than one mile south of Interstate 694. The facility is bordered on the west by East River Road and on the east by the

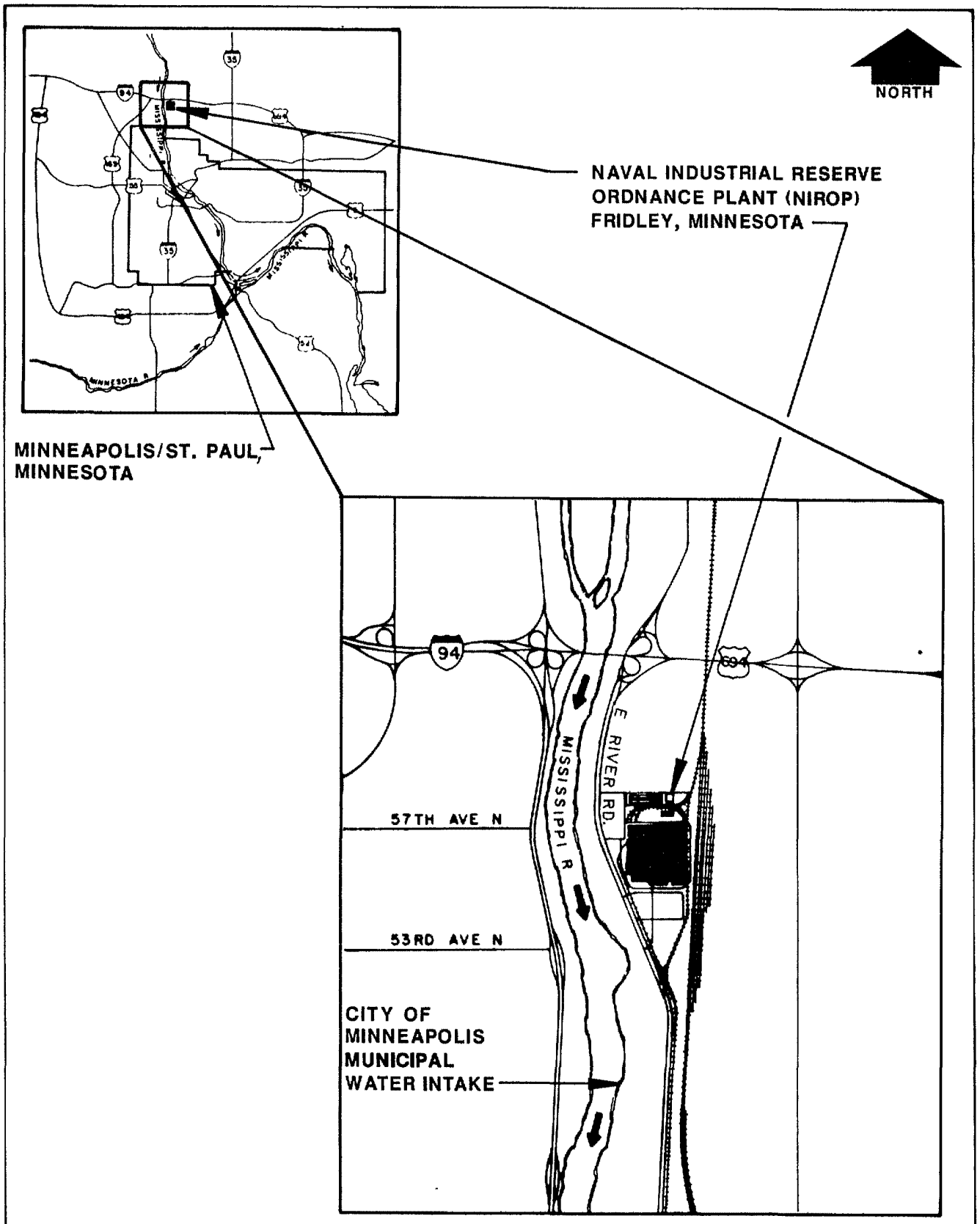


FIGURE 1-1
GENERAL VICINITIES MAP

RMT	DWN BY: MDZ
	DATE: 2/16/88
	PROJ #: 1332.50

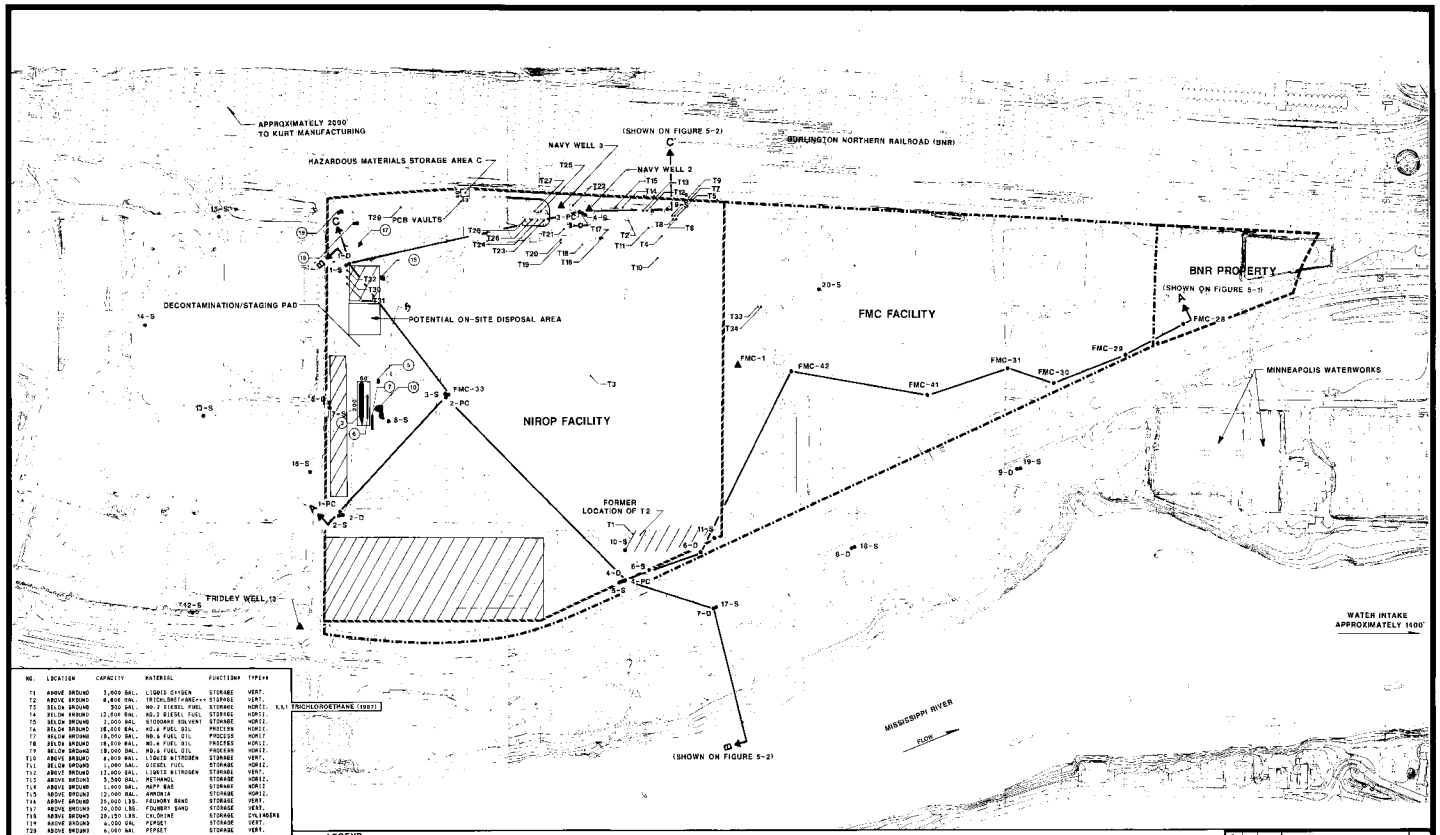
FEB 1 7 1988

Burlington Northern rail yard. The government-owned, contractor-operated portion of the plant occupies about 83 acres. The plant is located in an industrial area which has a number of adjacent manufacturing facilities. A map of the NIROP facility is shown on Figure 1-2.

In previous years, the storage yard in the northern quarter of the site had been used for the disposal of drummed waste by burial in 8- to 10-foot-deep trenches or in pits. The materials disposed were thought to include waste oil, plating sludge, paint sludge, cleaning solvents, and degreasing solvents, which may have contained hazardous substances such as cyanide, trichloroethylene (TCE), methyl ethyl ketone (MEK), and 1,1,1-trichloroethane (RMT, 1987).

Fourteen monitoring wells were installed at the NIROP between May and August 1983. Seven additional on-site monitoring wells were installed in May and June 1985. Installation of 12 off-site monitoring wells was completed in February 1986. The purpose of these wells was to determine ground water flow directions and the general extent of ground water contamination. Water level measurements and samples have been collected from these wells on an intermittent basis through November 1986.

The main ground water contaminant identified was trichloroethylene. A map of the mean TCE concentrations in shallow ground water at the site (Figure 1-3) shows two areas of high concentration - one apparently originating in the north storage yard on the NIROP facility, and one of unknown origin extending from near well 9-S to well 18-S.



NO.	LOCATION	CAPACITY	MATERIAL	FUNCTION*	TYPE**
T1	ABOVE GROUND	3,000 GAL.	LIQUID OXYGEN	STORAGE	VERT.
T2	ABOVE GROUND	8,400 GAL.	TRICHLOROETHANE***	STORAGE	VERT.
T3	BELOW GROUND	500 GAL.	NO.2 DIESEL FUEL	STORAGE	HORIZ.
T4	BELOW GROUND	12,000 GAL.	NO.2 DIESEL FUEL	STORAGE	HORIZ.
T5	BELOW GROUND	1,000 GAL.	STODDARD SOLVENT	STORAGE	HORIZ.
T6	BELOW GROUND	18,000 GAL.	NO.6 FUEL OIL	PROCESS	HORIZ.
T7	BELOW GROUND	18,000 GAL.	NO.6 FUEL OIL	PROCESS	HORIZ.
T8	BELOW GROUND	18,000 GAL.	NO.6 FUEL OIL	PROCESS	HORIZ.
T9	BELOW GROUND	18,000 GAL.	NO.6 FUEL OIL	PROCESS	HORIZ.
T10	ABOVE GROUND	8,000 GAL.	LIQUID NITROGEN	STORAGE	VERT.
T11	BELOW GROUND	1,000 GAL.	DIESEL FUEL	STORAGE	HORIZ.
T12	ABOVE GROUND	12,000 GAL.	LIQUID NITROGEN	STORAGE	VERT.
T13	ABOVE GROUND	5,540 GAL.	METHANOL	STORAGE	HORIZ.
T14	ABOVE GROUND	1,000 GAL.	MAPP GAS	STORAGE	HORIZ.
T15	ABOVE GROUND	12,000 GAL.	AMMONIA	STORAGE	HORIZ.
T16	ABOVE GROUND	25,000 LBS.	FOUNDRY SAND	STORAGE	VERT.
T17	ABOVE GROUND	20,000 LBS.	FOUNDRY SAND	STORAGE	VERT.
T18	ABOVE GROUND	20,150 LBS.	CHLORINE	STORAGE	CYLINDERS
T19	ABOVE GROUND	4,000 GAL.	PERCET	STORAGE	VERT.
T20	ABOVE GROUND	6,000 GAL.	PERCET	STORAGE	VERT.
T21	BELOW GROUND	2,000 GAL.	GASOLINE	STORAGE	HORIZ.
T22	ABOVE GROUND	100,000 GAL.	WATER	STORAGE	VERT.
T23	ABOVE GROUND	45,000 GAL.	NO.6 FUEL OIL	STORAGE	VERT.
T24	ABOVE GROUND	45,000 GAL.	NO.6 FUEL OIL	STORAGE	VERT.
T25	ABOVE GROUND	45,000 GAL.	NO.6 FUEL OIL	STORAGE	VERT.
T26	ABOVE GROUND	45,000 GAL.	NO.6 FUEL OIL	STORAGE	VERT.
T27	ABOVE GROUND	45,000 GAL.	NO.6 FUEL OIL	STORAGE	VERT.
T28	ABOVE GROUND	45,000 GAL.	NO.6 FUEL OIL	STORAGE	VERT.
T29	ABOVE GROUND	90,000 GAL.	PROPANE	STORAGE	HORIZ.
T30	ABOVE GROUND	17,325 GAL.	PROPANE	STORAGE	HORIZ.
T31	ABOVE GROUND	17,325 GAL.	PROPANE	STORAGE	HORIZ.
T32	ABOVE GROUND	17,325 GAL.	PROPANE	STORAGE	HORIZ.
T33	BELOW GROUND	1,000 GAL.	GASOLINE	STORAGE	HORIZ.
T34	BELOW GROUND	1,000 GAL.	GASOLINE	STORAGE	HORIZ.

* STORAGE OR PROCESS
** TANKS, BINS, DRUMS, ETC.
*** FORMERLY TRICHLOROETHYLENE

TANK LOCATIONS FROM ENVIRODYNE, 1983

LEGEND

- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING BUILDING
- EXISTING FENCE
- EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- 665.5 EXISTING SPOT ELEVATION
- TREES AND / OR BRUSH
- EDGE OF WATER
- WET AREA
- 16-S MONITORING WELL LOCATION
- WATER SUPPLY WELL
- LOCATION AND NUMBER OF STORAGE TANKS (SEE SUMMARY TABLE)
- EXCAVATED WASTE DISPOSAL PITS/TRENCHES
- NIROP PROPERTY LINE (APPROXIMATE)
- FMC PROPERTY LINE (APPROXIMATE)
- GEOLOGIC CROSS SECTIONS

BASE MAP PROVIDED BY CORPS OF ENGINEERS, DATE OF SURVEY AND DATUM UNKNOWN. MONITORING WELL LOCATIONS ARE APPROXIMATE, BASED ON PROXIMITY TO LANDMARKS.

SCALE 1" = 200'
0 200 400 800 FEET

CONTRACT NO. DACA45-86-C-0015

NO.	BY	DATE	REVISION	APPD
3				
2				
1				

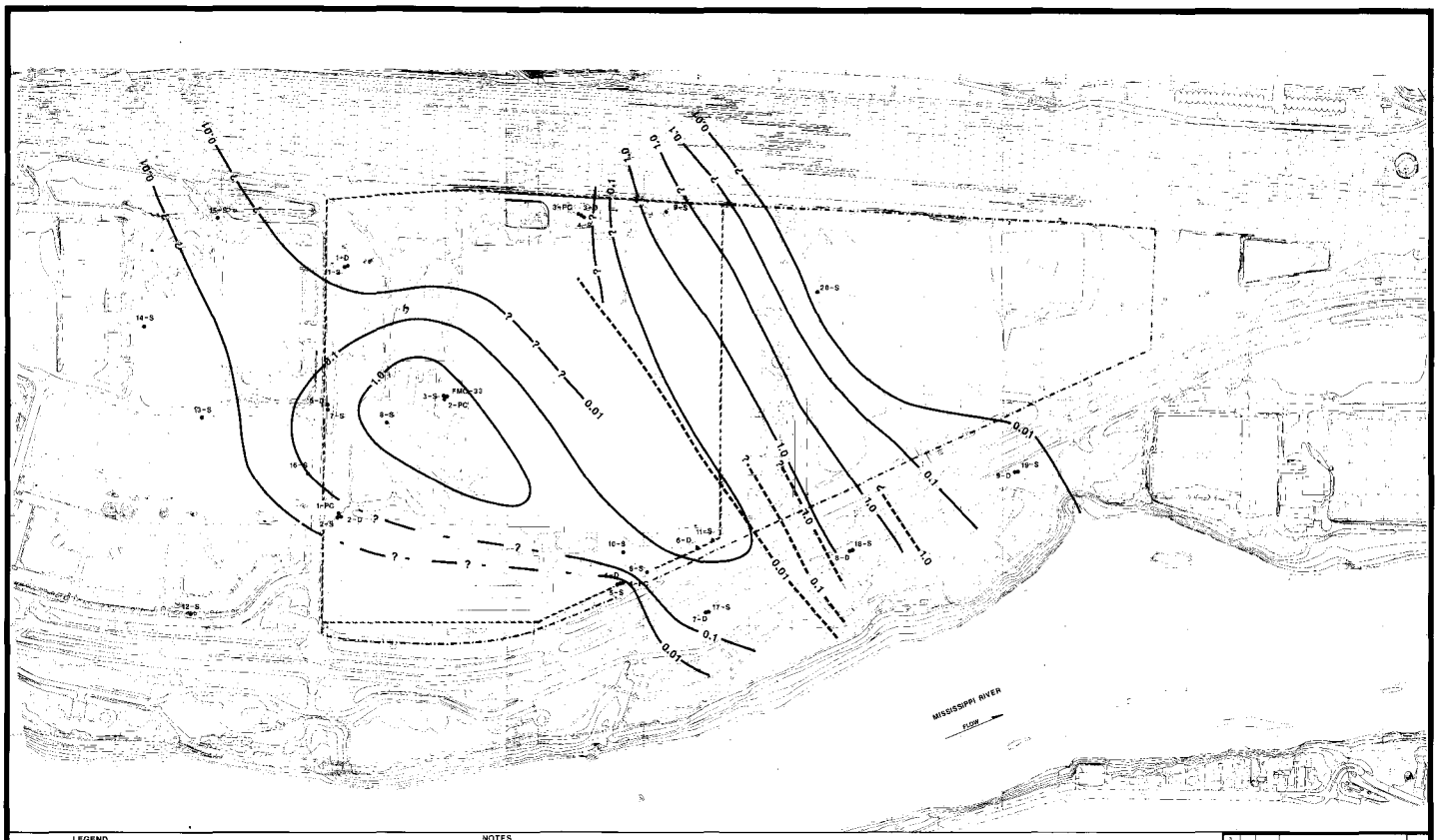
PROJECT: RI/FS AT NIROP FRIDLEY, MINNESOTA

SHEET TITLE: NIROP FACILITY MAP

DRAWN BY: JMM MOC | SCALE 1"=200' | PROJ. NO. 133938
CHECKED BY: JJB | DRWG. NO.
APPROVED BY: | DATE PRINTED: FEB 17 1988
DATE: 2-16-88

FIGURE 1-2

FMT INC.
1400 72nd Ave. N.E.
Minneapolis, MN 55432
Phone 612/571-7700



LEGEND

- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING BUILDING
- EXISTING FENCE
- 600 EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- + 895 EXISTING SPOT ELEVATION
- TREES AND / OR BRUSH
- EDGE OF WATER
- WET AREA
- MW-22A MONITORING WELL LOCATION AND NUMBER
- TCE IN mg/L IN DEEP UNCONSOLIDATED AQUIFER
- 0.1 TCE IN mg/L IN SHALLOW UNCONSOLIDATED AQUIFER
- APPROXIMATE NIROP FACILITY PROPERTY LINE
- APPROXIMATE FMC FACILITY PROPERTY LINE
- INFERRED TCE CONCENTRATION

NOTES

TRICHLOROETHYLENE CONCENTRATIONS USED IN PREPARATION OF THIS PLATE ARE MEAN VALUES FOR DATA COLLECTED BETWEEN OCTOBER, 1983 AND NOVEMBER, 1986

SCALE 1" = 200'
0 100 400 800 FEET

CONTRACT NO. DACA45-86-C-0015

NO.	BY	DATE	REVISION	APPD.
3				
2				
1				

PROJECT:
RI/FS AT NIROP
FRIDLEY, MINNESOTA

SHEET TITLE:
EXTENT OF TCE CONTAMINATION-SHALLOW & DEEP UNCONSOLIDATED AQUIFER

DRAWN BY: JOHN MOLZ
SCALE: 1" = 200'
PROJ. NO.: 2322.06
CHECKED BY: RB
DRWG. NO.:
APPROVED BY:
DATE REVISED: FEB 17 1988
DATE: 2/18/88
FIGURE 1-3

FMC
SUB CM
1300 Nicollet Avenue South
Minneapolis, MN 55403
Phone 338-7575/TM

Initial remedial action in the north storage yard area began in November 1983. Nine areas were excavated, and 43 drums and approximately 1,200 cubic yards of soil were removed. The majority of the drums contained inert solids; others contained PCB wastes, flammable solids, base solids, and inert liquids; and some were empty. The hazardous soils and drums were disposed in an EPA-approved landfill. Soil samples were subsequently taken from the bottom of the excavations and analyzed for volatile organics. Two trenches showed total VOCs above one part per million. No further testing was done at that time. The trenches were backfilled with clean fill, and removal activities were completed in March 1983. The approximate location of the excavated trenches is shown on Figure 1-2.

Ground water VOC contaminant concentrations have remained above desirable levels despite the excavation and removal of the drums and soil from the trenches.

1.2 Purpose and Scope

The purpose of the soil gas sampling program was to screen and identify areas of shallow, VOC-contaminated soil that may be contributing to the ground water contamination problem. Once the soils were identified, the results could be used for the following:

1. Assist in selecting locations for the next round of ground water monitoring wells.

2. Locate contaminated soil that may be a source of VOC contamination to ground water so that further analysis, including soil borings and laboratory analysis of the soils, can be done if desired.

3. Identify areas that may require soil remediation.

The scope of the work as originally defined was as follows:

1. Compare two soil gas monitoring techniques - soil pore gas monitoring and soil headspace analysis - and determine the more appropriate technique (if either) for the remainder of the investigations.

2. Take soil samples in three areas on-site and immediately adjacent off-site, and one background area off-site for soil gas analysis.

3. Determine areas of contamination and do more intensive soil gas sampling in those areas.

4. Develop a map showing the relative levels of soil gas contamination.

5. Determine whether large unknown quantities of VOCs are present in the sampled soils.

1.3 Advantages and Limitations of Soil Gas Monitoring

While considering the purpose and scope of the soil gas sampling program, it is important to consider the advantages and limitations of soil gas analysis.

Soil gas analysis can be used to either identify contaminated soil or to trace ground water contamination plumes (Kerfoot, 1987; Marrin and Thompson, 1987; and Eklund, 1985). At the NIROP facility, the method was used primarily to identify contaminated soil.

The main advantages of soil gas investigations compared to other investigation methods and standard laboratory analyses are speed, flexibility, and reduced cost. Because the analysis is conducted on the same day that the sample is collected, the results are obtained very quickly in the field. Sampling plans can be modified in light of the results to focus on areas where contmination has been found.

However, soil gas analysis is limited in several ways. Most importantly, the distribution between compounds absorbed on the soil and in the soil gas is usually not established for soil at a given site. Therefore, the soil gas results cannot be used to quantify the amount of contaminant on the soil, but rather to give only a relative indication of concentrations in the soil. A soil gas survey can be used to identify contaminated areas relative to the rest of the site, but does not give a quantitative analysis of soil contamination. The primary value of soil gas analysis is when it is used as a screening technique.

2. FINDINGS AND CONCLUSIONS

2.1 Methodology

- Both soil pore gas analysis using a probe and soil headspace analysis using soil taken by hand augering give comparable results for soil gas analysis.

- Both methods give fairly reproducible results. The mean percent difference between replicates was 19.7% for headspace samples, and 6.1% for pore gas samples.

- The probe method was generally easier to use except in areas with large quantities of buried stones, where the probe was hard to install in the soil.

2.2 Results

Area 1 (Old TCE Tank Area West of Plant) and Background

- All samples had relatively low VOC concentrations in soil gas. The highest concentration was 1.9 ppm at sample point SG-8.

Area 2 (Trench Disposal and Storage Area North of Plant)

- Three areas of elevated soil gas concentrations were found:

  - Near the former disposal trench area
  - Near the newly installed water main at the north edge of the property
  - Near the decontamination pad

- Other sections of Area 2 had low soil gas concentrations.

- Areas of the highest soil gas concentrations (> 100 ppm TCE plus DCE) were south and east of the decontamination pad and in the vicinity of Trench 3.

- Concentrations decreased with increasing distance away from Trench 3, in the trench area.

- Trichloroethylene was the predominant soil gas contaminant in most areas. However, in the areas of highest contamination, cis-dichloroethylene was generally present in the highest concentration. Trans-dichloroethylene was generally present at low concentrations, if present at all, and was above 10 ppm in only two samples.

- Other unidentified compounds were detected at three locations: two next to the decontamination pad, and one near Trench 3.

Area 3 (TCA Tank Area)

- Soil gas concentrations were generally low in Area 3 samples. The two sample points on the west edge of the TCA tank both had concentrations of 3 ppm. The other five samples had concentrations less than 1 ppm.

2.3 Conclusions

- No significant chlorinated ethylene contamination of near surface soils was found in Area 1, suggesting that surface spills in this area are probably not a major contributor to ground water contamination.

- No significant chlorinated ethylene contamination of near surface soil was found in Area 3. The high TCE concentrations that have been found in monitoring well 9-S do not appear to have originated near well 9-S.

- A fairly large area in Area 2 was found to have surface soil contamination of chlorinated ethylenes. The following three contiguous areas were contaminated:

  - Disposal trench area
  - Decontamination pad area
  - New water main trench area (north edge of Area 2)

  The highest concentrations of chlorinated ethylenes were in the immediate vicinity of Trench 3 and near the decontamination pad.

- TCE was the predominant contaminant except in the most contaminated areas, where cis-DCE was at higher concentrations. The trans-DCE isomer was a small portion of the total chlorinated ethylenes in all but two of the contaminated sites. Both the cis- and trans-DCE isomers are breakdown products of TCE.

- Current locations for the new ground water monitoring wells are sufficient for monitoring the impact of the identified surface soil contamination areas. No new monitoring wells are needed.

3. RECOMMENDATIONS

Further investigation is needed to confirm the contaminated areas identified during this soil gas survey. Recommended work includes the following:

1. Verification of the contamination found near Trench 3 and the decontamination pad by taking soil borings with lab analysis for trichloroethylene and dichloroethylene.

2. Evaluation of depth profiles of contamination in the most contaminated areas. Borings should be made in two to three areas of high contamination and the soils at 3- to 5-foot depth intervals should be analyzed for TCE and DCE.

3. Development of a correlation curve between soil pore gas or headspace concentrations and laboratory compositional analysis for TCE and DCE.

4. SAMPLING PROGRAM

Soil gas sampling procedures are relatively new methods for investigating soil contamination and have not yet been standardized. The methods used are adapted to actual field conditions based on the investigator's experience with soil gas sampling. The methods used at the NIROP site were developed in consultation with the U.S. Army Corps of Engineers (USACE), and then tested and modified in the field.

The soil gas monitoring was divided into two phases. In Phase I, two methods of monitoring soil gas composition were compared - in-situ soil pore gas monitoring and soil headspace analysis (see Section 4.5). Both a non-specific VOC analyzer (an HNU Systems, Inc., Model PI 101 photoionization meter) and a portable gas chromatograph (a Photovac, Inc., Model 10S50 Portable Photoionization Gas Chromatograph) were used to analyze in-situ pore gas and headspace gas. Twenty (20) sample locations were chosen and analyzed during Phase I. The methods were compared using the following evaluation factors:

- Sensitivity
- Reproducibility
- Ease of field operation
- Relationship between portable GC and HNU results
- Ability to measure direct soil contamination or migrating contaminant vapors

Methods of collecting and analyzing soil gas samples were optimized for the actual conditions encountered. Based on the results of Phase I, the appropriate method was selected for Phase II work.

In Phase II, a larger number of samples were analyzed (initially planned to be approximately 120). Sampling was done on a regular grid

system, with more concentrated sampling in areas of particular interest (e.g., close to disposal trenches). Phase II was intended both to identify the most contaminated areas and to provide a basis for selecting final monitoring well locations.

4.1 Initial Sampling Procedures Plan

The planned procedures and locations for soil gas sampling are presented in Appendix A.

The planned procedures were modified in two ways prior to use in the field. First, at the request of the USACE, a methanol rinse was added to all decontamination procedures. The equipment to be cleaned was washed in soapy water, rinsed with clean water, methanol, and then again with clean water. Secondly, when collecting gas samples from the probe, a rectangular, sealable box was used rather than a wide-mouth plastic bottle (step 5 of the Soil Pore Gas Analysis, Appendix A). The Teflon® bags fit more easily into a rectangular chamber than into a round bottle.

4.2 Problems Encountered and Corrective Actions Taken - Sampling Procedures

Several problems were encountered in the use of both the probes and soil headspace measurements. The problems are discussed below by method.

4.2.1 Pore Gas Probe Method

1. Problem - The most serious problem encountered with the pore gas method was contamination of the Tedlar® bags. It was found that the bags would sorb and retain gaseous contaminants, releasing them

at low levels despite repeated purging with clean air. Table 4-1 gives concentrations of TCE and cis-dichloroethylene (DCE) in air in a bag after various numbers of purges. Each purge consisted of filling the bag with clean air and then allowing the air to escape. As can be seen, even after over 20 purges, the air in the Tedlar® bag contained a measurable quantity of TCE and DCE. This problem had not been previously encountered by the authors in previous pore gas studies.

Solution - The most obvious solution - use only new Tedlar® bags - was not practical. The bags were not available within a short enough time to fit the fieldwork schedule. By the time the problem was encountered, however, samples from the Trench 3 area had already been analyzed and the magnitude of TCE and DCE concentrations (i.e., hundreds of ppm) in the contaminated sample was known. Since the concentrations of interest were known to be well above the levels of carry-over in the bags, it was decided to set a practical lower cut-off level for identification of contaminated soils (for the sum of TCE and the two DCE isomers) of 1 ppm, a value well above the carry-over level in the bags after several purges. In addition, sample bags that contained samples with high concentrations of TCE or DCE were purged at least five times before reuse. Since the intent of the soil gas survey was a screening for contaminated soils, and levels of contamination had already been encountered at hundreds of ppm, it was felt that setting a cut-off level of 1 ppm was the most practical resolution of the difficulty. TCE and DCE concentrations are recorded in the data tables at the levels found in the analysis even if under 1 ppm. Evaluation of the extent of contamination in the surface soils used the 1 ppm cut-off value.

2. Problem - In very tight soils, no pore gas can be pulled from the soil with the hand pump and sampling apparatus employed.

   Solution - First a stronger vacuum was applied by attaching the Tedlar® bag directly to the exhaust valve from the pump, rather than using the vacuum chamber. The pump could exert a greater vacuum without the chamber in between. Testing in the field showed that the pump did not contaminate or cross-contaminate the samples (see also problem 3 below). If a sample still could not be obtained, then a soil sample was taken with an auger for headspace analysis.

3. Problem - The vacuum chamber used for filling the bags was somewhat cumbersome to use and did not always exert sufficient vacuum to pull pore gas from the soil.

   Solution - One solution was to attach the Tedlar® bag directly to the exhaust valve of the hand pump. A number of samples were collected using both the sampling vacuum container and the direct probe attachment to determine whether there was a significant difference between the two methods (i.e., whether the pump was sorbing or releasing contaminants to the pumped air). Table 4-2

TABLE 4-1

TCE AND DCE CONCENTRATIONS IN TEDLAR® SAMPLING BAGS AFTER VARIOUS NUMBERS OF CLEAN AIR PURGES

Number of Purges	Concentration of TCE (ppm)	Concentration of cis-DCE (ppm)
Original Sample	82.6	195
Purged 5 times	0.78	0.56
10 times	0.26	0.27
20 times	0.20	0.16
25 times	0.14	0.09
35 times	0.02	0.02
Original Sample	18.4	0.4
Purged 10 times	0.008	BD
Original Sample	0.30	1.6
Purged 5 times	BD	0.02
Original Sample	76.3	182.4
Purged 10 times	0.10	0.03

TABLE 4-2

COMPARISON OF SAMPLE PORE GAS QUALITY COLLECTED
USING TWO METHODS OF FILLING THE TEDLAR® BAG

Sample Site Point Number	Vacuum Chamber Method		Direct Probe Method	
	TCE	cis-DCE	TCE	cis-DCE
	(ppm)		(ppm)	
12	3.3	0.52	5.2	0.75
8	0.3	1.6	0.3	1.6
21	BD	BD	BD	BD
27	14.0	3.5	13.0	3.5

BD - Below detection level

presents the results of the replicate analysis. Both methods gave essentially equivalent results, and the direct probe method was used throughout the rest of the sampling. Direct probe sampling was both easier and faster than the vacuum chamber.

4. Problem - It was difficult to pound the probe into very hard or gravelly soil, especially in Area 2 (the storage yard north of the plant) where the surface soil appeared to be tightly compacted fill. Frequently, the probe or auger would encounter obstructions buried in the soil.

   Solution - A trench was dug in the soil to a depth of approximately one foot using a pick axe in order to remove the most tightly compacted soil. The probe was then driven into the less-compacted soil. If an underground obstruction was hit, the probe was removed and reinserted a short distance away. Sometimes four or five attempts were necessary before the probe could be successfully installed. In one area (sample points SG-81 and SG-82) a large obstruction was found under the whole area (possibly a buried concrete slab). No samples were taken at these locations.

4.2.2 Sample Analysis

Portable GC Analysis

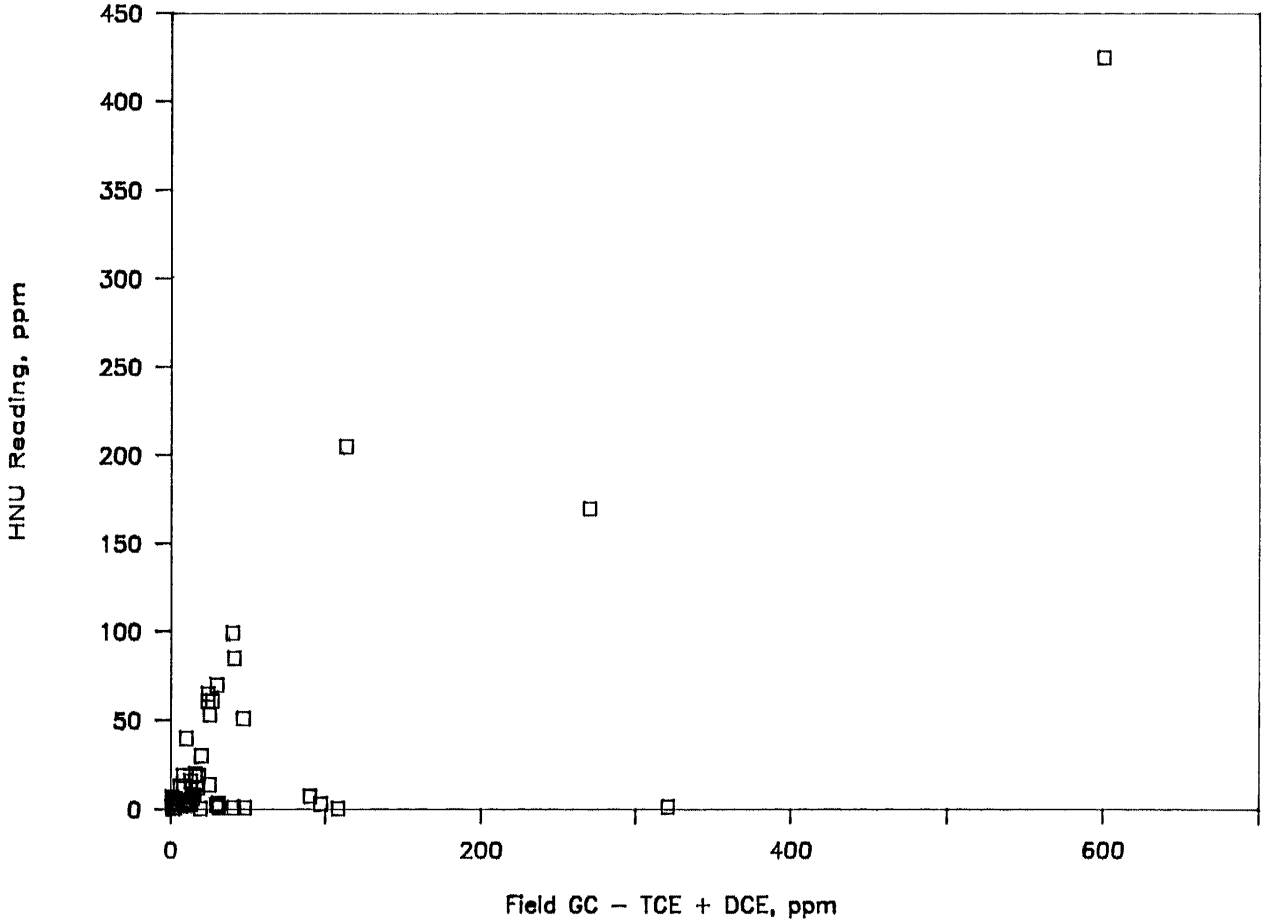
No major problems were encountered using the portable GC. At one location (sample point SG-95), the sample was so concentrated that a small enough aliquot could not be injected to have the chromatographic peaks on scale even using the smallest possible injection volume. Since the sample was so highly contaminated, the lack of a numerical value was not of great importance.

HNU Meter Analysis

The HNU meter gave considerably more problems than the portable GC. Most of the difficulties were encountered during Phase II, when the HNU was used for health and safety purposes. There was poor correlation between the HNU readings in the field and the portable GC readings for the same sample. Figure 4-1 presents the relationship between the HNU

FRIDLEY PORE GAS ANALYSIS

PORTABLE GC VS HNU READINGS



readings and portable GC results (for TCE plus DCE). For several samples that gave high field GC results, the HNU gave low readings. Apparently, the HNU was not sensitive to the contaminants in some samples. The portable GC results have been used throughout the analysis. A second problem with the HNU was a poorly operating HNU probe during week 2 of the sampling. The problem was rectified by using another HNU probe.

4.3 Problems Encountered and Corrective Actions Taken - Sample Locations

A major problem was encountered in the selection and implementation of the sample locations; legal access to off-site locations was not obtained for much of the planned off-site work. Off-site samples were to be taken in three areas: directly north of the site (Area 2), east of the site in the railroad yard (Area 3), and west of the site in a county park between the site and the Mississippi River (background). Access to the off-site areas was to have been obtained by the USACE, but unfortunately the process of obtaining permission to the areas north and east of the site could not be completed prior to completion of the field work. The background samples that were to be taken as part of Phase I (SG-1 and SG-2) were not obtained since permission to sample on the county park property was not obtained until after the end of Phase I. Background samples were then taken as part of Phase II.

After consultation with the USACE (see Appendix B for the correspondence), it was agreed that RMT would not sample off-site except in the area north of Area 2 where access could be made from a public road, and in the county park. Any additional sample time gained by not

sampling off-site would be used in more intensive sampling in areas where contamination had been found.

Some site-specific problems were also encountered, as discussed below:

Sample Points SG-81 and SG-82 - A large underground obstruction was found at these two sites, possibly a buried concrete pad. Since the pad covered the whole area where these samples were to have been taken, no samples were taken.

Sample Point SG-24 - Underground obstructions were also found at this site. After several unsuccessful attempts to obtain a sample, this sampling location (near the water tank) was abandoned.

Sample Point SG-7 - The original location for sample point SG-7 was under pavement. However, a few feet away was an unpaved area. The sample location was moved to the unpaved area so that the sample could be taken without drilling through the pavement.

At other locations, obstructions were encountered when taking a sample, and a second location within a few feet of the first was tried. At some sites, particularly in Area 2, up to six or seven attempts were required before a sample could be obtained.

4.4 Comparison of Sampling and Analysis Methods

One of the purposes of Phase I sampling was to compare two methods of soil sampling (pore gas and soil headspace) and two methods of gas analysis (a general organic vapor analysis using an HNU organic vapor analyzer, and a portable GC for semi-quantitative analysis of gas samples). The different sampling and analysis methods are discussed in Section 4.5.

4.4.1 Sampling Methods

Pore Gas Sampling

Advantages:

1. Generally faster and easier to install in soil.

2. Faster to clean and decontaminate.

3. Allows sample collection in a Tedlar® bag, which in turn allows replicate analysis of the sample. This feature provides an advantage over headspace sampling, where once the aluminum foil or septum is punctured in the headspace sample, further samples are less reliable.

4. Several locations can be sampled without stopping to decontaminate probes since the probes are smaller and more portable than soil augers, and several can be carried into the field.

5. In theory, pore gas sampling involves less disturbance of the soil. Therefore, a more representative sample is obtained and lower concentrations of volatile contaminants can be measured. In practice, the low concentration samples are not of much interest at this site, and the higher concentration samples gave approximately the same results for both the headspace and probe methods.

Disadvantages:

1. It is difficult to obtain a sample in soils that are not very permeable to gas flow. If the soil is tight, the vacuum required to pull the pore gas out of the soil is greater than can be generated or maintained by the sampling device. Taking a sample directly from the pump allows a sample to be taken from somewhat tighter soils, but is still limited by the vacuum that can be generated by the pump.

2. Samples are difficult to obtain in very wet soils. The samples taken were quite dry. Therefore, soil water content was not a problem during the sampling period. However, soil water content has been a problem at other sites.

3. Driving the probe into the soil is somewhat more affected by small stones than is augering. The problem can be overcome by removing the probe and resampling in the same area. In both methods it is difficult to obtain samples in hard soils, or in very gravelly soils. Some of the soils encountered were both hard and gravelly, especially in Area 2, which appeared to be fill and contained both gravel and hard-packed soil.

Soil Headspace Sampling

Advantages:

1. Can be used in low permeability soil because gas does not have to be drawn through the soil.

2. Not as affected by soil moisture (refer to item 2 in the disadvantages for the pore gas sampling).

Disadvantages:

1. More effort is needed to obtain samples.

2. There is more possibility of VOC loss as the sample is handled to place it into jars.

3. It is more difficult to obtain truly replicate analyses.

4. There is more exposure of the field crew to soil vapor.

4.4.2 Analytical Methods

HNU Meter (Versus the Portable GC)

Advantages:

1. Faster.

2. Can be used at the sampling locations.

3. Useful as a screening tool for determining approximate VOC concentrations.

Disadvantages:

1. Much less sensitive.

2. Much less precise, and results are less reproducible.

3. Smaller measurable concentration range.

4. Results are less reliable.

   a. Affected by rate of gas flow through the probe - breezes or vacuum can affect the readings.

   b. Apparently affected by water vapor (especially the 11.7 electron volt lamp).

c. Can have such a high VOC concentration that the detector is overdosed, and the operator may not know it (the meter still gives a reading).

5. Not easily standardized to the gas being analyzed.

6. Does not differentiate between different compounds - gives a total HNU-detectable VOC reading.

7. Uses much larger gas volumes, requiring larger samples.

8. Numbers are more difficult to interpret.

Portable GC (Versus the HNU)

Advantages:

1. More sensitive.

2. Can differentiate and quantify individual compounds.

3. Easy to run replicates and standards.

4. Less affected by moisture or outside conditions.

5. Requires very small volumes; therefore, only small sample volumes are required.

Disadvantages:

1. Easily contaminated - internal contamination of the instrument is the major factor controlling detection limits.

2. Each sample requires a longer analysis time.

3. Not as portable as the HNU.

4.4.3 Comparison of Headspace and Probe Analysis of the Same Sampling Point

Two points were sampled using both pore gas and headspace analysis. One sample point, SG-18 in Area 3 next to the TCA tank, was sampled in duplicate using both methods. Results are presented in Table 4-3. While some differences occur between the results for the two methods, the general trend is clear. Samples that are shown to be contaminated by one method are also shown to be contaminated by the

TABLE 4-3

COMPARISON OF HEADSPACE AND PORE GAS ANALYSIS
OF THE SAME SAMPLING POINT

	Headspace (Auger), ppm			Pore Gas (Probe), ppm		
Sample Point	TCE	cis-DCE	trans-DCE	TCE	cis-DCE	trans-DCE
SG-18 (A)*	3.25	BD	BD	1.06	BD	BD
(B)	0.19	BD	BD	0.25	BD	BD
SG-11	22.7	1.61	BD	18.5	1.23	BD

* A and B indicate replicate samples taken within 4 to 5 feet of each other.

BD = Below detection level

other method. While there are not enough sampling points using both methods to do a statistical analysis of the variation between the replicates, the results are of the same approximate variation as that found for headspace analysis. The variation observed between the two sampling methods may be more a result of variation in the contaminant concentration in the soil over the short distance between the precise location of the headspace and pore gas sampling points than a result of the sampling method.

4.4.4 Selected Sampling and Analytical Methods in Phase II

Sampling Method. The probe was used as the main sampling method, with augering as a backup method. For situations where gas samples could not be collected with the probe, the field crew was instructed to determine when augering was necessary.

Analytical Method. The portable GC was used for analysis. The HNU was available for use as a general screening instrument, if required.

4.5 Final Sampling Plan

4.5.1 Pore Gas Sampling Method

The field methods described below were used in Phase II of the soil gas survey.

Decontamination

Soil augers and probes were carefully cleaned with soapy water, rinsed with clean water, methanol, clean water again, and dried before collecting each sample.

The stainless steel probes used for soil pore gas analysis were checked with the HNU meter for cleanliness prior to use. If the soil gas probes showed higher than background HNU readings, they were cleaned by drawing air through the tube.

The plastic sheet laid on the ground at each soil augering sample point was shaken clean between sample locations, with visual inspection to ensure that no soil was stuck to the sheet.

New Ball jars and 40-ml VOA vials were used.

Calibration

The HNU meter was calibrated in the RMT laboratory using the calibrant gas supplied by HNU Systems, Inc., prior to taking the instrument into the field. During use, the battery was kept charged and the zero reading checked each time the instrument was turned on. Before each sample was collected, the HNU was checked for response using an available VOC source (e.g., felt tip marker).

Calibration of the portable GC was done by making up a standard gas containing the compounds of interest at known concentrations in the range corresponding to anticipated sample concentrations. The instrument was calibrated in the lab prior to use in the field. Instrument settings for analyzing the parameters of interest were also set in the lab prior to taking the instrument into the field.

The instrument used (a Photovac, Inc., Model 10S50 portable GC) has an internal calibration curve that identifies and quantifies compound peaks based on the stored standard curve. Each time the portable GC is turned on, blanks were run to ensure that there was no background

contamination in the instrument. Then, a standard was run and the internal standard curve calibrated for the current operating conditions (especially temperature and gas flow rate). Following this, samples were run. During routine operation, blanks and standards were run after every 8 to 10 samples. If a sample with a particularly high VOC concentration was injected, then the instrument was cleaned by running blanks until the baseline returned to background.

Sample Collection

Soil Pore Gas Analysis:

1. Four-foot- or five-foot-long stainless steel tubing (probe, 0.25 inches inside diameter) was used for collecting samples. The probe has a tapered hose attachment tube at one end and an open downhole end.

2. Prior to installing the probes, the cleanliness of each probe was checked by drawing air through the probe and monitoring VOCs in the gas with an HNU meter. If the HNU reading was greater than 1 ppm over background, then air was drawn through the tube until it was clean.

3. Once a sampling location was chosen, a loose-fitting screw was placed in the open end of the probe. The probe was then placed vertically on the ground. A special sleeve was placed over the tapered hose attachment, and the probe was hammered into the ground to a depth of 3.5 feet. The probe was withdrawn one foot from the bottom of the hole. The screw stayed at the bottom of the hole. Therefore, the probe can draw soil gas from a one-foot vertical section of exposed soil in the 2.5- to 3.5-foot depth interval.

4. A vacuum was applied to the probe to determine if gas could be withdrawn from the soil. If gas could be withdrawn, then the gas was extracted for approximately one minute, and an HNU reading of the pore gas was taken by attaching the HNU meter to the probe. The reading was noted, and the meter was then taken off the probe and a vacuum was reapplied. After another minute of evacuation, a second HNU reading was taken. If a constant HNU reading was obtained, then a sample was taken for final HNU analysis and for portable GC analysis. If the

reading was not steady, then the process was repeated until a steady reading was obtained. Readings usually stabilized quickly. For a few days when the HNU was not working, the probe was purged for several minutes (a time that had resulted in steady readings at other sites), then a sample taken.

5. A gas sample was taken by placing a deflated Tedlar® bag in a covered plastic basin. Ports in the top of the cover allowed a tube to be connected to the Tedlar® bag and allowed evacuation of gas from the area between the bag and the basin wall. Gas was withdrawn from the basin with a vacuum pump, causing the Tedlar® bag to draw in air from the soil probe and inflate. Once the bag had inflated, the vacuum pump was turned off and the Tedlar® bag sealed. The bag was then marked with the sample identification, sampling location, time and date, and saved for analysis. A second, simpler method for filling the Tedlar® bags was also used in the latter part of Phase II. The Tedlar® bag was attached directly to the exhaust of the pump and filled directly from the pump.

6. Samples were taken directly from the bag for portable GC analysis. Injection volumes for the portable GC were selected based on either the field HNU readings or analysis of previous samples in the area. If the sample chromatogram was off-scale, the sample was reinjected using a more appropriate sample volume.

7. Data was collected on the form shown in Table 4-4.

8. The stainless steel probe assembly was checked for leaks following removal from the ground after collecting each sample. This was accomplished by applying a passive vacuum (pipet bulb) to the gas extraction end of the probe and sealing the other end by finger pressure. If the bulb maintained its vacuum, then the probe was still leak tight.

Soil Headspace Analysis:

1. The soil auger (bucket type) was cleaned initially with soapy water, rinsed with clean water and methanol, wiped off with a paper towel, and then air dried prior to use.

2. Once the sample location was identified, the surface litter was scraped off the soil, and a plastic sheet was spread near the boring site. The top 2.5 feet of soil was removed with the auger and placed on one side of the plastic sheet. The next foot of soil (2.5 to 3.5 feet) was removed, placed on the plastic sheet, and quickly homogenized on the sheet. Sub-samples were taken for both HNU and portable GC analysis.

TABLE 4-4

FIELD DATA FORM
SOIL GAS INVESTIGATION

DATE:

PROJECT:

FIELD STAFF:

PROBE/HEADSPACE:

Sample Identification			HNU Reading (ppm)		Portable G C Results			Comments
					TCE	DCE		
#	Location	Depth	Probe	Bag		cis	trans	

1332.50 139:RTA:frid0111T

3. For HNU analysis, a one-quart Ball jar was filled approximately 1/2 full with soil. Any large aggregates (greater than 1/2 inch) of soil were broken up. The top of the Ball jar was covered with aluminum foil (shiney side up). The screw ring was then placed on the jar. The jar was marked with sample information, sampling location, time and date, and then placed in the field laboratory at room temperature to equilibrate.

4. For the portable GC analysis, a 40-ml VOA vial was filled approximately 1/2 full of soil. The top was covered with aluminum foil (shiney side up), and the cap and septum were then put on the vial. The vial was marked with the same sample information as the Ball jar. Duplicate vials were taken for all samples. Samples were taken for both HNU and field GC analysis as quickly as possible to minimize volatilization.

5. The excavated soil was returned to the boring and tamped down. Extra soil was then added to fill the hole. The auger and spatulas used for taking the soil samples were washed with soapy water, rinsed with clean water and methanol, wiped with a paper towel, and then air dried.

6. The soil headspace sample for HNU analysis was equilibrated at room temperature for between 1.0 and 1.5 hours before taking the HNU reading. The sample was shaken prior to analysis. The HNU probe was gently inserted through the aluminum foil, making as small a hole as possible. The probe was lowered to approximately one third of the way down the bottle (making sure the probe did not touch the soil). The meter reading was carefully monitored as the probe was pushed through the foil and into the jar, because a rapid rise and fall in concentration may indicate very high VOC concentrations in the bottle. If there was no large spike in the HNU reading, then the highest and stable reading were both recorded.

7. Samples in VOA vials were equilibrated for at least one hour. Analysis was run within 6 to 8 hours of sample collection. The injection volume to be used was based on the soil headspace HNU reading or on the expected soil concentration range.

8. Portable GC and HNU analyses were recorded on Field Data Forms (Table 4-4). The presence of major unidentified peaks was noted on the data sheet. If a tentative identification could be made based on relative retention time, then the identification was noted in parentheses with a question mark (e.g., "PCE?").

9. If the results of portable GC analysis were off-scale or questionable for some reason, the duplicate soil sample was run, adjusting the injection volume as appropriate.

Duplicates were run in any case on every fifth sample as part of the quality control program.

10. The chromatograms for the day or work period were marked with the date, project name and number, and analyst's initials, and saved for future reference.

11. All Ball jars and VOA vials were returned to the RMT Laboratory for cleaning or disposal. Tedlar® bags were cleaned by filling and emptying the bag several times with clean air. This did not completely clean the bags, as discussed in Section 4.2.1.

Additional Data Recording and Storage Procedures

1. HNU - All HNU readings were recorded on data sheets. These sheets were kept in a 3-ring binder at the site. Results were also frequently relayed to the RMT office in Madison for evaluation.

2. GC - Portable GC results were recorded in two places (in addition to the chromatogram itself). First, portable GC results were recorded on the Field Data Form accompanying the samples, and stored in a 3-ring binder which is kept with the instrument. Second, the results were stored in the portable GC log book. All field GC runs - blanks, standards, samples, and replicates - were recorded in the log book so that a complete record of all analyses was maintained. The 3-ring binders are part of the project file maintained in the RMT office. The log book is kept with the instrument in the field. All chromatograms were marked with the sample information (e.g., sample identification number, injection volume) on the chromatogram itself. The instrument records sample date and time of analysis.

   Each day's or work period's output was marked with the date and project number, and the information is stored in the RMT Laboratory for future reference. If there is any question about whether a sample was run and what the results were, the log book will provide this information, and, if necessary, the actual chromatogram can be retrieved to review the results.

4.5.2 Sampling Locations

A map of the final sampling locations is shown on Figure 6-1. Sample location information using site physical features for location of the sampling sites is given in Appendix C.

4.5.3 Daily Quality Control Reports

The Daily Qualilty Control Reports are presented in Appendix D. Table 4-5 gives the locations sampled on each working day.

TABLE 4-5

LOCATIONS SAMPLED AND METHOD USED
ON EACH DAY OF THE FIELD WORK

DATE	LOCATIONS SAMPLED AND METHOD USED
(1987)	
November 3	SG-19 Boring
November 4	SG-17 Boring
	SG-18 Probe
	SG-20 Boring
	SG-3 Boring
	SG-4 Probe
	SG-5 Probe
November 5	SG-9 Probe (with Duplicate)
	SG-10 Probe
	SG-11 Boring and Probe
	SG-18 Boring and Probe (Duplicate Boring)
November 6	SG-10 All Probe
	SG-12
	SG-13 (Duplicate)
	SG-15
	SG-16
November 9	SG-7 Probe (Duplicate)
	SG-8 Boring (Duplicate)
	SG-14 Boring (Duplicate)
November 10	SG-21 Probe (Dupliate)
	SG-22 Probe (Duplicate)
November 11	SG-23 All Probe
	SG-25
	SG-26
	SG-27
	SG-28
November 12	SG-29 (All Probe)
	SG-30
	SG-32
	SG-33
	SG-34
	SG-35 (Duplicate)
	SG-36
	SG-38
	SG-39

TABLE 4-5 (CONT'D)

LOCATIONS SAMPLED AND METHOD USED
ON EACH DAY OF THE FIELD WORK

DATE	LOCATIONS SAMPLED AND METHOD USED
November 12 (Cont'd)	SG-40
	SG-41 (Duplicate)
	SG-42
	SG-43
	SG-44
	SG-48
November 13	SG-31 All Probe (Duplicate)
	SG-37
	SG-72
	SG-74
	SG-76
November 16	SG-60 Boring
	SG-64 Probe
	SG-68 Probe (Duplicate)
	SG-69 Probe
	SG-70 Probe
	SG-71 Probe
	SG-73 Probe
	SG-75 Probe
November 17	SG-65 All Probe
	SG-66 (Duplicate)
	SG-67
	SG-80
	SG-83
November 18	SG-6 All Probe
	SG-45
	SG-46 (Duplicate)
	SG-47
	SG-79
	SG-84
	SG-85
	SG-86
	SG-87
	SG-98 (Duplicate)
	SG-101
November 19	SG-52 Probe
	SG-56 Probe
	SG-97 Probe

TABLE 4-5 (CONT'D)

LOCATIONS SAMPLED AND METHOD USED
ON EACH DAY OF THE FIELD WORK

DATE	LOCATIONS SAMPLED AND METHOD USED
November 19 (Cont'd)	SG-99 Boring
	SG-100 Probe (Duplicate)
	SG-102 Probe
	SG-103 Probe
	SG-105 Probe
	SG-108 Probe
	SG-109 Probe (Duplicate)
	SG-110 Probe
	SG-111 Probe
November 20	SG-104 Probe
	SG-106 Probe
	SG-107 Probe
November 23	SG-88 All Probe
	SG-89
	SG-90
	SG-91
	SG-92 (Duplicate)
	SG-93
	SG-94
	SG-95
	SG-96
	Sg-118
	SG-128
	SG-129 (Duplicate)
November 24	SG-115 All Probe
	SG-116 (Duplicate)
	SG-121
	SG-123
	SG-124
	SG-125
	SG-126
	SG-127 (Duplicate)
November 25	SG-112 All Probe
	SG-113
	SG-114
	SG-117
	SG-119
	SG-120
	SG-133 (Duplicate)
	SG-134

5. ANALYTICAL QUALITY CONTROL

Analytical quality control was monitored and maintained in several ways. First, numerous replicates were run. Replicates included both sampling replicates, where two soil or gas samples were taken, and analytical replicates where the same sample was analyzed twice. In addition, GC blanks and standards were run at frequent intervals to ensure that the GC was operating properly. If the GC operator had any suspicions about a particular run, that run was redone.

Data gathered during the investigation are used for survey purposes only. Measurements are compared with each other to evaluate the relative differences in VOC concentrations.

A summary of all GC runs is given in Table 5-1. The runs are divided into several categories:

- Blank runs are simply a GC run with no injection. It is used to determine if and to what level the column is contaminated, and to purge any residuals after a particularly high concentration sample.

- Standards were prepared daily by injecting an appropriate volume of saturated headspace over the pure solvent (e.g., TCE) into a 1-liter Tedlar® bag filled with purified air. All analytes (TCE, cis-DCE, trans-DCE) were combined into one standard. Initially, tetrachloroethylene (PCE) was also included; however, very few of the samples contained PCE, and preparation of PCE standards was discontinued.

- Samples are self explanatory.

- Replicates included both sample and analytical replicates. The two types of replicates are discussed separately below.

- Volume adjustments were made on runs where the initial run of a sample used an injection volume that did not give optimum analysis (the measured concentration was either below detection or off scale) and additional runs had to be made to determine the contaminant concentration.

TABLE 5-1

SUMMARY OF GC RUNS, BROKEN DOWN BY DATE AND RUN CATEGORY

Date	Blank	Std.	Sample*	Replicates	Volume Adjustment	Other	Total
(1987)							
November 3	6	4	2**	1	1	6	20
November 4	7	4	6**	0	4	0	21
November 5	4	3	6	4	6	2	25
November 6	8	3	6	4	1	9	31
November 9	5	2	2	2	1	5	17
November 10	4	2	2	3	1	7	19
November 11	4	3	6	2	9	7	31
November 12	5	4	17	3	9	0	38
November 13	5	5	6	3	2	5	26
November 16	6	3	8	2	3	7	29
November 17	3	4	5	3	2	1	18
November 18	7	5	13	2	5	3	35
November 19	4	3	3	2	11	0	23
November 20	4	2	4	0	3	4	17
November 23	4	3	14	4	9	2	36
November 24	3	2	9	2	2	1	19
November 25	3	2	8	1	5	1	20
	82	54	117	38	74	60	425

* Samples taken from the same sampling location using different sampling methods are considered separate samples.

** Included several samples used for system setup. Results not used in analysis.

- Others indicates runs that do not fit any of the above categories. These runs included checks of Tedlar® bags, runs where the syringe was plugged, or miscellaneous instrument checking.

A total of 425 GC runs were made, consisting of 117 sample runs, 38 replicates (both sample and analytical replicates), and 54 standard runs. One replicate was run for every 3.1 sample runs, and one standard was run for every 2.2 sample runs.

5.1 Replicate Sampling

A total of 25 replicate samples were taken, including 3 headspace and 22 pore gas samples. The results of the replicate analyses are presented in Table 5-2. With one exception, the replicates showed good reproducibility. The one exception (replicate 1 of SG-133) may have been the result of a blocked syringe for one injection, since one replicate gives very low contaminant values, while the other replicate is much higher.

Analysis of the variation between each replicate was done by calculating the percent difference between the mean of the two replicates and each replicate, then determining the mean of the percent differences for all the replicates. The mean percent difference gives an indication of the reproducibility of the analyses. Since very low concentrations will inherently have a larger percentage difference, only samples with mean concentrations above 1 ppm were used.

The mean percent differences for both headspace and pore gas analysis are as follows:

TABLE 5-2

RESULTS OF GC ANALYSIS ON REPLICATED SAMPLES

Sample Point # & Sampling Method	Replicate 1			Replicate 2		
	TCE	cis-DCE	trans-DCE	TCE	cis-DCE	trans-DCE
	- - -	ppm	- - -	- - -	ppm	- - -
SG-18 Headspace	3.25	BD	BD	1.06	BD	BD
SG-18 Probe	0.19	BD	BD	0.25	BD	BD
SG-9 Probe	22.3	0.58	0.5	14.2	0.40	0.50
SG-11 Headspace	20.4	BD	1.45	24.9	BD	1.77
SG-13 Probe	82.6	195	BD	76.3	182.4	BD
SG-15 Probe	14.2	0.3	BD	18.4	0.4	BD
SG-16 Probe	0.25	0.62	BD	0.24	0.58	BD
SG-14 Headspace	15.4	0.8	BD	18.2	0.7	BD
SG-7 Headspace	0.29	0.01	BD	0.28	0.01	BD
SG-22 Probe	0.04	BD	BD	0.03	BD	BD
SG-21 Probe	0.13	BD	BD	0.07	BD	BD
SG-27 Probe	14.9	3.7	BD	14.0	3.5	BD
SG-41 Probe	0.02	0.002	BD	0.006	0.005	BD
SG-35 Probe	0.26	0.08	BD	0.26	0.08	BD
SG-31 Probe	0.02	0.01	BD	0.03	0.01	BD
SG-68 Probe	0.01	0.003	BD	0.01	0.003	BD
SG-66 Probe	0.004	0.005	BD	0.06	0.10	0.10
SG-46 Probe	0.04	0.005	BD	0.09	0.03	BD
SG-98 Probe	16.7	14.3	0.4	17.1	14.6	0.4
SG-100 Probe	0.2	0.2	BD	0.1	0.1	BD
SG-109 Probe	49.4	BD	BD	46.4	BD	BD
SG-92 Probe	20.3	9.5	BD	20.7	9.6	BD
SG-129 Probe	15.4	0.8	BD	14.5	0.8	BD
SG-127 Probe	9.0	0.1	BD	8.0	0.2	BD
SG-116 Probe	0.8	0.03	BD	1.2	0.3	BD
SG-133 Probe	0.3	0.05	BD	8.4	2.7	BD

BD = Below detection level

1332.50 139:RTA:frid0111T

Sampling Method	Mean % Difference	Number of Data Sets Used in Analysis
Headspace	19.7	4
Pore Gas	17.4	16
Pore Gas*	6.1	14

(* excluding one outlier sample, possibly due to a blocked syringe)

Headspace analysis is somewhat less reproducible than the pore gas (19.7% versus 17.4%), especially when the one outlier sample is excluded (19.7% versus 6.1%). The greater variability of the headspace is not surprising, since one would expect the pore gas to be more homogeneous than the soil itself. Headspace analysis measures the contaminant contained in the soil itself, while the pore gas method measures contaminants in the gas phase.

Analytical variability and sampling variability are both incorporated in analysis of replicate samples. Both the headspace and pore gas variability are at an acceptable level for a survey investigation.

5.2 Replicate Analyses

Replicate GC runs of the same sample were conducted twelve times throughout the field investigations. Replicate GC runs of standards were conducted every day, but the results are not reported. The results of the replicate runs on samples are reported in Table 5-3. The reproducibility of the runs was excellent. The mean percent difference between the mean of the replicates and each value for parameter concentrations over 1 ppm was 1.3 percent.

TABLE 5-3

RESULTS OF ANALYTICAL DUPLICATE RUNS ON GC

Sample Identification	GC RESULTS Replicate A TCE (ppm)	Replicate A cis-DCE (ppm)	Replicate A trans-DCE (ppm)	Replicate B TCE (ppm)	Replicate B cis-DCE (ppm)	Replicate B trans-DCE (ppm)
SG-15(b)	18.4	0.4	BD	18.4	BD	BD
SG-11	off scale	2.08	BD	off scale	2.04	BD
SG-27	14.8	3.7	BD	14.9	3.7	BD
SG-39	0.04	0.003	BD	0.04	0.006	0.002
SG-37	1.6	0.03	BD	1.7	0.04	BD
SG-74	0.1	0.01	0.05	0.1	0.004	0.01
SG-64	2.3	0.03	BD	2.4	0.02	BD
SG-67	0.1	0.01	BD	0.1	0.01	BD
SG-66	0.06	0.1	0.1	0.05	0.1	0.1
SG-83	1.2	0.05	BD	1.1	0.03	BD
SG-88	35.5	3.0	0.9	36.3	3.0	0.9
SG-97	trace	0.3	BD	trace	0.2	BD

BD = Below detection level

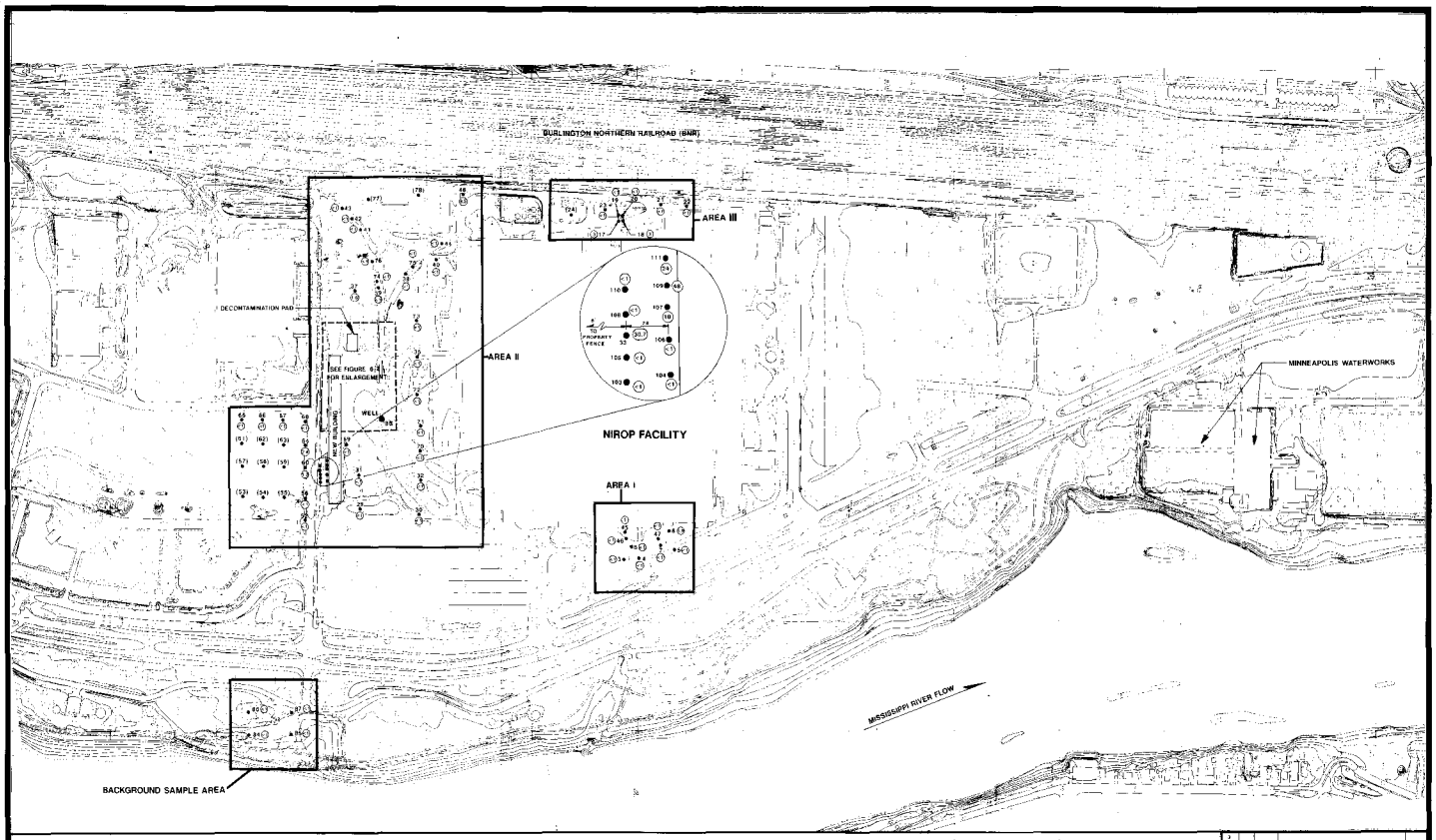
6. RESULTS AND DISCUSSION

The results for all sampling points are presented in Appendix E. Sampling locations, and the results for all areas except in the vicinty of the trenches in Area 2 are presented in Figure 6-1 (A and B). Results for trichloroethylene and cis- and trans-dichloroethylene are presented numerically; the presence of other analytic peaks is noted where they occur. The following discussion of the results is presented by sampling area.

6.1 Background and Area 1 - Former TCE Tank Area

The soil gas analysis for the background and Area 1 sample points are presented on Figure 6-1 and in Table 6-1. The background samples were taken in the Anoka County Park between the NIROP facility and the Mississippi River. Four soil samples were taken (SG-84 through SG-87) using the soil gas probe method. The background area soils (SG-84 through SG-87) all had soil gas concentrations less than 1 ppm. TCE concentrations were between 0.03 and 0.05 ppm for the background samples, with DCE concentrations even lower. These concentrations most likely represent the background contamination of the Tedlar® sampling bags. The concentrations are well below the 1 ppm cut-off used to indicate levels of interest.

Area 1 is on the western side of the NIROP facility. The area is of interest for three reasons. First, TCE was stored in an above-ground storage tank close to the building, and there is a potential of tank or piping leakage. Second, two storm sewers converge under the area into



LEGEND

- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING BUILDING
- EXISTING FENCE
- EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- EXISTING SPOT ELEVATION
- TREES AND / OR BRUSH
- EDGE OF WATER
- WET AREA
- INTENDED LOCATION, NOT SAMPLED
- SITE NUMBER
- CONCENTRATION OF TCE AND DCE IN PPM
- AREA BOUNDARY LINE
- ENLARGEMENT BOUNDARY LINE

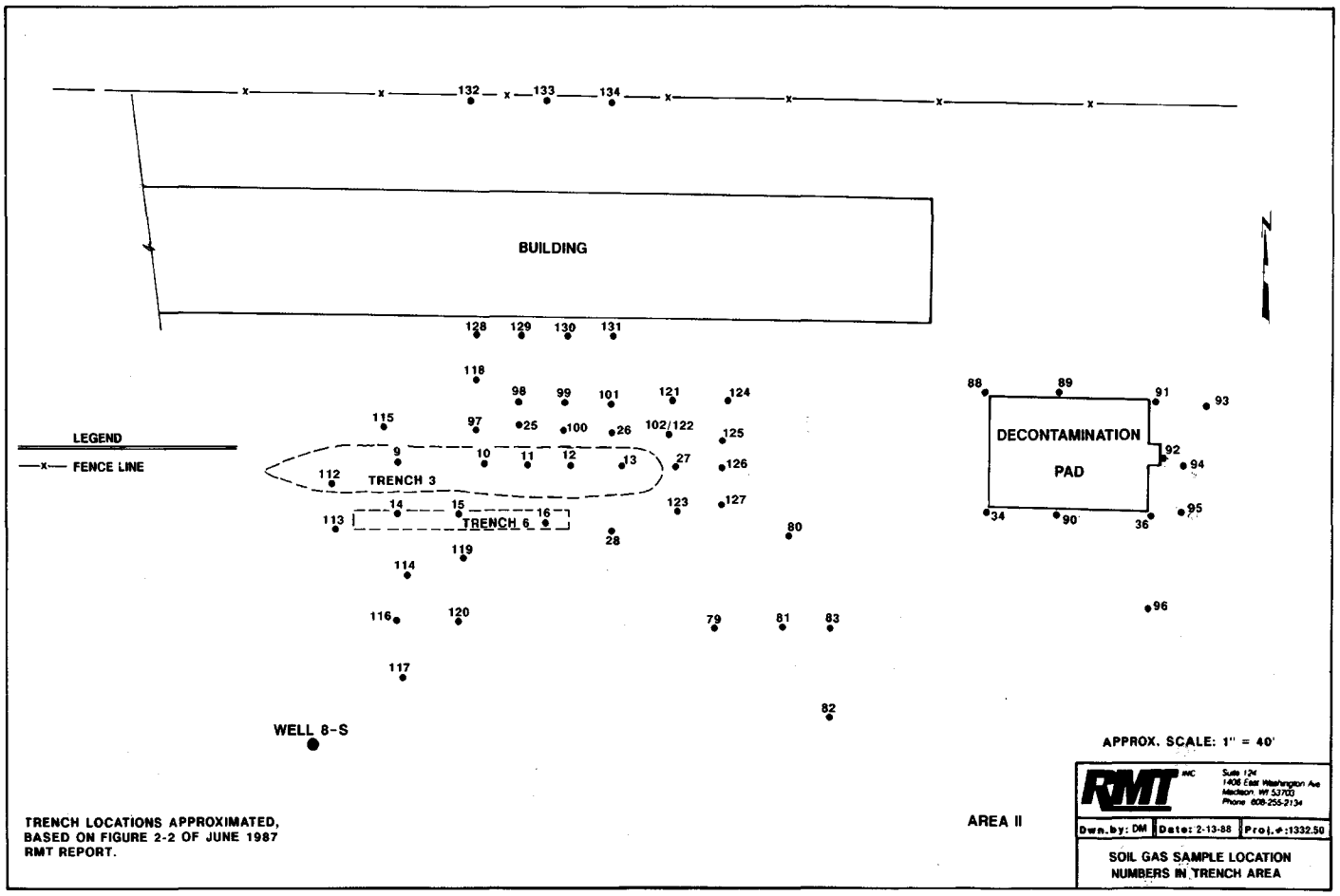
NO.	BY	DATE	REVISION	APPD.
3.				
2.				
1.				

PROJECT
A-E QCSR
RI/FS AT NIROP
FRIDLEY, MINNESOTA

SHEET TITLE: SOIL GAS SAMPLING LOCATIONS FOR ALL AREAS AND TCE + DCE CONCENTRATIONS FOR ALL AREAS – TRENCHES

DRAWN BY: DM | SCALE: | PROJ. NO.: 1108.58
CHECKED BY: [illegible] | DRWG. NO.:
APPROVED BY: [illegible] | DATE PRINTED: FEB 16 1988 | SHEET OF
DATE: 2-10-88 | FIGURE 6-1A

RMT INC
SUITE 100
1400 Gail Boulevard, Ave
Minneapolis
Phone 612/553-7234



FEB 17 1989 FIGURE 6-1B

TABLE 6-1

SOIL GAS RESULTS FOR BACKGROUND AND AREA 1 - FORMER TCE TANK

Sample Number SG-	HNU Reading* ppm	Portable GC Results TCE	cis-DCE	trans-DCE	Others	Sum CE**
		ppm (v/v)				
Background						
84	0.8-1.0	0.05	0.02	0.03	No	< 1
85	0-0.2	0.05	BD	0.003	No	< 1
86	0.8-1.0	0.03	BD	0.003	No	< 1
87	--	0.04	BD	0.003	No	< 1
Area 1 - Old TCE Tank						
3	0	Trace	0.03	0.05	No	< 1
4	3	0.45	BD	BD	No	< 1
5	7.5-8.5	BD	BD	BD	No	< 1
6	--	0.2	0.03	0.03	No	< 1
7	0.2	0.29	0.01	BD	No	< 1
8	0.3-0.8	0.3	1.6	0.03	No	1.9
45	2.0-2.4	0.7-0.9	0.05	0.1	No	1.0
46	1.4-1.8	0.04-0.09	BD	0.03	No	< 1
47	1.4-1.6	0.15	0.07	0.07	No	< 1

* HNU reading from Tedlar® bag or direct reading from installed probe
** CE = chlorinated ethylenes (TCE & DCE)
BD - Below detection level
-- - No reading taken

one sewer. Third, TCE has been found at relatively high concentrations in wells 6-S and 10-S in the area. The sampling in Area 1 was to determine whether the high concentrations in the ground water were the result of a near-by source (i.e., leaking tanks or sewer lines) or were a continuation of the ground water contamination plumes from north and east of the building.

Of the nine soil samples in Area 1, only two were at or above the 1 ppm cut-off level. Sample point SG-45, near the former location of the TCE tank, has a concentration of 1 ppm, while sample point SG-8 had a level of 1.9 ppm. These low concentrations indicate there is no general surface soil contamination in the area.

6.2 Area 2 - Former Disposal Area

A total of 101 sampling points were selected in Area 2. TCE and DCE were found in two parts of Area 2, primarily near the previous disposal trenches and existing decontamination pad, and near a recently installed water main along the north boundary of the site. More intensive sampling was conducted in the areas where TCE and DCE were detected at high concentrations. The general survey of the area is discussed first, then each of the areas where high concentrations were found is discussed individually.

6.2.1 General Survey

Samples were taken along two lines that divided the area into thirds in an east-west direction (Figure 6-1). Sampling was done along two roads in the central and west portions of the area. In the eastern

portion, the southern sampling line followed the projection of the road, while the northern sampling line curved north following a railroad track. During the previous geophysical survey conducted as part of the remedial work done in 1983, several magnetic anomalies were noted along the railroad track. Sampling points were located in the approximate location of these magnetic anomalies, to investigate the possibility that the anomalies were caused by buried, and potentially leaking drums. In addition, a series of samples were taken along the southern and eastern edges of the property located just north of the western portion of Area 2 to determine if the soil was contributing to the ground water contamination. A grid system of sampling points was planned across the whole section and in the off-site area in the north part of Area 2. However, because legal access could only be obtained for the right-of-way next to the road, the other points on the grid were not sampled. The sample points at the extreme east end of Area 2 (SG-79, and SG-78) were also not sampled.

Results of the general sampling of Area 2 showed only four points (SG-60, SG-64, SG-37 and SG-48) where concentrations of chlorinated ethylenes (i.e., the sum of trichloroethylene and dichloroethylene) were above 1 ppm (see Figure 6-1 and Table 6-2). Three of the four sites are at the edge of areas of much higher contamination, as discussed in the next two sections. The fourth sample point, SG-48, was located near Hazardous Waste Storage Area C and apparently indicates some low level surface contamination in the area. The other twenty-four sample points had soil gas or headspace levels of less than 1 ppm. The low levels indicate there is probably not widespread shallow soil contamination throughout most of Area 2, with the exception of the areas discussed below.

TABLE 6-2

SOIL GAS RESULTS FOR AREA 2 - GENERAL SURVEY

Sample Number	HNU Reading*	Portable GC Results				
		TCE	cis-DCE	trans-DCE	Others	Sum CE**
SG-	ppm	ppm (v/v)				
31	1-1.4	0.02	0.01	BD	No	< 1
32	--	0.13	0.05	BD	No	< 1
35	--	0.26	0.08	BD	No	< 1
37	2-2.8	1.6	0.04	BD	No	1.6
38	--	0.18	0.08	BD	No	< 1
39	0.2-0.4	0.04	0.006	0.002	No	< 1
40	--	0.24	0.12	BD	No	< 1
41	--	0.10	0.05	0.1	No	< 1
42	--	0.12	0.02	BD	No	< 1
43	--	0.008	0.007	BD	No	< 1
44	--	0.42	0.25	BD	No	< 1
48	--	8.5	0.08	BD	No	8.5
52	0.4-0.6	0.2	0.2	BD	No	< 1
56	1.4-1.8	0.1	0.1	BD	No	< 1
60	1.2	1.3	BD	0.03	No	1.3
64	0.8-1.2	2.4	BD	0.03	No	24
65	0.3-0.4	0.003	BD	0.005	No	< 1
66	0.5-0.6	0.06	0.1	0.1	No	< 1
67	1-1.8	0.1	BD	0.01	No	< 1
68	0.8-1.0	0.12	0.003	0.003	No	< 1
69	0.8-1.7	BD	BD	0.003	No	< 1
70	0.6-0.8	0.007	BD	0.003	No	< 1
71	0.4-0.5	BD	BD	0.003	No	< 1
72	0.4-0.6	0.2	0.01	0.004	No	< 1
73	0.6-1.0	BD	0.004	0.006	No	< 1
74	0.8-1.0	0.1	0.01	0.05	No	< 1
75	1-1.4	0.005	0.007	0.006	No	< 1
76	0.4	0.04	0.01	BD	No	< 1

* HNU reading from Tedlar® bag or direct reading from installed probe
** CE = chlorinated ethylenes (TCE & DCE)
BD - Below detection level
-- - No reading taken

6.2.2 Trench and Decontamination Pad Area

The most intensive sampling was conducted in the vicinity of the former disposal trenches in the center of Area 2. Sampling points were located in the estimated locations of Trenches 3 and 6, based on trench location information previously provided to RMT. High concentrations relative to concentrations in other samples of TCE and DCE were found in several of the samples. Further sampling was conducted about 15 feet from the previous sampling grid in each direction from the trenches. As additional samples exhibited high concentrations, the grid was extended outward in an effort to find the edge of the apparent soil contamination area.

Results for the trench disposal area are given in Table 6-3. A map of the area showing the sum of TCE and DCE (chlorinated ethylenes) is shown on Figure 6-2. Concentrations of chlorinated ethylenes are notably high in the area north of and near Trench 6 and at the southeast corner of the decontamination pad. The area near the trenches gave results that were consistently above 1 ppm in the pore gas; in three samples, concentrations were above 100 ppm. As noted previously, these values indicate only relative levels of contamination - the actual concentrations in the soil cannot be determined by the methods utilized.

The concentrations measured appear to indicate soil contamination itself, rather than migration of contaminated pore gas through soil. This conclusion is based on two observations. First, at sampling point SG-13, both pore gas and soil headspace analysis were conducted. Both measurement methods gave similar results. The pore gas concentration

TABLE 6-3

RESULTS OF PORE GAS SAMPLING IN TRENCH AND DECONTAMINATION PAD AREAS (AREA 2)

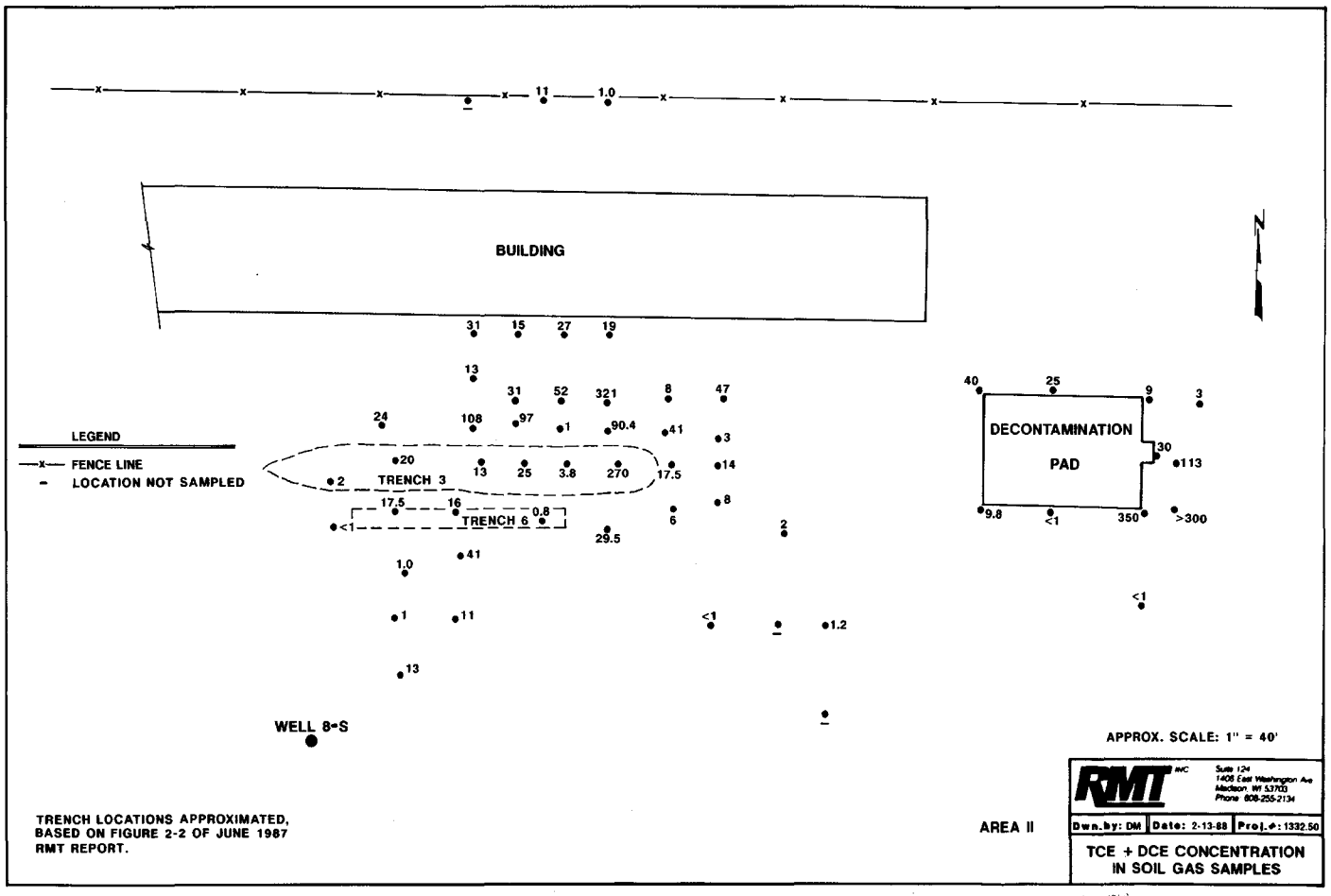
Sample Number	HNU Reading* ppm	Portable GC Results TCE	cis-DCE	trans-DCE	Others	Sum CE**
		ppm (v/v)				
9	22-35	18.4	0.7	0.5	No	20
10	16	12.7	0.53	0.19	No	13
11	12-15	22.5	1.6	BD	No	25
12	3	3.3	0.52	BD	No	3.8
13	140-205	79.5	188	BD	No	270
14	12.2	16.8	0.77	BD	No	17.5
15	17-22	16.3	0.35	BD	No	16
16	6-8	0.24	0.60	BD	No	0.8
25	2.5-3.0	0.71	93.4	2.8	No	97
26	7.2-7.5	0.13	88.5	1.8	No	90
27	18.6-19.2	13.9	3.6	BD	No	17.5
28	2.2-2.6	22.8	6.3	0.37	No	29.5
34	--	6.1	3.7	BD	No	9.8
36	--	158	192	5.0	Yes	350
79	1.2-1.8	0.18	BD	0.003	No	< 1
80	0.8-1.0	2.0	BD	0.1	No	2
81	Obstruction - No Sample					
82	Obstruction - No Sample					
83	0.8-1.2	1.2	BD	0.04	No	1.2
88	48-99	35.9	3.0	0.9	No	40
89	52-53	21.9	3.0	0.7	No	25
90	1.8-2.0	0.6	0.06	0.02	No	< 1
91	3.2-3.6	8.0	1.3	0.2	No	9
92	69-70	20.6	9.5	BD	No	30
93	2.8-3.0	2.1	0.9	BD	No	3
94	200-210	74.3	38.9	BD	No	113
95	420-430	299	572 (off scale)	5.9	Yes	> 300
96	1.0-1.2	0.1	0.15	BD	No	< 1

TABLE 6-3 (CONT'D)

RESULTS OF PORE GAS SAMPLING IN TRENCH
AND DECONTAMINATION PAD AREAS (AREA 2)

Sample Number	HNU Reading* ppm	Portable GC Results TCE	cis-DCE	trans-DCE	Others	Sum CE**
		ppm (v/v)				
97	0.4-0.6	0.4	105	3.1	Yes	108
98	1.0-1.4	15.9	0.54	14.2	No	31
99	--	44	7	0.7	No	52
100	1.2-1.8	0.4	0.3	0.1	No	1
101	1.4-1.8	205	3.9	112	No	321
102	84-86	22.5	18.1	0.8	No	41
112	2.0-2.2	1.6	0.04	BD	No	1.6
113	1.0-1.8	0.3	0.06	BD	No	< 1
114	2.0-2.4	1.1	0.04	BD	No	1
115	60-62	13.9	10.5	BD	No	24
116	2.0-2.6	1.0	0.15	BD	No	1
117	3.0-3.6	12.8	0.2	BD	No	13
118	--	2.8	9.8	BD	No	13
119	0.8-1.0	40.1	1.0	BD	No	41
120	5.0-5.2	10.9	0.2	BD	No	11
121	18.6-19	7.4	0.4	BD	No	8
123	12-13	6.2	0.1	BD	No	6
124	50-51	46.9	BD	BD	No	47
125	5-5.8	2.2	1.2	BD	No	3
126	6-6.6	10.5	3.5	BD	No	14
127	12.4-13.6	7.5	0.2	BD	No	8
128	3-3.6	27.5	3.1	BD	No	31
129	6.8-10	15.0	0.8	BD	No	16
130	60-62	25.8	1.3	BD	No	27
131	0.4-0.8	17.8	1.2	BD	No	19
132	No Sample Taken					
133	2.0-2.8	8.4	2.7	BD	No	11
134	2.0-2.4	1.0	0.06	BD	No	1

* HNU reading from Tedlar® bag or direct reading from installed probe
** CE = chlorinated ethylenes (TCE & DCE)
BD - Below detection level
-- - No reading taken



FEB 17 1988

FIGURE 6-2

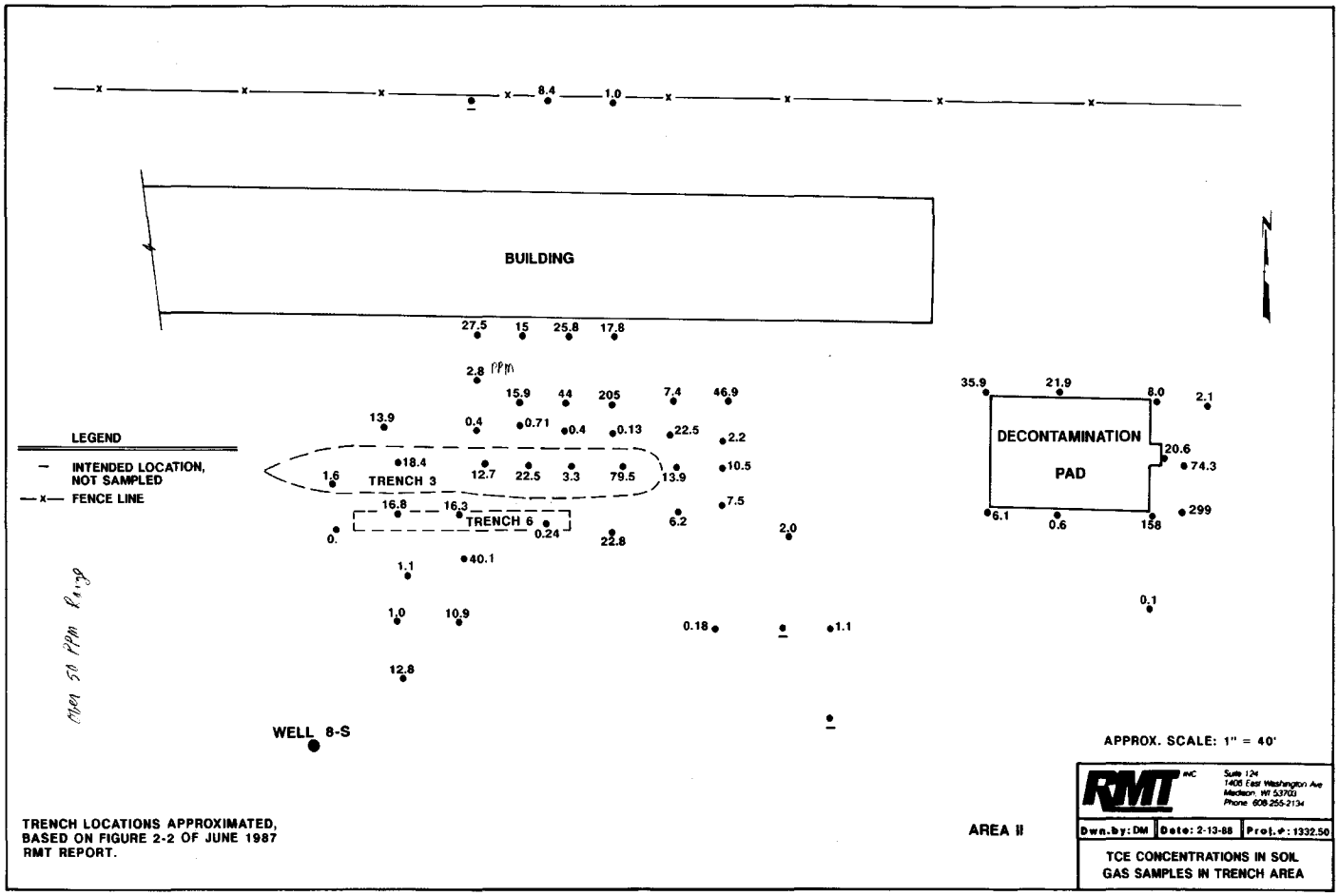
measured by the probe method is similar to the soil gas concentration that can be sustained by the soil in the VOA vial after the pore gas is removed. The similarity in results also implies that a fairly large reservoir of contaminant is in the soil. During sampling for soil headspace, some of the original pore gas is lost. If there were only a small reservoir of contaminant in the soil, the replenishing of the soil headspace would deplete a large portion of the reservoir, and the resultant gas concentration would be lowered. Second, there are fairly large soil gas concentration gradients between some adjacent sampling points (3.8 ppm at SG-12 and 270 ppm at SG-13, 15 feet away). The steepness of the gradient suggests that the pore gas samples reflect local soil conditions, not large-scale vapor migration. Provided the soil gas components move relatively slowly through the soil, one would expect steady state or equilibrium conditions in the distribution of contaminants between the soil and soil gas. Under these conditions, it would not be surprising that the soil in the headspace jar can re-establish the equilibrium to almost the same level once the pore gas is removed.

Soil gas concentations were also high in the area southeast and east of the decontamination pad. Concentrations were well over 300 ppm in one sample (SG-95). It appears that the observed concentrations near the decontamination pad represent a separate contamination area from the area around the trenches, since there is a general trend of decreasing, then increasing, soil gas concentrations as one moves from the trench area to the decontamination pad.

Maps of the concentrations of trichloroethylene, cis-dichloroethylene, and trans-dichloroethylene are presented on Figures 6-3, 6-4 and 6-5, respectively. The pattern for TCE is similar to the overall contamination pattern discussed above, except that for several of the sampling points just north of Trench 3, TCE is relatively low. Cis-DCE is present at generally much lower concentrations than TCE except for an area just north of Trench 3 and in the area south and east of the decontamination pad. Trans-DCE was below detection in most samples. The only areas showing high trans-DCE concentrations (SG-98 and SG-101) are north of Trench 3 and the area of high cis-DCE concentrations, and the area south and east of the decontamination pad. At three sample points (SG-97, SG-36, and SG-95), several other peaks were observed in the chromatograms, indicating other, unidentified volatile organic compounds.

The difference in distribution patterns for TCE and the DCE isomers can be evaluated by plotting the ratio of TCE to DCE for all the sample points with total TCE + DCE above 1 ppm. For sample points where the DCE concentration was below detection, a DCE concentration of 0.01 ppm was assumed for the calculation. The ratios are shown by sampling location on Figure 6-6. A line of low TCE/DCE ratios exists just north of Trench 3, in the region of high cis-DCE concentrations, and to the south and east of the decontamination pad. The contamination in the other areas is predominantly TCE.

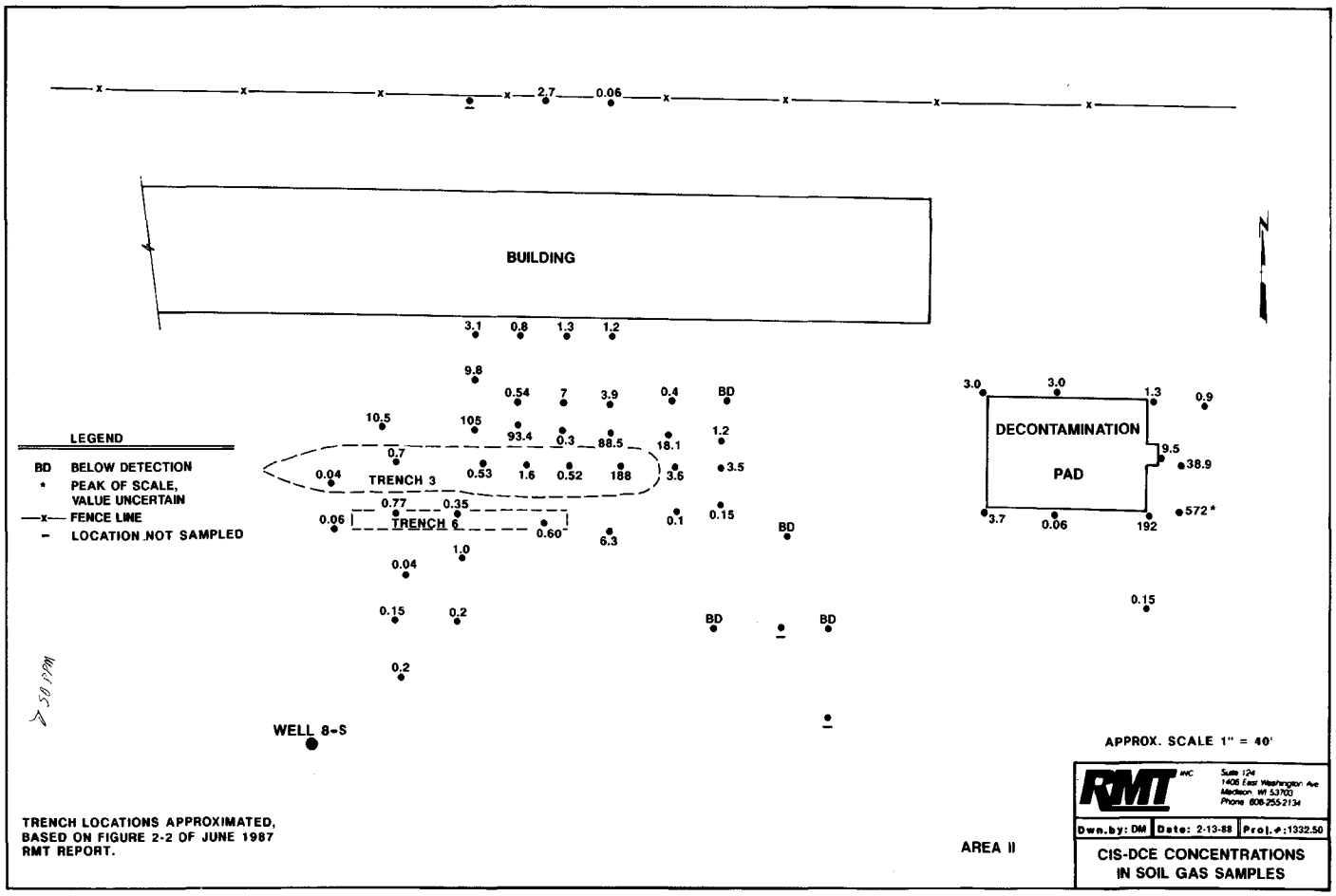
Other investigators have shown that TCE can be chemically or biologically degraded to the DCE isomers, and to monochloroethylene or chlorinated ethane (Vogel, et al., 1987; Barrio-Lage, et al., 1986).



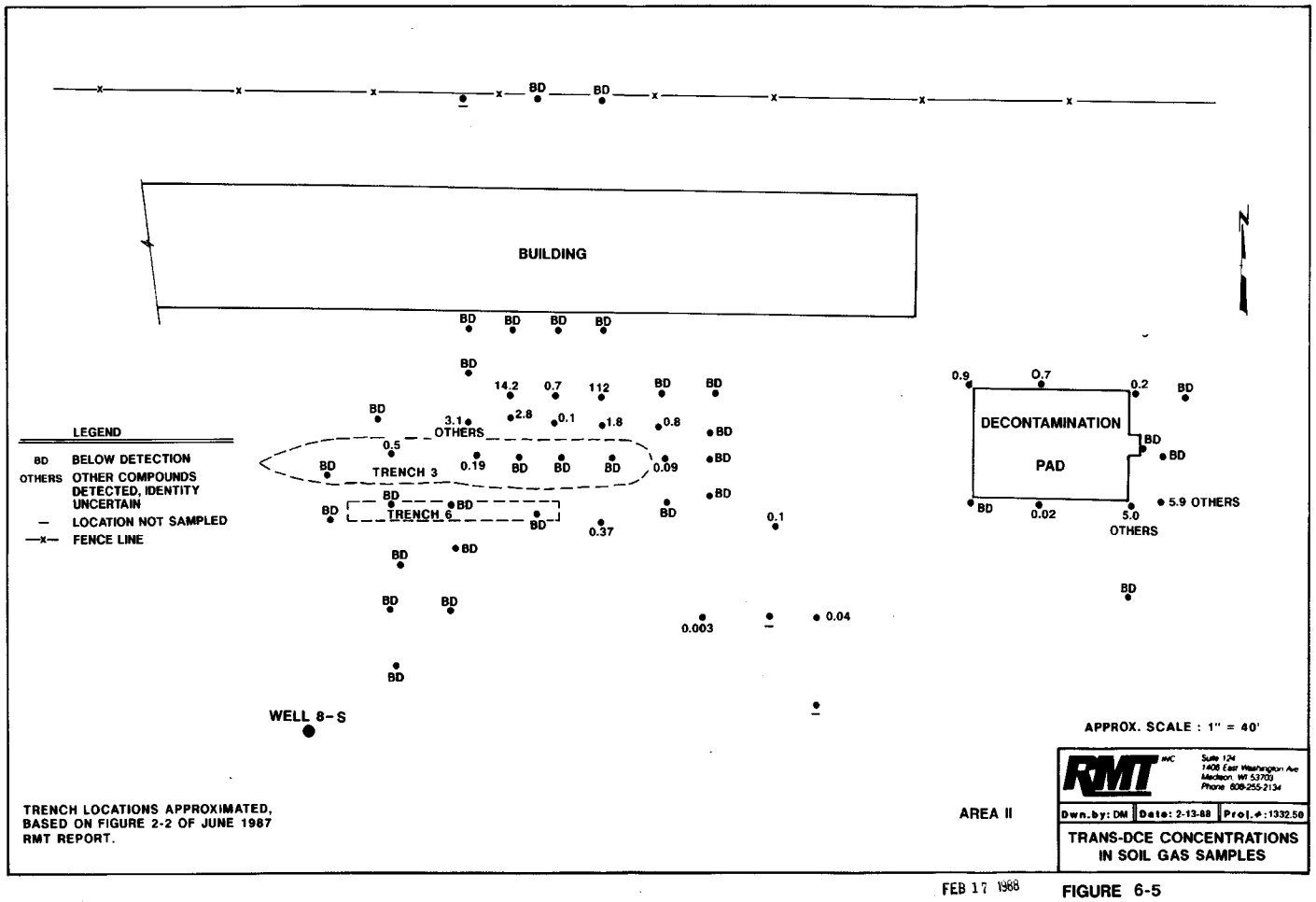
TRENCH LOCATIONS APPROXIMATED, BASED ON FIGURE 2-2 OF JUNE 1987 RMT REPORT.

FEB 17 1988

FIGURE 6-3

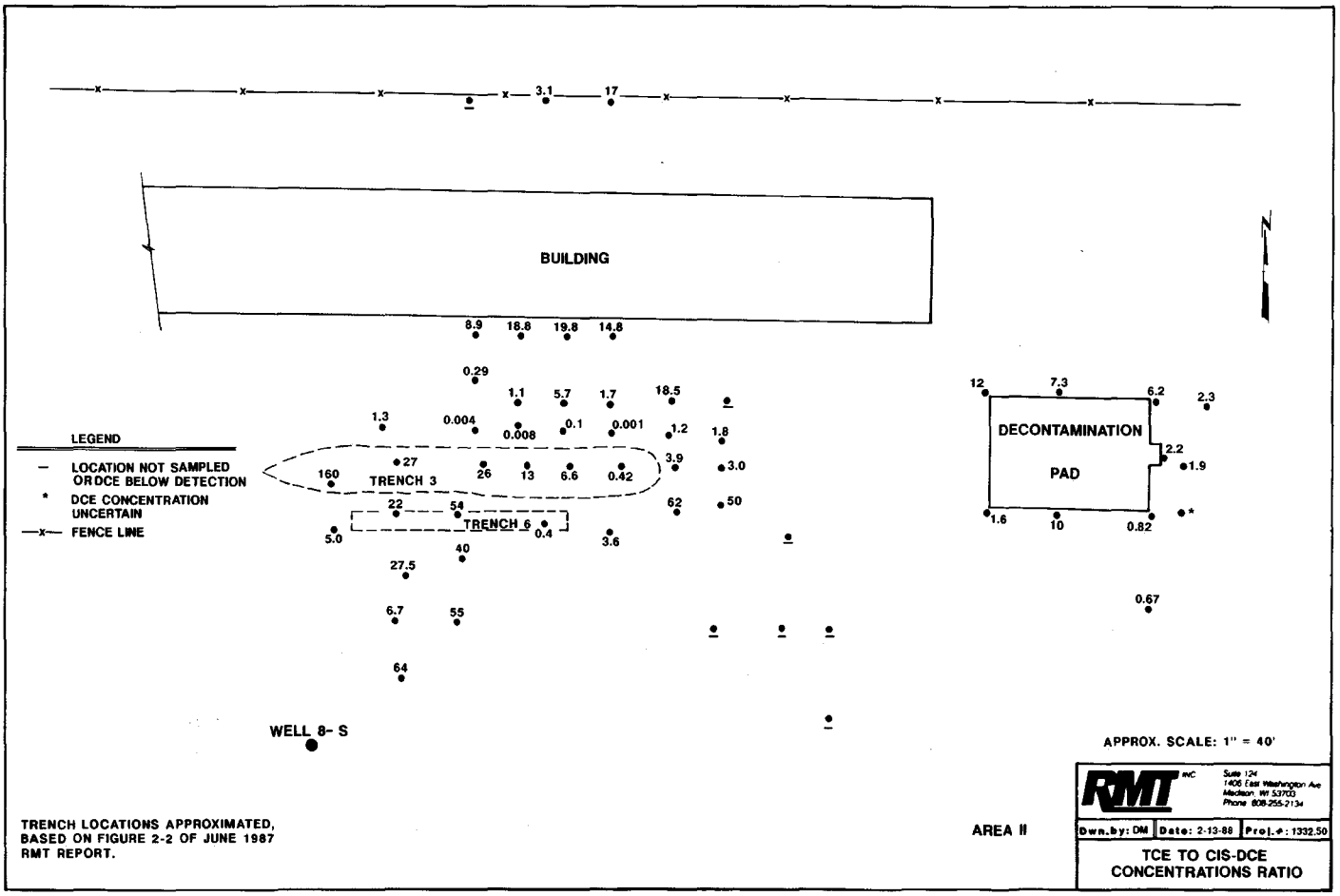


FEB 17 1988 FIGURE 6-4



FEB 17 1988

FIGURE 6-5



FEB 17 1988

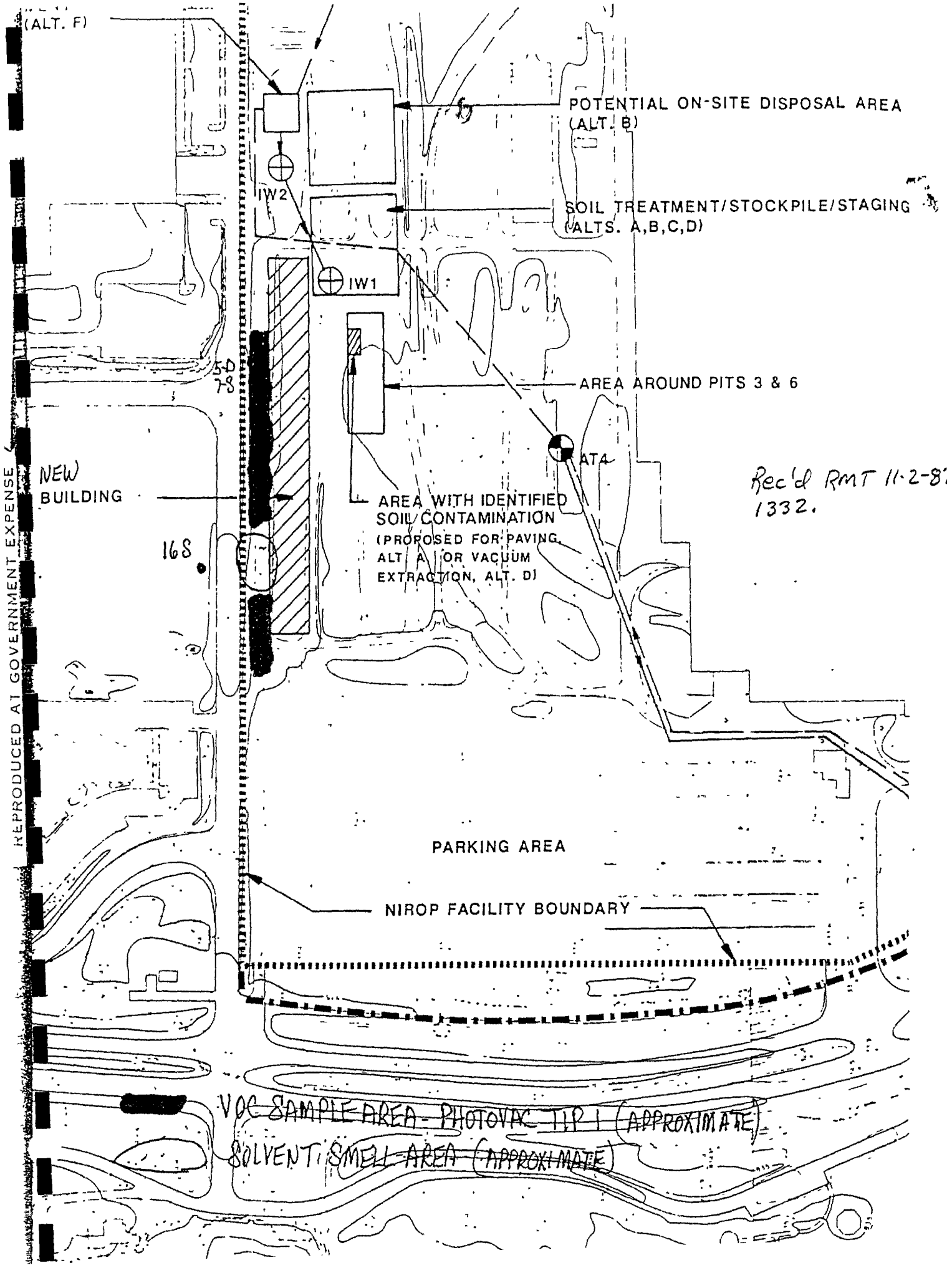
FIGURE 6-6

Half-lives of TCE in soil varied from months to hours in sediment or rock slurries (Barrio-Lage, et al., 1987). The redox status of the soil or water is an important influence on the dechlorination of TCE (which is a reduction process). The reaction generally occurs faster under more anaerobic conditions (Barrio-Lage, et al., 1987).

The systematic variation in the ratio of TCE to DCE may reflect the degradation process. One possible scenario is that soil redox status was more reducing immediately north of Trench 3 and less reducing in the areas where TCE has not degraded. However, other scenarios are possible. TCE/DCE ratios may reflect the time of the release. A more recent release of TCE would presumably exhibit a higher TCE/DCE ratio, since the degradation process requires time. Degradation is also affected by concentration. Very high or low concentrations are not biologically degraded as quickly. There is insufficient evidence to verify one of these particular scenarios.

6.2.3 Water Main Excavation Area

During installation of a 20-inch diameter water main between the new storage building and the north edge of the NIROP property in September 1987, solvent odors were noted along one section of the trench in an area near well 16-S. A map showing the approximate trench loction is given on Figure 6-7. Notes were made during the excavation by MPCA personnel (Appendix F). VOC analysis was made using a TIP meter (similar to the HNU). No soil samples were taken. The solvent was said to be strongest in the surface soils. The TIP readings do not confirm that observation. Ten pore gas sampling points were established in



REPRODUCED AT GOVERNMENT EXPENSE

this area; nine were sampled in undisturbed soil on either side of the water main trench (sites SG-33 and SG-103 through SG-111). TCE and traces of cis-DCE were found in four of the samples (see Figure 6-1 and Table 6-4). The highest concentrations were found in a wedge-shaped area with the point of the wedge pointing off-site (SG-33), and the wide portion generally pointing toward the trench disposal area.

The results indicate an area of moderate contamination in the area where solvent odors were noted during the water main installation. Whether this contamination is a continuation of the contamination in the trench area, or represents a separate contamination area, is not clear.

TCE was by far the major component of the measured contamination. In this respect, the samples are similar to the less contaminated samples from the trench area.

6.3 Present TCA Tank Area

Eight soil locations were sampled in the area to the east of the NIROP building in the general vicinity of the TCA tank and monitoring well 9-S. The TCA tank is the same tank previously used to store TCE. The tank was relocated from the west side of the building to its current location on the east side of the building. The tank now contains 1,1,1-trichloroethane (TCA). Soil gas results are presented on Figure 6-1 and in Table 6-5. The soil at SG-24 was rocky; therefore, no sample could be taken from this point.

Soil gas concentrations of chlorinated ethylenes were generally low. At five of the seven sites analyzed, concentrations of chlorinated ethylenes were less than 1.0 ppm. Concentrations of 3 ppm were found at

TABLE 6-4

RESULTS OF PORE GAS SAMPLING IN WATER MAIN TRENCH AREA (AREA 2)

Sample Number	HNU Reading* ppm	Portable GC Results TCE	cis-DCE	trans-DCE	Others	Sum CE**
		ppm (v/v)				
33	--	30.2	0.43	0.1	No	31
103	1.8-2.2	0.1	0.04	BD	No	< 1
104	0.4-0.8	Trace	0.01	BD	No	< 1
105	--	0.1	0.04	BD	No	< 1
106	0.6-1.0	0.4	0.1	0.1	No	< 1
107	40	9.7	0.5	0.3	No	10
108	1.8-2.4	0.3	0.1	BD	No	< 1
109	0.8-1.0	47.9	0.07	0.07	No	48
110	2.4-2.6	0.2	0.1	BD	No	< 1
111	62-68	23.5	BD	BD	No	24

* HNU reading from Tedlar® bag or direct reading from installed probe
** CE = chlorinated ethylenes (TCE & DCE)
BD - Below detection level
-- - No reading taken

TABLE 6-5

SOIL GAS RESULTS FOR AREA 3 - NEW TCA TANK

Sample Number	HNU Reading* ppm	Portable GC Results TCE	cis-DCE	trans-DCE	Others	Sum CE**
		ppm (v/v)				
17	5-7	3.06	BD	0.05	No	3
18	1-7	3.00	BD	BD	No	3
19	2-5	< 0.1	BD	BD	No	< 1
20	1	BD	BD	BD	No	< 1
21	3.6	0.20	BD	BD	No	< 1
22	0	0.03	BD	BD	No	< 1
23	--	0.27	0.06	BD	No	< 1
24	No Sample Obtained - Hit Obstruction					

* HNU reading from Tedlar® bag or direct reading from installed probe
** CE = chlorinated ethylenes (TCE & DCE)
BD - Below detection level
-- - No reading taken

the two sampling locations on the west side of the TCA tank. At SG-18, both soil pore gas and soil headspace analysis were conducted, and each sampling method was done in duplicate. Thus for SG-18, four separate samples were taken. Results for all four samples were low (3 ppm or less), indicating reasonably good reproducibility of sampling results.

A new ground water monitoring/pumping well was installed near sample point SG-21. During boring for the well, high HNU readings were noted in the boring near the ground water surface. TCE was measured in the soil pore gas at SG-21 at 0.2 ppm. DCE was below detection. It appears that for this location, high concentrations of TCE in the ground water or deep soil are not reflected in high surface soil concentrations.

7. REFERENCES

Barrio-Lage, G., F.Z. Parsons, R.S. Nassar, and P.A. Lorenzo. 1986. "Sequential dehalogenation of chlorinated ethenes." Environ. Sci. Tech., 20, 96-99.

Barrio-Lage, G., F.Z. Parsons, and R.S. Nassar. 1987. "Kinetics of the depletion of trichloroethene." Environ. Sci. Tech., 21, 366-370.

Eklund, B. 1985. "Detection of hydrocarbons in ground water by analysis of shallow soil gas/vapor." American Petroleum Institute Publication No. 4394, May 1985.

Kerfoot, H.B. 1987. "Soil-gas measurement for detection of ground water contamination by volatile organic compounds." Environ. Sci. Tech., 21, 1022-1024.

Marrin, D.L. and G.M. Thompson. 1987. "Gaseous behavior of TCE overlying a contaminated aquifer." Ground Water, 25, 21-27.

RMT, Inc. Reports on The Naval Industrial Reserve Ordianance Plant, Fridley, Minnesota

- June, 1987 Remedial Investigation Report for Remedial Investigation/Feasibility Study

- January, 1988 A-E Quality Control and Sampling Plan for Additional Investigations

Vogel, T.M., C.S. Criddle, and P.L. McCarty. 1987. "Transformations of halogenated aliphatic compounds." Envrion. Sci. Tech., 21, 722-736.

APPENDIX A

INITIAL SOIL GAS SAMPLING AND ANALYSIS PLAN

FROM

A-E QUALITY CONTROL AND SAMPLING PLAN
FOR ADDITIONAL INVESTIGATIONS

AT THE

NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
FRIDLEY, MINNESOTA

JANUARY 1988

FIELD METHODS - SOIL GAS SAMPLING AND ANALYSIS

The field methods described below are those that will be used in Phase I. The methods may be modified, based on site-specific conditions encountered in Phase I, to optimize each method. Any modifications made in the field will be noted on the field data sheets. It is anticipated that only one of the methods will be used in Phase II. The quality control procedures will remain the same in both phases of work unless unanticipated difficulties indicate a change is warranted.

Decontamination

Soil augers should be carefully cleaned with soapy water, rinsed with clean water, and dried before each sampling session. Between samples, the augers should be wiped clean with a wet paper towel. If organic residue appears to be adhering to the auger, then an HNU reading should be taken. If the reading indicates organic contamination, then the auger should be cleaned with soapy water and rinsed with clean water.

The plastic sheet used during soil boring should be shaken clean between sample locations, with visual inspection to ensure that no soil is stuck to the sheet.

New Ball jars and 40-ml VOA vials are preferred for both methods. If used Ball jars or vials are used, at least 10 percent will be checked for cleanliness with the HNU.

The stainless steel probes used for soil pore gas analysis should be checked for cleanliness prior to use with the HNU meter. If the probes show residual contamination, they should be cleaned with a

propane torch to drive off volatile compounds. If a probe is still not free of volatiles when tested with the HNU meter, then the probe should be rinsed with acetone and heated until clean, or the probe should be discarded and a new probe substituted.

Calibration

The HNU meter should be calibrated using the calibrant gas supplied by HNU Systems, Inc., prior to taking the instrument into the field. During use, the battery should be kept charged and the zero reading checked each time the instrument is turned on. Before each sampling episode, the HNU should be checked for response using an available VOC source (e.g., felt tip marker).

Calibration of the portable GC is done by making up a standard gas containing the compounds of interest at known concentrations in the range corresponding to sample concentrations. The instrument is calibrated in the lab prior to its use in the field. Instrument settings for analyzing the parameters of interest are also set in the lab prior to taking the instrument into the field.

The instrument being used (a Photovac, Inc., portable GC) has an internal calibration curve that identifies and quantifies compound peaks based on the stored standard curve. Each time the portable GC is turned on, blanks are run to ensure that there is no background contamination in the instrument. Then, a standard is run and the internal standard curve calibrated for site-specific operating conditions (especially temperature). Following this, samples are run. During routine operation, blanks and standards are run after every 8 to 10 samples. If

a sample with a particularly high VOC concentration has been injected, then the instrument is cleaned by running blanks until the baseline returns to background.

A. Soil Pore Gas Analysis

Soil pore gas will be collected using stainless steel probes in the following manner:

1. Four-foot stainless steel hollow probes will be used for collecting samples. The probe has a tapered hose attachment tube at one end and an open downhole end.

2. Prior to installing the probes, the cleanliness of the probe will be checked by drawing air through the probe and monitoring VOCs in the gas with an HNU meter. If the HNU reading is greater than 1 ppm over background, then the cleaning procedure specified above, under Decontamination, will be initiated. If the probe cannot be cleaned, then another probe will be used.

3. Once a sampling location has been chosen, a loose-fitting screw is placed in the open end of the tube. The tube is then placed vertically on the ground. A special sleeve is placed over the tapered hose attachment, and the probe is hammered into the ground to the 3.5-foot mark. The tube is withdrawn one foot from the bottom of the hole. The screw stays at the bottom of the hole, and the tube can draw soil gas from a one-foot vertical section of exposed soil in the 2.5- to 3.5-foot interval.

4. A vacuum is applied to the probe to determine if gas can be withdrawn from the soil. If gas can be withdrawn, then the gas is extracted for approximately one minute, and an HNU reading of the pore gas taken by attaching the HNU meter to the probe. The reading is noted, and the meter is then taken off the probe and a vacuum is reapplied. After another minute of evacuation, a second HNU reading is taken. If a constant HNU reading is obtained, then a sample is taken for final HNU analysis and for portable GC analysis. If the reading is not steady, then the process is repeated until a steady reading is obtained. If no steady reading is obtained after 15 minutes of evacuation and if gas is being removed, then a sample is taken and the unsteady HNU reading noted on the Field Data Form.

5. A gas sample is taken by placing a deflated Tedlar® bag in a wide-mouth plastic bottle. The top is screwed on the bottle. Ports in the top allow a tube to be connected to the Tedlar® bag and allow evacuation of gas from the area between the bag and the bottle wall. Gas is withdrawn from the bottle with a vacuum pump, causing the Tedlar® bag to draw in air from the soil probe and inflate. Once the bag has inflated, the vacuum pump is turned off and the Tedlar® bag sealed. The bottle is then marked with the sample identification (sample number, sampling location, time, date, field staff initials, project number), and saved for analysis.

6. Samples are taken directly from the bag for both HNU and portable GC analysis. Portable GC analysis should be conducted first, using the field HNU readings as a guide for injection volumes, as follows:

HNU Reading (ppm)	Injection Volume (uL)
0 - 5	250
5 - 25	100
25 - 100	50
100 - 200	25
> 200	10

7. Data is collected on the form shown in Table A-1.

8. The stainless steel probe assembly should be checked for leaks following removal from the ground after each sampling episode. This is accomplished by applying a passive vacuum (pipet bulb) to the gas extraction end of the probe and sealing the other end by finger pressure. If the bulb maintains its vacuum, then the probe is still sealed.

B. Soil Headspace Analysis

1. The soil auger (a bucket auger) should be cleaned initially with soapy water, rinsed with clean water, wiped off with a paper towel, and then air dried prior to use.

2. Once the sample location is identified, the surface litter is scraped off the soil and a plastic sheet spread near the boring site. The top 2.5 feet of soil is removed with the auger and placed on one side of the plastic sheet. The next foot of soil (2.5 to 3.5 feet) is removed, placed on the plastic sheet, and quickly homogenized on the sheet. Subsamples are taken for both HNU and portable GC analysis.

TABLE A-1

FIELD DATA FORM
SOIL GAS INVESTIGATION

DATE:

PROJECT:

FIELD STAFF:

PROBE/HEADSPACE:

Sample Identification			HNU Reading (ppm)		Portable G C Results			Comments
					TCE	DCE		
#	Location	Depth	Probe	Bag		cis	trans	

3. For HNU analysis, a one-quart Ball jar is filled approximately 1/2 full with soil. Any large chunks (greater than 1/2 inch) of soil should be broken up. The top of the Ball jar is covered with aluminum foil (shiney side up). The screw ring is then placed on the jar. The jar is marked with sample information (sample number, sampling location, time, date, field staff initials, and project number), and then placed in an area at room temperature to equilibrate. During equilibration, Ball jars are maintained in an inverted position.

4. For the portable GC analysis, a 40-ml VOA vial is filled approximately 1/2 full of soil. The top is covered with aluminum foil (shiney side up), and the cap and septum are then put on the vial. The vial is marked with the same sample information as the Ball jar. As with Ball jars, vials must equilibrate to room temperature while in an inverted position. Duplicate vials should be taken for all samples. Samples should be taken for both HNU and field GC analysis as quickly as possible to minimize volatilization.

5. The excavated soil is returned to the boring and tapped down with a steel bar. Extra dirt is then added to fill the hole. The auger and spatulas used for taking the soil samples should be washed with soapy water, rinsed with clean water, wiped with a paper towel, and then air dried.

6. The soil headspace sample for HNU analysis should be equilibrated at room temperature for between 1.5 and 2 hours before taking the HNU reading. The sample should be shaken prior to analysis. The HNU probe should be gently inserted through the aluminum foil, making as small a hole as possible. The probe should be lowered to approximately halfway down the bottle (making sure the probe does not touch the soil). The meter reading should be carefully monitored as the probe is pushed through the foil and into the jar, because a rapid rise and fall in concentration may indicate very high VOC concentrations in the bottle. If there is no large spike in the HNU reading, then the highest and stable reading are both recorded. The probe often takes 10 to 15 seconds to approach a stable reading, which is maintained for 20 to 30 seconds (or more) until the reading starts to fall as incoming air dilutes the headspace air.

7. Samples in VOA vials are equilibrated for at least one hour. Analysis should be run within 6 to 8 hours of sample collection if possible. The injection volume to be used is based on the soil headspace HNU reading, using the guide given for the soil pore gas analysis.

8. Portable GC and HNU analysis should be recorded on Field Data Forms (Table B-1). The presence of major unidentified peaks

should be noted on the data sheet. If a tentative identification can be made based on relative retention time, then the identification should be noted in parentheses with a question mark (e.g., "PCE").

9. If the results of portable GC analysis are off-scale or questionable for some reason, the duplicate soil sample should be run, adjusting the injection volume as appropriate. Duplicates should be run in any case on every fifth sample as part of the quality control program.

10. The chromatograms for the day or work period should be marked with the date, project name and number, and analyst's initials and saved for future reference.

11. All Ball jars and VOA vials should be returned to the RMT Laboratories for cleaning or disposal. Tedlar® bags will be cleaned by filling and emptying the bag several times with clean air.

C. Additional Data Recording and Storage Requirements

1. HNU - All HNU readings are recorded on duplicate data sheets. One of these sheets is kept in a 3-ring binder at the site. The other sheet is sent to the location where the portable GC is being operated.

2. GC - Portable GC results are also recorded in two places (in addition to the chromatogram itself). First, portable GC results are recorded on the Field Data Form accompanying the samples, and stored in a 3-ring binder which is kept with the instrument. Second, the results are stored in the portable GC log book. All field GC runs - blanks, standards, samples, and replicates - are recorded in the log book so that a complete record of all analyses is maintained. The 3-ring binders become part of the project file maintained in the RMT office. The log book is kept with the instrument in the field. Results from previous projects are stored in the laboratory. All chromatograms are marked with the sample information (e.g., sample identification number, injection volume) on the chromatogram itself. The instrument records sample date and time of analysis.

Each day or work period's output is marked with the date and project number, and then stored in the laboratory for future reference. Thus, if there is any question about whether a sample was run and what the results were, the log book will provide information on what samples were run, and, if necessary, the actual chromatogram can be retrieved to review the results.

APPENDIX B

TELEPHONE LOGS FOR CONVERSATIONS RELATING TO PORE GAS SAMPLING

RMT INC

INTEROFFICE MEMORANDUM

CONFIRMATION NOTICE # 158

NIROP IN/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

DATE: October 20, 1987

TO: Files

FROM: Eric Gredell

RE: COE-NIROP Fridley, Project 1332

SUBJECT: Phone Call from Tom Thiele on October 16, 1987, 10:15 a.m.

Tom noted that the draft QC Plan has a considerable amount of details for the field procedures. He asked whether this plan was intended to define all of the workplan details, or if we would also be issuing a Project Workplan. I told him that we do intend to issue a separate Project Workplan. However, the workplan will not duplicate details already described in the QC Plan. Our intention is to cross-reference these plan documents as much as possible. Tom said this would be acceptable.

He said he would be sending most of their review comments on the draft QC Plan today. Some additional comments may follow next week. He said that Kevin Coats was not available to review the draft QC Plan. Another chemist has completed a review. Tom said he would like to have Kevin review certain portions of the plan as part of their final review comments.

Tom said he spoke yesterday with someone at the NIROP who works with Mel Vojvodich. Tom said he reviewed the items in my letter of October 13, regarding coordination items for the field work.

He said the new building in the "North 40" is completed. He said the east end of the building is located in line with a major road which runs through the plant in a north-to-south direction, approximately at the centerline of the plant. This road is called "Broadway Road." The new building extends to the west approximately 660 feet from this roadway. The north side of the building is 40 feet from the north fence along the NIROP property. The building is 60 feet wide. It is a pre-engineered building with a slab-on-grade foundation. There are no foundation footings. The building was designed by FMC. The west end of the building is located about 40 feet to the east of the location of the gun turrets in the North 40. A new paved driveway has been completed in front of the building. There are four truck doors on the south side of the building. (See the attached sketch for additional location dimensions.) No soil borings were made during the design phase for the building.

Tom said the cost of the plant water and the cost to discharge the ground water to the sanitary sewer would be paid by RMT as previously agreed. He told the plant people that the cost of electric power was to be taken care of by the Navy, since this cost is not in RMT's scope. He said they need more information about the power requirements for the pumping tests and the electric hook-up details.

He said the tentative location for our construction trailers would be at the southwest corner of the plant building. This location is preferred due to the proximity to utility tie-in points.

1332.30 926:TFR: -rmt31

The Navy will provide us with the use of a conference room inside the plant to set up the field GC. A sink with a water source would be available in the near vicinity. We can use the room for the duration of the field work.

He asked if we would be using the existing decon pad. There are some barrels presently stored on the pad which would have to be moved by the Navy. He asked if we intend to decontaminate the drill rig and other equipment on the pad, or if it would be used only for personnel decon. I said I would have to check and get back to him.

He said the Navy has agreed to go ahead of the drill rig set-up locations to approve each drilling location prior to the start of drilling. I asked Tom to obtain written confirmation of this from the Navy.

We discussed the status of access permission for property around the NIROP. On the north side, near the printing company, the Navy still has a valid right-of-entry agreement. Therefore, we will have no difficulties obtaining access in this area. The Navy has obtained an approximate legal description of the areas on the park property where we need access, and the COE's attorneys see no problem with access permission in these areas. Tom has contacted lawyers with the COE regarding permission to enter and work on the Burlington Northern Railroad property. Substantial difficulties are expected with permission for entry to this property. The COE's lawyers indicated that in the extreme case, formal condemnation of the railroad land may be necessary to obtain access. The COE is still pursuing access permission with the railroad.

We discussed some options available if access to the railroad property is not possible. Tom will ask Mel at the plant if there is a maintenance zone on the outside of the outer plant fence which could be wide enough for access and for setting up a drill rig. I said I would discuss with our hydros the impact on the project objectives for obtaining new data if we are only allowed to do soil gas testing or perhaps only install the monitoring wells on the railroad property, rather than the full scope of work which was planned for the railroad property area. We discussed the possibility of locating a monitoring well on other property to the east of the railroad property. Tom said he is not sure who owns that property. Tom felt that if a monitoring well was proposed to be located to the east of the railroad property, the proposed location should be approved by the state before drilling.

Tom said that during a phone call last week, Dave Smith told him that someone recently made an anonymous phone call to Mel's office at the plant to report that some company located to the east of the NIROP had dumped spent solvent on their property over an unspecified period of time. The report given to the Navy was that as much as two barrels per week or two barrels per day of the spent solvent had been dumped. Tom did not know whether the solvent was reported to have been dumped on the ground or into a sewer, ditch, etc. Tom

did not have any more details of this report. He did not know where the property was located or any other details of the reported dumping. I suggested that the COE and Navy continue to follow up on this report. I also suggested that if it is found there is some basis of fact to this report, our investigation should include efforts to identify the owners of property within a fairly wide radius of the NIROP, and also to identify the current and past types of manufacturing activities on these properties.

I said we would like to arrange for a site coordination meeting at the plant next week, probably on Thursday or Friday. However, I said that we are still not sure who the lead hydrogeologist for the field work will be. I noted that the timing for a meeting next week would be very good, since RMT is planning to be at the site during the week of November 2, with the driller to follow during the week of November 9. Tom said that he could be available for a meeting next week and that Dave Smith said that he would like to attend this meeting also. I said I would call Tom back to confirm the date and arrangements for the meeting. We briefly discussed whether it would be appropriate to request a meeting with the MPCA during our visit next week. We agreed that such a meeting may be premature, since the MPCA will have received our FS-11 report only a few days earlier. It may be advisable to meet with representatives of the railroad to discuss access arrangements. I suggested that if this meeting can be arranged, it would be advisable to have a lawyer from the COE attend. Tom said he would consult with others at the COE to discuss whether a meeting with the railroad should be pursued. If we do meet with the railroad, it may be necessary to extend the trip to meet with them on October 23. Tom said the COE does not have any lawyers located in the Twin Cities area; they are all located in Omaha.

tfr

CONFIRMATION NOTICE # 168

NIRAP RI/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

1 of 2

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332.22

To/From Duane Hines

(Affiliation) COE

(Phone No.)

By: (Your Name) Tom Stolzenburg / Keith Bandt Date: 10/27/87 Time: 10:00 am

PURPOSE: (Describe Reason For Call)

Comment Item 2 – GC specs.

COMMENTS: (Briefly Summarize Discussion)

I asked why EC detector called for and pointed out:

(1) PID is more sensitive to TCE than ECD
(2) The HNU equipped with ECD is not portable (needs wall outlet)

Duane seemed to think we needed "confirmation" of PID output by using another detector or column. Again I asked why. He seemed to think water vapor was a major interference with a PID but was confused on how it actually worked (I doubt if he has intimate knowledge of PIDs). I asked for a specific recommendation of instrumentation which had these capabilities. He had none but asked if I could convert to 2 columns. I pointed out that in that configuration each sample run may take 4 times as long.

He will take our comments under advisement

~~ACTIONS REQD~~:

Cost Implications

- 2nd column:

  A second column will increase time of analysis by an unknown amount (maybe 4X) because in this configuration we lose the back flushing mode which prevents interferences from low volatility compounds

- 2nd type of detector:

  We would have to purchase another machine $10 - 15,000. Rental: $1 - 2,000/mo for a minimum of 2 months

CONFIRMATION NOTICE # 107

U.S. Corp RM/PS
Project # 1332
Contract #LACA 45-86-C-0015

1 of 2

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332

~~From~~/To: David Seep

(Affiliation) BNRR

(Phone No.) 612-298-2492

By: (Your Name) E. Gredell Date: 10-27-87 Time: 2:30 PM ±

PURPOSE: (Describe Reason For Call)
- Various topics.

COMMENTS: (Briefly Summarize Discussion)
- I said after seeing the BNRR property yesterday, we have revised the scope of our proposed work. I said that due to limited accessibility on the west side of the tracks, we do not propose to install a well there. We can move this well onto gov't property & probably still meet the objectives of our study. However, I said we still request authorization to install a well on the east side of the tracks.
- I told him we do not propose to do any soil gas tests & sampling across the tracks. This is primarily due to the safety problems related to working in the yard. He agreed with this.
- I told him about the anonymous phone call which FMC

ACTION NEEDED:

received in Sept. 1987 re: alleged dumping of spent TCE solvent over a 10-yr period at Dealer's Mfg. Co., 5130 NE. Main St. I said we would like to relocate our proposed soil gas work to the grass-covered strip of land between their eastern paved access road and the back fence of the mfg. plants along Main St., between approx. 50th St. & 52nd St. I asked if BNRR owned this property. He said he is waiting to receive some right-of-way maps from one of their dept's; he won't know if they own the land until he gets the maps. He expects to have them tomorrow. He said he will discuss our revised request for work on their property & the info. about the alleged TCE dumping w/ their division officers. He is also trying to contact their legal staff to discuss all these issues.
- He said he will call me soon with their comments.

CONFIRMATION NOTICE # 111

NORCO NI/FS
RMT Project # 1332
Contract #DACA 45-66-C-0015

1 of 3

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332

~~To~~/From: Tom Thiele

(Affiliation) COE

(Phone No.) —

By: (Your Name) E. Gredell Date: 10-28-87 Time: 4:30PMI

PURPOSE: (Describe Reason For Call)

— Returned my call.

COMMENTS: (Briefly Summarize Discussion)

— we discussed the review comment by D. Hines re: our GC. Tom said Kevin Coots originally wrote the scope re: GC req'nts. Tom said he needs to discuss the subject w/ Kevin when he returns to the office tomorrow. I pointed out that our GC does not meet all the req'nts in the COE's scope. However, I noted that we had included a description of our GC model in our proposal, and had not received any comments on this during discussion of our proposal w/ the COE. Tom said it may be possible that the GC req'nts included in the final Scope should have been changed, but for some reason it was left the same as earlier editions of the Scope. He said we should proceed w/ using our GC for the work to start next week.

ACTION NEEDED:

- I described my call to David Seep w/ BNRR on 10-27-87. Tom said the proposed revisions to the locations for well 22-S and the soil gas testing areas were O.K. He requested that we modify the drawings & descriptions of the proposed work in the planning doc's, & include the reasons why the revisions were requested in the Project Workplan.

- He said it is acceptable to begin field work next week with the current status of the planning doc's. We will continue to discuss the COE's review comments & agree on all work details while the field work is underway.

- He had talked to Joe Slattery re: my question about whether the OSHA reg's should be strictly applied to the work to be done by a general contractor under subcontract to RMT. Tom said that the contractor would not have to use personnel who have the 40 hrs of OSHA-req'd H&S training. However, for drilling through pavement, we should have the HNU at the location to check for contamination when they break through the pavement. If VOC's are detected at conc's high enough to require going to Level C protection, the contractor should move out of the work or hot zone. We would then call the COE for further instructions. Tom asked if RMT personnel could operate the contractor's pavement cutting machine. I said we would not allow our employees to do this. ∴, some other arrangements would have to be made if Level C conditions arise, under a contract mod.

- Tom agreed that pumping out the sump at the decon pad & disposing of the runoff water that is currently there should be the responsibility of FMC. Tom verified that FMC had indicated they would also remove the barrels & racks currently stored on the pad. However, cleaning of mud, gravel, etc. from the pad & runoff sump would have to be done by RMT, under a contract mod..

We also discussed the possibility of a contract mod. for power hookups to our trailers & to the pumping wells, & the phone hookups. I noted that we originally planned to

use the phones in the plant, & not have phones in our trailers. However, we decided to use a phone in the trailer after we decided to use a computer w/ modem to transmit DQCR's to our office each day from the field. I pointed out that this will allow us to send the DQCR's to the COE daily using our new telecopy machine.

- We discussed the COE's procedures for pay requests for contract mod's. Tom will check w/ others at COE to find out if they can pay invoices from our subcontractors directly (for contract mod's), or if the contractor's charges must be included in RMT's invoice.

- I pointed out that if we use the contractors currently used at the plant by FMC, we have no control over the charges they will require, since the work is non-competitive. Tom said this will not be a problem; the COE will not estimate what they feel are "reasonable, customary, & necessary" costs, & hold us to their estimate as a maximum amount they will pay. We also do not have to have a firm lump-sum amount or a not-to-exceed amount for the contractor's work. However, he said they cannot approve a set percentage of the contractor's charges for our costs for subcontract admin. & coordination. They will need our estimate of specific manhours & expenses for our costs related to the contract mod's. These estimates would be negotiated with us, & converted into a lump-sum fee for RMT's part of the contract mod.

- We agreed that I will prepare a letter which lists all the items we feel should be included under a contract mod. This initial list will not include our cost estimates. The letter will be telecopied to Tom. The COE will then decide which items are acceptable for inclusion in a mod. I said we must at least have the COE's acknowledgement that the items will be covered under a mod. before RMT will hire any additional subcontractors.

170

1332

Contract #DACA 43-86-C-0015

10/6

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332

~~To~~/From: Mel Vajvodich

(Affiliation) NAVPRO

(Phone No.) 612-572-6451

By: (Your Name) E. Gredell Date: 10-29-87 Time: 3:00PM

PURPOSE: (Describe Reason For Call)

- Returned his call.

COMMENTS: (Briefly Summarize Discussion)

- He said during installation of the 20" water main on 10-28-87, the workers noticed some "solvent odors" from the soils when excavating the trench. The odor was in the top 1' to 3' of soil. It reportedly had an "oil-like" odor or like "PVC solvent." It was in the trench located near well 16-S, in about a 50' section of the trench.
- He said someone from the City of Fridley called the MPCA to report the odors. Dale Thompson of the MPCA came to the site today & used a Photovac-Tip 1 analyzer to check for VOC's in the ambient air. Readings of 0.1 to 0.6 ppm were recorded at various locations. He checked about every 30' along the entire length of the proposed trench. He also went into the open trench & took readings; detectable VOC's were measured at all levels in the trench. They also took

ACTION NEEDED:

a random bucket sample of soil somewhere near the trench. They detected VOC's in a grab sample from this bucket.

- He will send me a copy of all info he has related to the odors detected in the soils, the testing by MPCA, etc.

- He will send me prints of buried utilities he rec'd from FMC. I told him we need dwgs of utilities in all the work areas, including the soil gas areas, since electric conduits are generally only 2' deep.

- He will call me w/the name & phone # of the phone co. rep. who works at the plant.

- The plant fire protection system is supplied with water from the City of Fridley as the primary supply, and the City of Minneapolis as a backup supply.

- I told him the names of RMT personnel who will be at the site next week. I said they will probably hand-carry their photos & other info. needed by the Navy to make the contractor's badges. The person at the plant who handles the security clearances is Ed Larson.

RMT INC CONFIRMATION NOTICE 190 INTEROFFICE MEMORANDUM 1 of 2

NIROP RI/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

cc: Records.
TEG
RMT Field Office

DATE: November 3,

TO: Project File

FROM: Eric Gredell EG. and Keith Bandt

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Phone call to Tom Thiele of the COE on November 3, 1987, 1:45 p.m.

Tom Thiele received a call from Mel Vojvodich today. Mel needs a list of Layne-Northwest personnel as soon as possible. Tom also told Mel that Mel does not need to respond to Eric Gredell's letter dated October 13, 1987, requesting assistance from the NAVPRO with various field work coordination items.

1. Access Agreements

Access agreements in question are the City of Fridley, Maxwell Printing Company, the "Park," and the Burlington Northern Railroad property. The Corps of Engineers' real estate officer, Martin Frawley, has made inquiries regarding the access agreement with Maxwell Graphics, the printing company. However, no decision has been reached as of this date. Chuck Troia, a lawyer in the Corps of Engineers' district office, knows the most about the Burlington Northern Railroad access agreement. Nothing has yet been received from the railroad regarding that access. With regard to the park property, nothing has been received in writing yet. The Corps of Engineers has written a letter to the park commission. With respect to the city property, the Corp of Engineers has written a letter to the city. FMC currently has a right of entry for this property. The Corps of Engineers will notify the city of our work. Regarding the Burlington Northern Railroad, Tom will ask Chuck Troia to call David Seep. RMT personnel should not contact David Seep directly.

2. Recent Water Main Installation

We discussed the recent water main installation and solvent-like odors that were found in the soil. Tom knew about this finding. Captain Meyer was upset that no one was there to collect samples during the installation. We suggested that Tom ask Mel to be sure to notify us in the future regarding these kinds of activities that might affect the project. Tom gave approval for us to contact Dale Thompson at MPCA regarding his measurements during the installation work.

3. Underground Utilities

We discussed the underground utilities issue in detail, particularly the utility locations near wells AT-1 and AT-2. We expressed our concern over the lack of adequate utility maps to identify underground utilities in the sampling locations. Tom will check with Mel regarding additional maps that Mel was to have sent us recently.

1332.32 926:TFR:-thiele

4. Decontamination Pad Washwater

We discussed the decontamination pad washwater and sump cleaning prior to RMT beginning work, and also how to deal with that washwater during our field work on-site. The decontamination pad must be clean prior to RMT beginning work. We are assuming that FMC will do the cleaning and will pay for the pumping of the sump water from the decontamination pad. Prior to cleaning the sediment from the sump, the decontamination pad must be washed down. We agreed that FMC should be required to clean up the decontamination pad and to restore it to the condition that it was in following its last major use. Tom said that if the contractor cleans the decontamination pad, he must follow health and safety procedures. We agreed that we (RMT) will call FMC to discuss cleaning the decontamination pad. If FMC balks at cleaning the sump, Tom said we should try to hire them to clean the pad and the Corps of Engineers will pay the cost as an extra. We also discussed discharging the decontamination water onto the ground surface as opposed to collection and disposal to the sanitary sewer system. Tom said he will discuss this issue with Tommiann. He thinks it should be ok.

5. Disposal of Off-Site Drill Cuttings

We discussed the method for determining if off-site drill cuttings need to be containerized and how we would determine acceptable levels of VOCs in these drill cuttings. Kevin Coats with the Corps of Engineers had reviewed California Title 22 regulations regarding the testing of drill cuttings. He will send a copy of this regulation to us for our review. We (RMT) agreed to review how this issue originated. Tom said he would also review his notes.

6. Disposal of Discharge Water from Wells AT-1 and AT-2

We indicated that we had not heard any word from FMC regarding the discharge of pumped water to the sanitary sewer system laterals in the plant. FMC's participation is critical. Tom said there was a storm sewer manhole in the southwest corner of the plant. This storm sewer ultimately discharges to the river. Mel had talked to Tom about the possibility of pushing a hose through this storm sewer by way of the manhole, passing it under East River Road, bringing it back to the ground surface, and then routing it to the City sanitary sewer. We expressed some concern regarding the feasibility and advisability of this method.

7. GC Calibrations

We discussed the Corps of Engineers' request to do additional calibrations and standard runs with our field GC. We pointed out that we were already doing 20 percent QC samples, which is twice as many as we normally do for other types of sampling. We asked that the Corps be more specific on their request. Tom said that he would talk with Kevin Coats, hopefully this afternoon, and call us back with his findings.

Tom said he would be in all week.

1332.32 926:TFR:-thiele

RMT INC

INTEROFFICE MEMORANDUM

DATE: November 11, 1987

CONFIRMATION NOTICE # 194

TO: Project File

NIROP RI/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

FROM: Eric Gredell EG

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Phone call from Mark Lahtinen of the MPCA on November 5, 1987

Mark was returning my call from yesterday. I told him we are beginning the field work described in the Conceptual Workplan. I said the decon procedures we intend to use involve cleaning of the sampling equipment and steam cleaning of the drilling equipment in the immediate area around each drill site and sampling location. I asked him if the MPCA had any problems with this procedure. He said that discharging the decon water onto the ground at the various locations would be acceptable to the MPCA.

We briefly discussed the events last week concerning the installation of the new 20-inch city water main along the north side of the NIROP property. He confirmed that Dale Thompson of their staff had gone to the site after they received the reports of solvent-like odors from the surface soils during the trench excavation. I said I would like to speak with Dale Thompson about his observations and any test results from his visit to the site. Mark said this would be alright, and that I should call Dale at my convenience.

I told him about our intentions to revise the proposed area for soil gas testing on the Burlington Northern Railroad property from the original area shown in the Conceptual Workplan. I also explained the reasons for moving the testing area from directly on the railroad tracks to the open strip of land somewhat to the northeast of the original area, directly behind the manufacturing companies along Main Street. He agreed that this was a preferable location for the soil gas testing work. He said he talked recently with David Smith regarding the alleged dumping of spent solvents at Dealers Manufacturing Company. He said the MPCA has also received anonymous phone calls from apparently the same previous employee of Dealers Manufacturing who phoned FMC in September. He said the MPCA has been in contact with Dealers Manufacturing, and has considered installing a monitoring well in the downgradient area near the company. I described our knowledge of the alleged dumping from the phone memo written by FMC and supplied to us by the Navy. His information was consistent with the information we have from this memo.

I also asked him about the status of the Kurt Manufacturing site. He said I should talk to Shawn Ruotsinoja in their Preliminary Assessment/Site Investigation Unit at 612-296-7391. He said Shawn is handling both the Kurt Manufacturing site and the recent developments at Dealers Manufacturing.

I asked if he could provide us with additional monitoring data from wells FMC #1 and Fridley #13. He said he would check with their department which would have these records and call me back with the name of someone I could contact there.

1332.32 926:TFR:-frid1112

I asked if he had his comments on the FS 11 Report. He said that he had only briefly reviewed the report. He expects that sometime next week, he and Dale Thompson will meet to combine their review comments and he hopes to have their written comments submitted to the COE sometime next week. He mentioned that the remedial alternatives and the conclusions in the report looked alright to him, based on his initial brief review.

I told him our schedule for production of the full FS Report now includes issuing the draft report sometime in December. He had no comment on this.

He said he had anticipated a meeting with the Navy and COE. I told him that I thought this was a meeting which I had suggested to the COE several weeks ago, with the intention that the meeting would be held prior to our start on the full FS Report. I told him that I thought the usefulness of this meeting had now passed, since we have already completed a considerable amount of work on the FS Report, and the FS 11 Report has now been distributed. I told him the next meeting that is definitely scheduled would be the draft FS Report review meeting.

tfr

cc: RMT Field office 11-16-87

1332.32 926:TFR:-frid1112

RMT INC

INTEROFFICE MEMORANDUM

CONFIRMATION NOTICE # 195

NIROP RI/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

DATE: November 6, 1987

TO: File

FROM: E. Gredell E.G.

SUBJECT: COE-NIROP-Fridley, Minnesota
Project #1332
Phone call from Tom Thiele on November 5, 1987, 10:15 a.m.

1. Tom said he needs the names of Layne-Northwest employees and the other information on these people to get security clearances for them to enter the site next week. I said I would talk to Greg Aluce about this today.

2. Tom said he talked to Kevin Coats regarding the additional standardization runs on the field GC which Kevin had requested previously. He said Kevin does not have a specific number of additional runs he would like to see; however, he thought 5 to 10 restandardizations should be sufficient. Tom said the number of additional runs is actually dependent on the conditions we see in the field when setting up and initially standardizing the unit. If we are having difficulties, we should use our judgment and perform the additional runs we feel are necessary to obtain proper equipment setup.

3. We discussed the procedures for disposal of drill cuttings from the off-NIROP wells. Tom said that he still was not sure how the subject of possibly drumming the cuttings came up in the first place. I said I still have not had a chance to check my notes to see how the subject came up either. He asked if we would have an HNU on each drill rig site full time. I said I was not sure, but I thought we had not intended to have an HNU at the drill rig full time. Tom said he thought it was preferable to have an HNU available at the rig full time. He said that Kevin Coats felt it would be all right to dump the cuttings on the NIROP property as the COE had done previously. Kevin also felt that monitoring of the drill cuttings as they were produced to meet some specific requirements for VOC concentrations before the cuttings could be dumped at the NIROP was unnecessary. Tom said that if my records show that the entire subject of testing these cuttings came up only during a phone conversation between him and me, then we should just ignore the subject and dispose of the cuttings on the NIROP without any additional testing, as previously planned.

4. We discussed methods to dispose of the decon water. Tom said he talked to Tomiann McDaniel about this. She said that for installation of the other wells, the COE did not use the decon pad. They decontaminated the drill rig at each drill site, and allowed the decon water to discharge onto the ground. She said that the MPCA had someone on the site observing these decon procedures, and the MPCA did not raise any objections. Tom said that our draft QCP says that the decon water will be dumped into the sanitary sewer. He mentioned that the MPCA has not commented on this draft procedure. However, I pointed out that we did

not submit a copy of the draft QCP to the MPCA. We both agreed that it would be prudent to contact the MPCA to describe the intended decon procedures to them, to obtain their concurrence. We agreed that I would contact the MPCA to discuss this with them. For now, we should assume that the decon pad will be used for decontamination of all equipment, but that the decon water collected in the sump can be discharged onto the ground near the sump. Tom said he believes that some division of the state government would have authority over the discharge of decon water to the sanitary sewer, and therefore, if we decide that the water should go to the sewer, some approval from the state would probably be necessary, even if the MWCC does not have jurisdiction or any problems with this.

5. Tom said he has no more news about access agreements to the off-NIROP property. He said he talked to Chuck Troia today about access onto the BNRR property. They still have no word on this, although they do have some type of draft agreement from the BNRR. He said he will be meeting with Chuck Troia this afternoon to discuss the access agreement for this property. I mentioned that the work needed on the railroad property now consists of the new monitoring well 23-S located on the east side of the railroad tracks, and the soil gas testing located in the grassy area to the east of the tracks near the manufacturing companies along Main Street. I emphasized the importance of obtaining these final access agreements as soon as possible, since we have crews in the field now and the lack of final agreements can substantially impact the field work schedule.

dls

CONFIRMATION NOTICE # 197

RMT Project # 1332
Contract #DACA 45-86-C-0015

1 of 1

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332.

~~To~~ From: Tom Thiele

(Affiliation) COE.

(Phone No.) —

By: (Your Name) E. Gredell Date: 11-5-87 Time: 3:30PM ±

PURPOSE: (Describe Reason For Call)
- Status of access agreements.

COMMENTS: (Briefly Summarize Discussion)
- He said he will send me a letter stating that the COE has valid access agreements with all the owners of property where work is to be done. The letter will indicate that the agreements apply to RMT & its subcontractors, and will specify any special provisions re: site restoration, entry hours or procedures, restrictions, etc. He'll send this by telecopy ASAP. I said that RMT cannot begin work on the off-NIROP properties until we receive this letter, as a minimum.
- I told him I intend to call the MPCA, & gave him a list of the topics to be covered. Tom said it was OK. to call them.

ACTION NEEDED:

CONFIRMATION NOTICE # 205

RMT Proj. # 1332
Contract #DACA 45-86-C-0015

1 of 2

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332

~~To~~ From: Tom Thiele (returned my call)

(Affiliation) COE

(Phone No.) —

By: (Your Name) E. Gredell Date: 11-9-87 Time: 4:20PM.

PURPOSE: (Describe Reason For Call)
Access permission status

COMMENTS: (Briefly Summarize Discussion)
- He said he contacted Maxwell Graphics; they gave permissi for RMT to do the work on their property. We should contac Daniel Thornton at 612-571-1865 to give him a description of the work.
- He also received permission from the Anoka County Park Commission. We should contact either Tom Mresen or Dave Tornildson (his supervisor) to arrange a time for our Site Coordinator to meet one of these people at the si of the proposed work, to give them a description of the work. Their phone # is 612-757-3920.
- He has sent a letter to the BNRR requesting access permission. However, BNRR has not responded yet.

ACTION NEEDED:

Call from T. Thiele
11-9-87.

- He said he believes the City owns the property to the north of the plant, across the northern access road. He said the COE has a current valid Right of Access agreement w/ the City, which would apply to RMT & our subs as well. He will check for the name of someone to contact at the City to confirm this.

RMT INC

INTEROFFICE MEMORANDUM

DATE: November 12, 1987

CONFIRMATION NOTICE # 206

TO: Project Files

RMT Project # 1332
Contract: DACA 45-86-C-0015

FROM: E. Gredell E.G.

RE: COE-NIROP Fridley
RMT Project #1332

SUBJECT: Phone Call from Tom Thiele of the COE on November 9, 1987, 4:20 p.m.

Tom returned my call of earlier today.

He said the printing company, Maxwell Graphics, told him it was alright for RMT to enter their property to do the proposed work. Tom said that our site coordinator should contact Daniel Thornton at the plant to arrange a time to meet with him to present a description of work to be done and to shown him the general area of the work. His phone number is 612-571-1865. Tom also spoke with the Anoka County Park Commission. They told Tom that it was alright for RMT to do the work on the County property. They also requested that the RMT site coordinator meet with one of their representatives on the site of the proposed work to describe the work to them. Our site coordinator should contact Tom Miesen at 612-757-3920 to arrange for this meeting. If we have difficulties which Mr. Miesen cannot resolve, we should contact David Torkildson at the same phone number to discuss these problems.

Tom said he sent a letter to the Burlington Northern Railroad regarding requests for access permission. However, he has not yet received any word. He has not talked with David Seep since my phone conversation with Mr. Seep last week. I stressed the importance of resolving access permission for the work proposed on the railroad site.

I asked if Tom had confirmed the name of the owner of the property immediately north of the plant. Tom said he believes the City owns this property, and that the COE has a valid right-of-access agreement. Tom said he will check into this further, and give us the name of a person we should contact at the City to discuss access to this property. I again emphasized the need to resolve all of the access authorization issues as soon as possible.

tfr

cc: RMT field office 11-17-87

1332.10 139:TFR:-rmt7

RMT INC

INTEROFFICE MEMORANDUM

CONFIRMATION NOTICE # 207

PROJECT # 1332

Contract #DACA 45-86-C-0015

DATE: November 11, 1987

TO: Project Files

FROM: E. Gredell E.G.

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Conference Call to Tom Thiele and Kevin Coats of the COE November 9, 1987, 4:30 p.m. with Bob Stanforth, Keith Bandt, and Eric Gredell

Bob Stanforth reviewed the purpose of the Phase I Soil Gas Testing Program, and the results of the work done last week. He said at two of the sample points, two methods of soil gas sampling were compared: the first method used a stainless steel probe with soil gas pulled into a Tedlar bag, and the second method used a hand-augered soil sample. For both methods, the field GC was used for analysis of soil gas. Bob said that one of these sample points had easily detectable concentrations of volatile compounds. Both the probe and the augered sampling methods gave comparable results with the field GC.

Bob said there were two sample points found where the soil was so "tight" that there was insufficient vacuum to pull a gas sample. He recommended that in similar soils, the hand-auger and testing of soil headspace should be the alternate sampling method used. He also recommended that the probe and Tedlar bag method be used as the primary sampling procedure.

Bob said the highest concentrations were detected over trench 6, with total VOC levels greater than 100 ppm. He said over trench 6, both TCE and DCE were detected in soil head space gas. This indicated that the soil may actually be contaminated with VOCs at the depths sampled.

Bob said that for Phase II, a specific grid sampling pattern would be set up. We would also interpret the data from the soil gas program "semi-quantitatively." Kevin Coats agreed with this. Kevin also requested that we continue to consider the final use of the data when outlining our procedures and sampling grid for Phase II. Eric Gredell reviewed a list of the various purposes for the data collected from the soil gas program.

Bob reviewed our comparison of use of the HNU with the Photovac GC. He said we found a significant difference in the results using these two instruments. The HNU did not have the precision, accuracy, or ease of operation of the field GC. We also found that the sampling method using the Tedlar bag worked better than the soil headspace method. Kevin Coats said that the COE has also found this to be true from their other project work. Everyone agreed that the use of the field GC takes longer than the HNU. However, it was also agreed that the quality of the results with the GC was much preferable.

We briefly discussed the scope of the Phase II program which can still be accomplished in the remaining budgeted field time. Eric Gredell noted that now that we have some field experience with the different sampling methods and GC use, we will update our estimates of the number of sample points and overall scope of the sampling and testing program which we can accomplish with the originally intended level of effort. Kevin Coats said he would like to have our estimate of what we can accomplish under Phase II.

Kevin Coats said he is still concerned that RMT should have a clear understanding of the objectives of the entire soil gas program and specifics regarding how the data will be used in our investigation. It was agreed that RMT will proceed to Phase II of the soil gas program using the probe and Tedlar bag sampling method with the GC as the primary procedure. Hand augering of soil samples and testing of soil headspace with the GC will be the alternate procedure. It was agreed that RMT will provide more frequent updates of Phase II progress during the work for the COE's benefit in assessing the progress and results of the work.

tfr

cc: RMT field office 11-17-87.

RMT INC

INTEROFFICE MEMORANDUM

DATE: November 10, 1987

CONFIRMATION NOTICE # 211

TO: Project Files

NIROP FUTC
RMT Project # 1332
Contract #DACA 45-86-C-0015

FROM: E. Gredell EG

Re: COE-NIROP-Fridley
Project #1332

SUBJECT: Phone Call from Tom Thiele of the COE on November 10, 1987, 3:05 p.m.

Tom asked if we had received the list of personnel from Layne-Northwest. I said we received a list by telecopy late yesterday, however, the information was incomplete. I told him I had talked with Layne-Northwest this morning and they are completing the information we need as a top priority. Tom said we should telecopy this list to him as soon as possible. He must receive the list tomorrow to have sufficient time to allow the Navy to prepare the access clearances for Layne's people to arrive at the site on November 16.

He said the COE is on holiday tomorrow, and he will be out of the office on Thursday and Friday this week. He has made arrangements for someone else in their office to send the information on Layne's personnel to the Navy on Thursday, November 12. I should still address the telecopy transmission to his attention.

He said that David Smith told him that he needs a schedule for issuing a draft and final FS Report. I told Tom that our preferred schedule is currently to issue the draft report on December 21. Tom said that this date may cause the Navy some problems. He said he will attempt to call Dave Smith early Thursday morning and try to get back to me as soon as he talks to Dave. He said that if I do not hear from him by 9:00 a.m. on November 12, I should proceed to call Dave and discuss the schedule for the FS Report with him.

I said from my review of phone memos, I found that the subject of testing the off-NIROP drill cuttings with an HNU meter came from our phone conversation on October 8. I said that my phone memo indicates that he had talked with Kevin Coats and Tomiann McDaniel's supervisor regarding their comments on the draft QC Plan. These reviewers had told Tom that they thought the continuous monitoring of the drill cuttings on off-NIROP drill sites was preferred. Tom said that because of our subsequent conversations with Kevin Coats, this is no longer a requirement. We do not need to monitor the drill cuttings as they are produced at the off-NIROP drill sites.

All of the COE review comments on the FS 11 Report are presently in typing. We may not receive these until next week due to Tom's absence from the office this week. I told him that Mark Lahtinen told me the MPCA should have comments submitted to the COE this week. Tom said he believes all of the COE review comments on the draft Health and Safety Plan are also in typing. He said we should consider that the COE review comments on the draft QC Plan which we have received are their final comments. I told him I have a draft of our responses to their QC Plan review comments nearly ready to send.

1332.30 926:TRF:-rmt32

I said that before RMT or our Subs can enter the other properties to begin work, we still need to receive a letter from the COE stating that the COE has valid access agreements with all of the individual property owners and that these agreements would apply to work done by RMT and our subcontractors. I mentioned that of particular importance are the properties owned by the city immediately north of the plant and the parkway commission for the soil gas background work. Tom said he would telecopy this letter to me as soon as possible. He still has no word on access arrangements with the Burlington Northern Railroad.

tfr

cc: RMT field office 11-16-87

1332.30 926:TRF:-rmt32

cc: Records
TEG
RMT Field office

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332

CONFIRMATION NOTICE # 221

NIROP III/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

~~To~~ From: T. Thiele

(Affiliation) COE

(Phone No.) —

By: (Your Name) K. Bandt

Date: 11-13-87

Time: ~ 10:30 and 11:00 am (2 calls)

PURPOSE: (Describe Reason For Call)

Discuss access approvals and drill techniques.

COMMENTS: (Briefly Summarize Discussion)

Daniel Thornton @ 612-571-1865.

- Only necessary to contact Midwest Printing (Maxwell Graphics) by phone to inform them when we expect to access their property and what we intend to do. If we can't contact him in a timely manner, access property as necessary to perform our work. These guidelines also apply to Anoka County Park property (Phone contacts: Tom Miesen @ 612-757-3920 (or Dave Torkildson - Supervisor)). However, Tom Miesen is in radio contact with his office and so it should be easy to arrange for him to meet in the field.
- Problem with the "city-owned property" north of the plant. City only really owns 11 feet on each side of the road — Burlington Northern Railroad owns the rest. Tom just found this out now while talking with the city engineer (John Flora; 612-571-3450). We have not yet received access approval for any railroad property.

~~ACTION NEEDED~~

RMT, INC.
PHONE CALL FILE MEMO
F-59 (R4-84:D64)

File Correspondence
Project 1332

To/From: T. Thiele (Cont.)

(Affiliation)

(Phone No.)

By: (Your Name) K. Bandt Date: 11-13-87 Time: 10:30 and 11:00 am (2 calls)

PURPOSE: (Describe Reason For Call)

COMMENTS: (Briefly Summarize Discussion)

- I discussed the oversight regarding deep well construction — that these wells should be 4" instead of 2", according to CoE specs. Tom thought that 4" wells were specified to facilitate sampling equipment. I also mentioned that we will be seeking approval to weld 4" casing instead of using couplings. Tom said we would need to talk to Tomiann about each of these issues.
- Tom thought that we could proceed with hollow-stem augen drill techniques without checking with Tomiann, since it's an "accepted" and preferred CoE technique. He also approved cable-tool methods, but was surprised that "mud rotary" techniques were apparently used on-site in the past. We need to talk to Tomiann first about mud-rotary if we intend to use it.

~~ACTION NEEDED~~: We should talk with Tomiann on Monday.

RMT INC

INTEROFFICE MEMORANDUM

1 of 3

CONFIRMATION NOTICE # 228

NIROP RI/FS
RMT Project #1332
Contract #DACA 45-86-C-0016

DATE: November 16, 1987

TO: Project File

FROM: Eric Gredell E.G.

RE: COE-NIROP-Fridley
RMT Project #1332

c: Records
TEG
RMT Field Office

SUBJECT: Phone call to Tomiann McDaniel and Tom Thiele of the COE on November 16, 1987, 10:30 a.m. with K. Bandt and B. Rehm

We explained that in discussing field coordination details with our driller last week, we discovered that there was an oversight in our proposal regarding the diameter for the five deep wells. We explained that our proposal included 2-inch diameter deep wells, whereas the COE scope indicated 4-inch wells. We asked if it would be acceptable to install 2-inch diameter wells for these five deep wells. Tomiann said this was not acceptable. Her primary reason was that the COE believes the 4-inch size is needed to facilitate well development and purging using the 4-inch submersible pump which the COE has at the NIROP.

We said that our driller is now recommending use of augered well installation methods rather than water-rotary. We asked if the COE would accept hollow-stem auger techniques. Tomiann pointed out that the COE originally intended to use hollow-stem auger. However, RMT recommended use of water-rotary methods. Therefore, she said she has a problem with allowing us to use the auger method at this time.

We pointed out that our driller is doubtful that a 4-inch diameter well can be installed using the water-rotary technique because the method would require an overshot casing which would be too big to get sufficient return flow of the drilling water. We mentioned that to get sufficient flow, Layne-Northwest would have to use an Ingersoll-Rand rig, but this rig does not have split-spoon sampling capability. To provide the split-spoon capability, Layne would have to use their CME 750 rig. However, the CME rig does not have a pump of sufficient capacity for the water-rotary method for these deep 4-inch wells.

It was agreed that RMT would be allowed to install 3-inch diameter wells for the five deep monitoring wells, provided that RMT supplies a pump to the COE to fit these wells, and the pump should be capable of delivering approximately 20 gpm. If we use hollow-stem augers, the COE said they expect a credit to adjust the contract amount because the hollow-stem method should be cheaper than the water-rotary method as proposed. RMT will discuss this with Layne-Northwest and call Tom Thiele to discuss further.

RMT mentioned that the new 3-inch pump could be used for development of all of the 3-inch and larger wells to be installed. We also noted that the CME rig could be used with hollow-stem augers with 6-1/4 inch I.D. casing. For the bedrock well, we said that the driller will use a pilot boring to sample the soils. Tomiann said that this technique could be used for all of the wells.

1332.31 926:TFR:-rmt9

Tomiann also pointed out that we should expect lots of heaving sands to come up through the hollow stems. We noted that this would be compensated for by keeping a sufficient head of water on the borehole. We pointed out that Layne-Northwest would use their CME rig only if they are installing 2-inch wells with water-rotary methods. The problem would arise only if the 4-inch size wells are required using the water-rotary method.

For the bedrock well, Tomiann said that it was all right to use mud to set the 8-inch casing pipe inside the 12-inch borehole. We noted that the 8-inch casing would be cemented five feet into the rock.

Tomiann said she expects that centralizers would be used on all wells, not just the deep wells.

Tomiann said it is alright to use a 300-pound hammer for the split-spoons. She said we can also use a 3-inch diameter split-spoon if desired.

We discussed the possibility of using the field GC for screening tests of the sample from well 23-S, if this would allow us to get the pumping test at AT-1 back on schedule. Tomiann questioned the detection limits of the field GC for this purpose. We mentioned that the general detection limit is 5 to 10 parts per billion. It was agreed that this detection limit and use of the field GC would probably be acceptable, provided a lab analysis of the ground water sample be conducted eventually for confirmation of the GC results. It was agreed that Tom will discuss this with Kevin Coats. If Kevin has no objections, then the general approach of using the field GC for this screening purpose for the sample from well 23-S is acceptable to the COE. We said we will defer the decision on using the field GC versus use of the RMT laboratory for the screening test until the field schedule is more definite. We will keep the COE advised of the schedule, and discuss this again with them before deciding to use the GC or the RMT Laboratory. We pointed out that much of the decision regarding the field schedule depends on when we will receive access permission from the Burlington Northern Railroad.

Regarding access permission from the railroad, Tom said he tried to call David Seep of the railroad on November 13, and twice today. However, he has not been able to contact Mr. Seep.

Tomiann said she was intending to go to the NIROP on November 18. However, due to the uncertainty in the field schedule, she will wait to schedule her visit until the drilling schedule is more clear. We will keep her advised of the schedule as it develops.

I mentioned that FMC had supposedly completed a hydraulic flow test of the sanitary sewers which would receive the pump test discharge. However, I mentioned that we have not yet received any word from FMC or Mel Vojvodich regarding the results of these tests. Therefore, I suggested that we assume that FMC will not be able to accept the discharge into their sanitary sewers

inside the plant, and that we should finalize plans to route the discharge all the way from the pumps to the sanitary sewer main on the south side of the plant. I noted that this may require discharge of the water downstream of the FMC main flow meter. I noted that we will install flow monitoring instruments on each pump so that a record of the discharged volume can be provided to FMC. I mentioned that two techniques for routing the discharge water being considered Layne-Northwest were to use fire hoses or irrigation pipe from the pump to the sanitary sewer. I pointed out that irrigation pipe would probably not have water-tight joints, and that some leakage from the pipe onto the pavement or grass areas was possible. Tom said there should be no problem related to leakage of the ground water other than the possible freezing of the water on pavement. He said we should take measures to avoid laying joints across doorways or on the pavement as much as possible. I pointed out that the inability of FMC to accept the discharge water in the sewer laterals inside the plant as originally planned would require additional labor and materials. I noted that in our proposal, we had assumed only 250 or 300 feet distance from the pump locations to the discharge points in the sanitary sewer. I said we will prepare some estimates of the additional labor and material costs and provide these to Tom.

Tom said all of the personnel information from Layne had been sent to the Navy for access clearances for their personnel. We asked if it was possible to have all of the Layne personnel included on the master computer list maintained at the guard station so that any of Layne's personnel could enter or leave the plant without potential delays due to access clearance requirements. Tom said it was not possible to list all 20 or 25 of Layne's personnel on the daily list which the security guard maintains. However, he said it may be possible to have all Layne's personnel on a central list, and we would only have to provide a list of specific personnel to be at the plant only one or two days in advance. We mentioned that this request is being made in an attempt to eliminate stand-by time due to access delays. Tom said he will check with Ed Larson at the NIROP regarding allowable procedures. Tom said that normally Mr. Larson needs a list of personnel to be at the plant the following day by 2:00 p.m. on the day before.

tfr

RMT INC

INTEROFFICE MEMORANDUM

CONFIRMATION NOTICE # 230

NIROP RI/FS
RMT Project # 1332
Contract #DACA 45-86-C-0015

DATE: November 18, 1987

TO: Project File

FROM: Eric Gredell E.G.

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Phone call from Tom Thiele of the COE on November 16, 1987, 2:20 p.m.

He said he had just talked with David Seep of the Burlington Northern Railroad. Mr. Seep had sent a letter to Tom which included a map of their property line in the area of our proposed work on the railroad property. Tom said that in the strip of land between the eastern access road along the railroad tracks and Main Street, near the railroad crossing gate testing building, the BNRR owns the property from the railroad tracks all the way to the east to Main Street. However, farther to the north, the BNRR does not own much of the land to the east of the tracks. Tom said he would have to wait to see the map which he should receive from David Seep to tell whether the railroad owns the property we have proposed for the remaining soil gas testing.

He said David Seep mentioned that he will recommend to the railroad management that they give us permission to do the proposed work. However, it is not known how long it will take to get this permission. Tom said he would ask the COE's lawyer to call the BNRR to find out how long this will take.

Tom said he had mentioned the property immediately north of the NIROP near well 16-S to Mr. Seep. Tom told Mr. Seep that it is the COE's current understanding the the BNRR owns this property, and that the City owns only an 11-foot wide easement along the road in this area. Mr. Seep told Tom that if the BNRR does own this property, they would need an additional letter from the COE describing this area in more detail and also the proposed work. However, Mr. Seep said he would include this area in his recommendations to their management for granting us access permission.

Tom mentioned that Layne-Northwest could possibly get into the plant tomorrow if they can provide him with the list of specific personnel and equipment which would be at the plant. He said he needs to call Ed Larson at the NIROP by 2:00 p.m. in order to have the clearances processed in time for work to start the following morning. I said I would get back to him if I can get this information from Layne-Northwest.

tfr

1332.31 926:TFR:-rmt20

CONFIDENTIAL 240

NIROP MEMO
RMT Project #1332
Contract #DACA 45-86-C-0015

DATE: November 30, 1987

TO: Project File

FROM: Eric Gredell EG

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Phone call to Tom Thiele of the COE on November 19, 1987, 3:15 p.m.

We reviewed the maps which I had telecopied to Tom yesterday showing the initial preliminary results of the soil pore gas testing. I also gave Tom a summary of the results of the soil gas work to date. I mentioned that sampling for Phase I of the soil gas work was conducted on November 3, 4, 5, 6, and 9. I said that samples under Phase II had been collected on November 10, 11, 12, 13, 16, 17, and 18. I said that we also expect to continue sampling today and on November 20. I noted that for Phase I, we were able to collect 20 samples, over a period of 5 working days. I noted that a total of 9 working days would have been spent on Phase II through November 20, and that during this period we estimate that a total of 84 samples will be collected.

I described two options available for completion of Phase II of the soil gas testing. The first option would be to have our field people return to Madison tomorrow evening, and leave the GC set up at the NIROP. We would then send the soil gas testing team back to the NIROP during the week of November 30, and hopefully by that time we will have access permission from the Burlington Northern Railroad. The other option is to have our field people remain in Fridley over this weekend and complete the Phase II work on Monday through Wednesday next week. We would then pack up the GC and return all the soil gas testing equipment to Madison on Wednesday, November 25, and this would complete the Phase II soil gas work.

Tom said he still has no access permission from the BNRR. He has not received the property maps from David Seep of the BNRR which Mr. Seep had told him were in the mail. Tom said he has found that the property to the north of the NIROP near well 16-S is managed by Glacier Park Development Company, a real estate development subsidiary of BNRR. He said that Mr. Tom Patnode is supposedly the contact for the BNRR related to this property; however, Tom said he has been unable to reach Mr. Patnode. Tom said he would talk to Mr. Chuck Troia, the COE's lawyer, and ask him to check on the status of the access permission and the property maps. Tom said he is doubtful that we will have access permission from the BNRR even by the week of November 30. I mentioned that our driller now estimates that they will be at the plant on November 30. I explained that they were not able to mobilize this week or next week due to difficulties with staff and equipment availability. However, I noted that our driller still expects that the drilling can be completed before Christmas.

Tom asked me to call him at 8:30 a.m. tomorrow for his decision regarding whether to complete the soil gas work next week or during the week of November 30.

1332.31 926:TFR:-rmt28

I suggested that the COE consider asking the BNRR if it is possible to eliminate some of the red tape and delays regarding access clearance by having one of their representatives accompany our people on the railroad property to conduct only the soil gas testing work initially. The formal agreements related to the new monitoring well on the railroad property could then follow. Tom said he would suggest this to Chuck Troia.

kjw

cc: RMT Site Coordinator

1332.31 926:TFR:-rmt28

CONFIRMATION NOTICE 245

RMT 1332
Contract #DACA 45-86-C-0015

DATE: November 30, 1987

TO: Project File

FROM: Eric Gredell TEG

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Phone call from Tom Thiele of the COE on November 20, 1987, 11:00 a.m.

I told him I had tried to call this morning as we agreed yesterday, but there was no answer. He said this was because the phones in their office had been disconnected due to the office move going on today.

He said he still has received no word regarding access permission from the Burlington Northern Railroad. He said he is doubtful that we would receive access permission even next week. He said he will call David Seep of the BNRR to ask whether they would consider allowing RMT to conduct only the soil gas sampling initially, and follow up later with the agreements related to the new monitoring well. Tom said he would discuss this with Mr. Seep. He will call me back as soon as possible to give me instructions on completion of the soil gas program.

kjw

cc: RMT Site Coordinator

1332.31 926:TFR:-rmt29

CONFIRMATION NOTICE # 244

RMT Project # 1332
Contract #DACA 45-86-C-0015

DATE: November 30, 1987

TO: Project File

FROM: Eric Gredell EG

RE: COE-NIROP-Fridley
RMT Project #1332

SUBJECT: Phone call from Tom Thiele of the COE on November 20, 1987, 11:45 a.m.

He said he had talked to someone in their real estate department this morning regarding work on the Burlington Northern Railroad property. He was told that the COE will not allow RMT to go onto the BNRR property without a signed access agreement. Tom said he has little hope that we would be able to get onto the railroad property even during the week of November 30. Therefore, Tom said we should plan on completing Phase II of the soil gas sampling program next week. I told him that we would have our field crew stay in Fridley over this weekend and continue the sampling on Monday through Wednesday next week. I told him that we would pack up the field GC on Wednesday and return it to Madison.

I mentioned that soil gas samples collected yesterday in the strip of land between the new building in the north forty area and the northern perimeter fence showed very high readings on the HNU meter, and the samples also cause the GC to go off scale, requiring much smaller subsamples to be run to obtain a measurable value. I said we have a sampling plan laid out for next week which has the objective of defining the boundaries of contamination around the various "hot" areas we have detected so far. Tom said this approach would be acceptable for completing the soil gas work. I told him that the few samples we had collected across the road at the north end of the plant near well 16-S showed only minimal contamination.

Tom asked if it would be possible to collect soil gas samples in Tedlar bags later, when we are installing the monitoring well on the BNRR property. He asked if the samples could be shipped to our office in Madison for analysis. I said that I thought this was possible, but I would need to check with our chemist. Tom said we could discuss this again later. He also asked if we could leave the soil gas sampling equipment at the NIROP for possible use later. I said I would check into this.

He said they are moving into their new office building today. His new temporary phone number is 402-341-1575.

kjw

cc: RMT Site Coordinator

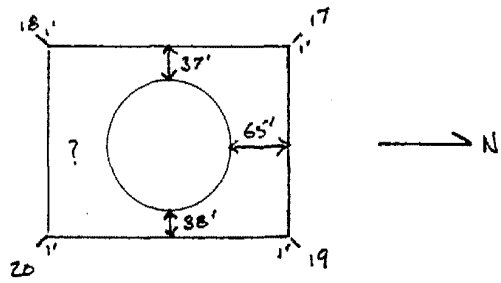
1332.31 926:TFR:-rmt33

APPENDIX C

ACTUAL SITE LOCATION DESCRIPTIONS USING LANDMARKS AT THE NIROP SITE

APPENDIX C

Sample Number SG-	Location Description
3.	75' W of well 10S & 25" S OF 10S
4.	50' E (60°) of fence & 75' S of 3
5.	88.9' N of 6D; 1' E of fence
6.	72' W of building garage door *83 (north end) 56' S of 10S
7.	200' S of building edge (10S), 25.2' W of fire hydrant (270°)
8.	60'N of substation 5 (mid center), 21.1' W of building; 35.6' S from corner of building
9.	64.8' S of SE corner of building & 243.3' W of SE corner
10.	64.8' S of SE corner of building & 204.1' W of SE corner
11.	64.8' S of SE corner of building & 184.3' W of SE corner
12.	62.8' S of SE corner of building & 164.6' W of SE corner
13.	64.8' S of SE corner of building & 140.3' W of SE corner
14.	87.1' S of SE corner of building & 243.8' W of SE corner
15.	87.1' S of SE corner of building & 215.5' W of SE corner
16.	91.1' S of SE corner of building & 175.5' W of SE corner

Sample Number SG-	Location Description
17.	
18.	
19.	SEE DRAWING 
20.	
21.	52.1' N of NE corner of building; 14.5' E of NE corner of building
22.	25' E of building' 125' S of 9S; 8.7' E of 9S
23.	50' S of edge of road & approximately 23' W of NH_3 tank
24.	Not measured
25.	188' W of SE corner of building; 48.7' S of building
26.	146.1' W of SE corner of building; 50.6' S of building
27.	64.8' S of SE corner of building; 115.3' W of SE corner
28.	95.1' S of SE corner of building; 145.7' W of SE corner
29.	80.5' S of SW corner of building; 22.7' W of SE corner
30.	14.8' E of fence; 96.6 N of S end of fence
31.	87.2' S of SW corner of building; 134.2' E of SW corner of building
32.	128' W of 7
33.	40' N of building; 6" S of fence
34.	1.45' from SW corner of decon pad
35.	0.90' N of south fence; 2.75' E of corner of fence
36.	1.9' from SE corner of decon pad

Sample Number SG-	Location Description
37.	77.1' W & 31' from SW corner of building by propane tanks
38.	9.8' N of center of RR tracks; 155.3' N of south fence
39.	Not measured
40.	12.5' due N of S fence; 5.5' W of S fence entrance
41.	18.3' N of center of RR tracks; 163.8' W of E fence
42.	10' N of center of RR tracks; 110.2' W of E fence
43.	13.2' N of center of RR tracks (in line with switch); 57.4' W of E fence
44.	6.1' S of fence and 55.1' E of fence entrance
45.	24.1' W from building garage door #83 (N end)
46.	46.8' W from building garage door #83 (N end)
47.	30.8' W of fire hydrant; 60.3' W of building
48.	11' S of haz. waste storage building & 21' W of SW corner
49.	No sample collected
50.	No sample collected
51.	No sample collected
52.	8' N of road edge
53.	No sample collected
54.	No sample collected
55.	No sample collected
56.	9' N from edge of road & approximately 100' E of SG-52
57.	No sample collected

Sample Number SG-	Location Description
58.	No sample collected
59.	No sample collected
60.	8' N of edge of road; 100' W of SG-64 & 2' E of 16S
61.	No sample collected
62.	No sample collected
63.	No sample collected
64.	8' of N edge of road & 100' W of SG-68
65.	300' N of SG-68
66.	200' N of SG-68
67.	100' N of SG-68
68.	8' from curb where curb begins to bend
69.	200' NNW of 8S
70.	15.6' E of center RR tracks; 90.8' N of S fence
71.	88.1' N of S fence (356°) & 108' W of 70
72.	100' N of S fence & approximately 75' E of SG-71
73.	1.65' N of building & 113.4' from W end of building
74.	9.6' N of center of RR tracks; 164.1' S of propane tank post
75.	9.4' N of center of RR tracks; 125.3' N of S fence
76.	6.4' N of center of RR tracks; 137.5 S of 1D
77.	No sample collected
78.	No sample collected
79.	136' S of SE corner of building & 97.5' W

Sample Number SG-	Location Description
80.	95.1' S of SE corner of building & 64.2' W
81.	136' S of SE corner of building & 44.5' W
82.	136' S of SE corner of building & 66.5' W
83.	9.6' N of center of RR tracks (340°), 40' S of 81
84.	Approximately 100' W of SG-86
85.	Approximately 100' S of SG-84
86.	Approximately 28' W of road edge in line with speed limit sign
87.	Approximately 100' S of SG-86
88.	2' N of NW corner of decon pad & 2' E
89.	33' E of NW corner of decon pad & 2' N
90.	33' E of SW corner of decon pad & 2'S
91.	3' S of NE corner of decon pad & 2.5' E
92.	4.5' from SE corner of sump pit (decon pad) & 2' E
93.	4' S of NE corner of decon pad & 25' E
94.	15' E of SE corner of sump pit
95.	15' E of SE corner of decon pad
96.	42' S of SE corner of decon pad
97.	208.1' W of SE corner of building; 49.5' S of building
98.	188.0' W of SE corner of building; 37.3' S of building
99.	167.4' W of SE corner of building' 37.3' S of building
100.	168' W of SE corner of building; 49.6' S of building

Sample Number SG-	Location Description
118.	208' W of SE corner of building & 28' S of building
119.	213' W of SE corner of building & 107' S of building
120.	215' W of SE corner of building & 135' S of building
121.	36' S of building & 118' W of SE corner of building
122.	No Sample
123.	84' S of building & 115' W of SE corner of building
124.	93' W of SE corner of building; 36' S of building
125.	53' S of building & 95' W of SE corner of building
126.	65' S of building & 95' W of SE corner of building
127.	81.5' S of building & 95' W of SE corner of building
128.	208' W of SE corner of building & 8' S of building
129.	188' W of SE corner of building & 8' S of building
130.	167' W of SE corner of building & 8' S of building
131.	146' W of SE corner of building & 8' S of building
132.	No Sample
133.	30' E of 7S & 43' N of building
134.	30' E of SG-133 & 43' N of building

Dimensions of New Building in "North 40"

Approximately 670' long x approximately 60' wide

Located 42.5' S of (N) fence (NE corner), and 135' E of W fence

SE Corner Building is 26.5' west and 28.5' north of NW corner of decontamination pad.

APPENDIX D

DAILY QUALITY CONTROL REPORTS FOR PORE GAS SAMPLING PERIOD NOVEMBER 2-25, 1987

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 2, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of sixtyseven degrees F., cloudy, foggy, light drizzle and no wind.

WORK PERFORMED:
Traveled to site. Met with Mel Vojvodich to pick up key for GC room and to get additional utility maps. Located and staked the following soil gas sampling locations: SG-4, -5, -6, -7, and SG-8. Unloaded and set-up GC and its equipment.

SAMPLING PERFORMED:
No sampling was performed.

FIELD ANALYSIS PERFORMED:
No field analysis was performed.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
Unable to locate soil gas sampling locations SG-17 thru SG-20. The TCE tank used as a reference point is actually a TCA [1,1,1-trichloroethane] tank.

Need to verify Area 3 sampling locations with PM.

QUALITY CONTROL ACTIVITIES INITIATED:
None.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 3, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of sixtyfour degrees F., cloudy, light fog, intermittent drizzle. Late afternoon (1600 HRS) rain became light showers and there was a light breeze.

WORK PERFORMED:
Located and staked soil gas sampling locations (SG-9 thru SG-16) in Area 2. Also located and staked the soil gas sampling locations (SG-17 thru SG-20) in Area 3. I met with Paul VanBrunt of FMC and Tom Oman of FMC to locate and verify locations of the various utilities. It was determined that SG-4 and SG-8 would need to be relocated because of underground utilities. Three to four feet east would be sufficient. Location SG-7 is located on the future

SAMPLING PERFORMED:
A sample at SG-19 was collected for headspace analysis.

FIELD ANALYSIS PERFORMED:
HNU readings at bottom of SG-19 were taken. The sample collected at SG-19 was analyzed with the field GC.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
There were no problems encountered.

QUALITY CONTROL ACTIVITIES INITIATED:
None

Site Coordinator Signature: _____

DATE: November 3, 1987 AUTHOR: Catherine A. Kwiatkowski

WORK PERFORMED (cont.) site of a tool utility shed. Construction of this area is to begin in about 2-3 weeks. The question of whether or not this sampling location (SG-7) should be moved to allow future sampling at that location should be addressed.

The office trailer arrived at about 1200 HRS. The remainder of the sampling equipment was unloaded from the truck into the trailer. I was unable to get in touch with the onsite telephone representative to arrange for hookup of phone service into the office trailer.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 4,1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of fiftythree degrees F., mostly sunny, no precipitation, winds 23mph gusting to 33mph.

WORK PERFORMED:
Soil gas samples were collected and analyzed on six samples. Pictures were taken of field staff (CAK, GLW, and RRS) so that FMC badges could be issued. This will eliminate daily signing in at the guard gate. Decon equipment was set up at the Decon pad so soil gas sampling equip. could be washed. The field GC was set up and calibrated and standards were run.

SAMPLING PERFORMED:
Soil gas samples were collected at SG-17, SG-18, SG-20, SG-3, SG-4, and SG-5.

FIELD ANALYSIS PERFORMED:
Headspace analysis was performed on soil samples collected at SG-17, SG-18, SG-20, and SG-3. Field GC analysis was performed on all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
Attempted to collect sample at SG-7 without success. Sampler could not get enough of a vacuum in the sample to pull gas. The soil appeared to be very tight (possibly clay). Suggestion was made by RRS that possibly a (cont.)

QUALITY CONTROL ACTIVITIES INITIATED:

Site Coordinator Signature: _____

DATE: November 4, 1987 AUTHOR: Catherine A. Kwiatkowski

PROBLEMS ENCOUNTERED (cont) soil boring sample would be more appropriate at this particular location.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 5, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of fortythree degrees F., clear, sunny, winds ou of the west @ 6-10 mph

WORK PERFORMED:
Field GC was calibrated and standards were run. Soil pore gas sampling was performed and soil borings were taken for headspace analysis. Air monitoring was performed by Chris Hansen of RMT. Keith Bandt of RMT talked with Bill Gould of Collins Electric about contract needs and requirements necessary to hookup power to the RMT office trailer and the drillers trailer. Power should be available by 11/11/87. Talked with phone (cont)

SAMPLING PERFORMED:
Samples points that were sampled are as follows: SG-18, SG-9, SG-11, SG-10. Air monitoring and air samples were taken be CH. HNU readings were taken at the beginning of the day and at each sampling location. Personal air monitoring was also done.

FIELD ANALYSIS PERFORMED:
Borings were done at SG-18 and SG-11. Gas probe sampling was performed at SG-9, SG-11, and SG-10.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
Rocks and/or dense gravel was encountered at SG-9, SG-11 (boring), and SG-10. By moving the sample location by about 1 ft. enabled us to take the samples.

QUALITY CONTROL ACTIVITIES INITIATED:
Replicate boring samples were taken at SG-18. Replicate probe sampling was done at SG-18 and SG-9.

Site Coordinator Signature: _____

DATE: November 5, 1987 AUTHOR: Catherine A. Kwiatkowski

WORK PERFORMED (cont.) rep at NAVPRO about establishing phone service to the office trailer. She referred our request to her supervisor who will call us Friday morning to discuss contractual agreements and setting up service.

I met with Paul VanBrunt (FMC) about cleaning of the decon pad. He agreed to move the barrels, pump out the sump, shovel the sediment out of the sump and to sweep off the pad. He wasn't sure about hosing the pad off. He said they didn't need to keep the water from the sump and have to analyzed.

At 1400 HRS I met with Doug Fullen and Jeff Simak both of FMC at the decon pad to discuss the extent to which the decon pad should be cleared off. Doug pointed out that they never had to test the water from the sump in the past but did analyze the water accumulated at the hazardous waste storage area on the southeast area of the site. There appears to be a miscommunication about which water from where had to be analyzed. We decided to meet Friday at 1300 HRS to discuss where to move the barrels from the decon pad so that they didn't put them in an area we needed to do sampling. KEB and I walked around the site to inspect the areas where well locations problems existed (AT-1, 22s, 23s).

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 6, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of fortythree degrees F., sunny, clear, no precipitation, winds out of the SE @ 6-8mph.

WORK PERFORMED:
KEB and I drove around the outside of the site to locate the offsite well locations and the existing well locations. We also looked at the areas of the Phase II soil gas sampling locations. I called the various utilities to verify the procedures needed to be followed to obtain utility locates. Phone numbers, names, and the companies needed to be contacted are listed in the field book. KEB talked with the general contractor about his assistance and the contractual requirements.
KEB and I met with Doug Fullen, Jeff Slimak, and Jim Johnson to discuss the clearing of the decon pad & the capacity of the sewer laterals to be used during the pump test. Before we met KEB talked with TEG and Tom Thiele about the possibility of not having to decon sampling equipment at the decon pad but to be able to perform this task at the sampling locations. It was decided and approval given to be able to decon at the sampling locations. FMC employees are going to calculate the capacity of the sewer laterals and determine the present flow in these laterals by Monday, 11/9/87. I will call Doug Fullen at 3 pm Monday to find out what they were able to determine. Air sampling was conducted by CH,of RMT. Bob Stanforth, RMT calibrated and operated the field GC and Greg Wiecks performed the soil gas sampling. I observed to refamiliarize myself with the procedure. Proposed onsite monitoring well locations were staked and marked. I need to verify the accuracy of the map from which I took the locations from.

SAMPLING PERFORMED:
Pore gas samples were taken at the following locations: SG-10, SG-12 SG-13, SG-15 and SG-16.

FIELD ANALYSIS PERFORMED:
Monitoring with the HNU was performed at each sampling point. Personal air monitoring equipment was attached to GLW. GC analysis was performed on all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
Dense garavel was encountered at soil gas sampling locations SG-14 and SG-15. Small trenches had to be dug with a pick before the probes could be driven into the soil. These trenches ranged in depth from 6 to 8 inches.

QUALITY CONTROL ACTIVITIES INITIATED:
Duplicate samples were collected at soil gas sampling location SG-13.

Site Coordinator Signature _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 9, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of forty degrees F., sunny, clear, winds out of the NW @ 10-15 mph.

WORK PERFORMED:
Three soil samples not taken week of 11/2/87 were taken today. The remainder of the onsite monitoring well locations were located and staked.

SAMPLING PERFORMED:
A soil pore gas sample was taken at location SG-8. Samples for headspace analysis were taken at locations SG-7 and SG-14.

FIELD ANALYSIS PERFORMED:
Field GC analysis was performed on soil sample locations SG-7, SG-8, and SG-14. Background HNU analysis was performed at each sampling location as well as of the soil before being placed in the sample containers and of the hole augered before putting the soil back in the hole. HNU readings were also taken of each probe before inserting it into the ground to assure cleanliness. HNU readings were also taken from the probe after it was inserted in the ground.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
The sampling location for pore gas sample point SG-8 had to be moved from the location it was moved to on 11/5/87. We attempted 6 probe samples and 3 auger holes in our attempt to sample this location. In all the locations attempted we hit an obstruction at about 2.5 feet. Since we hit obstructions at the same depth at each location it was assumed that there may be part of an old cement slab since there appeared to be old cement walls in the area. We moved that location about 15-20 feet East and were successful at this new location. At location SG-14 we encountered very dense gravel fill like material and had to dig a trench before beginning to auger a hole. The garavel was about 6-8 inches deep. Below the dense gravel was a tight clay material mixed with sand and gravel. It takes some time but this material can be augered through.

QUALITY CONTROL ACTIVITIES INITIATED:
Duplicate samples were taken and analyzed at the following sample locations: SG-7, SG-8, and SG-14.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 10, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of forty degrees F., clear, sunny, no precipitation, winds @ 5-15 mph out of the southwest.

WORK PERFORMED:
Calibrate field GC. Begin to clean tedlar bags. Purchase expendable field supplies to perform soil pore gas sampling. Take additional soil pore gas samples. Attempted to set up appointments with Dan Thornton, Midwest Printing and Tom Miesen, Anoka County Parks to show them the proposed offsite monitoring well and soil pore gas sampling locations that would be on their property. Dan Thornton referred me to Don Ball an engineer at Midwest and Tom Miesen could not be reached today. Tom Miesen can only be reached by radio so I will need to call him again on Thursday since Wednesday is a holiday for state employees.

SAMPLING PERFORMED:
Collected soil pore gas samples at soil gas locations SG-21 and SG-22. Both were collected in duplicate. Verified underground utility locations for these new sampling locations. Took background HNU readings. These soil pore gas sampling locations were based on phnoe conversations between RMT staff and the COE. The results of which were relayed to me through Bob Stanforth of RMT.

FIELD ANALYSIS PERFORMED:
Background HNU readings were taken. GC analysis was performed on samples SG-21 and SG-22 which were both taken in duplicate.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
We also attempted to take soil pore gas samples at locations SG-23 and SG-24. At SG-23 we tried 5 different locations and hit obstructions each time and at SG-24 we tried 3 times and again hit obstructions. The auger method will have to used.

QUALITY CONTROL ACTIVITIES INITIATED:
Duplicate samples were taken at and analyzed at SG-21 and SG-22.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 11, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of fortyeight degrees F., sunny, clear, no precipitation, winds out of the southwest @ 10-15 mph.

WORK PERFORMED:
Calibrated field GC and cleaned and checked Tedlar bags. This process takes two people working simultaneously on 28 bags 3 3/4 hours. It's time consuming and tedious. Sampled 5 soil pore gas locations.

SAMPLING PERFORMED:
Sampled the following sample locations: SG-23, SG-25, SG-26, SG-27, and SG-28.

FIELD ANALYSIS PERFORMED:
Analyzed all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
HNU failed to work today. The battery would not accept a charge and there appears to a loose connection and the meter "cuts out" when turned on. The Madison office is shipping another one to us over night. We were unable to get accurate and reliable HNU readings therefore it was not useful as a screening tool for the GC. Consequently a series of injections per sample had to be made because there was no way to estimate the concentrations of the samples.

QUALITY CONTROL ACTIVITIES INITIATED:
A duplicate sample was taken and analyzed.

Site Coordinator Signature: _____

To: KEITH BANDT

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 12, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
A high of sixtytwo degrees F., sunny, clear, no precipitation, winds were calm.

WORK PERFORMED:
Field GC calibrated, blanks and standards were run. Soil pore gas samples were located, staked and sampled. We were unable to perform any air monitoring because the HNU did not work. There appears to be a loose connection. I notified the Madison office of this problem on Wednesday 11/11/87 and a replacement was to be sent overnight to us. Tedlar bags were cleaned and checked for cleanliness.

SAMPLING PERFORMED:
The following sample locations were sampled for pore gas analysis: SG-39, SG-43, SG-42, SG-41, SG-33, SG-48, SG-36, SG-34, SG-44, SG-40, SG-38, SG-35, SG-32, SG-30, and SG-29.

FIELD ANALYSIS PERFORMED:
Field GC analysis was performed on all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
The HNU malfunctioned. It was decided to conduct the sampling without it until the replacement arrives. It was decided not reuse the tedlar bags that had contained samples with high concentrations due to the possiblity of carryover.

QUALITY CONTROL ACTIVITIES INITIATED:
Blanks and standards were run on the field GC. Duplicate pore gas samples were taken at pore gas sampling locations SG-41 and SG-35.

Site Coordinator Signature: Catherine A. Kwiatkowski

TO: KEITH BANDT

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No DACA45-86-C-0015, Mod. No. P00003

DATE: November 13, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of fiftyfive degrees F., sunny, clear, no precipitation, winds out of the North at 5 mph.

WORK PERFORMED:
Air monitoring with the HNU was performed before and during the sampling at each soil location. Pore gas samples were collected and analyzed. Met with Bill Becklin to sign contract and to discuss the type of work I need him to do for me. We went to look at the area where we need to drill through the concrete.

SAMPLING PERFORMED:
We took samples at the following pore gas sampling locations: SG-31, SG-37, SG-76, SG-74, and SG-72.

FIELD ANALYSIS PERFORMED:
Performed GC analysis on all the samples we took.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
None.

QUALITY CONTROL ACTIVITIES INITIATED:
Took a duplicate sample at location SG-31.

Site Coordinator Signature: Catherine A. Kwiatkowski

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 16, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of fiftysix degrees F., cloudy, intermittent rain showers all day, winds out of the SSW @ 5-10 mph.

WORK PERFORMED:
Calibrated the field GC. Performed background and periodic air monitoring with the HNU. Took samples for pore gas analysis and one for headspace analysis. Met with the general contractor to discuss boring through the concrete at several locations.

SAMPLING PERFORMED:
Took samples for pore gas analysis at the following locations: SG-70, SG-68, SG-64, SG-71, SG-69, SG-73, and SG-75. Took a sample for headspace analysis at sampling location SG-60.

FIELD ANALYSIS PERFORMED:
Performed background air monitoring with the HNU. Did GC analysis on all the samples that were collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
Could not take a pore gas sample at soil sample location SG-60 due to a dense layer of clay in that area. The only way to collect a sample at this location was to use the hand auger for headspace analysis.

QUALITY CONTROL ACTIVITIES INITIATED:
A duplicate sample was taken at pore gas sampling location SG-68.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 17, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary

High of thirty degrees F., cloudy, rain turning to snow and sleet, winds out of the north at 25-35 mph.

WORK PERFORMED:

Calibrated field GC. Took soil samples for pore gas analysis. Met with Doug Fullen of FMC to verify the utilities in the area where we need to bore through the concrete.

SAMPLING PERFORMED:

Took samples for pore gas analysis at the following locations: SG-65, SG-66, SG-67, SG-80, and SG-83.

FIELD ANALYSIS PERFORMED:

Took background HNU readings. Analyzed all the soil pore gas samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:

We attempted to take samples at locations SG-56, SG-52, SG-79, SG-81,and SG-82 but were unable to because we hit some type of obstruction. These locations will need to be sampled for headspace analysis. This could not be done today because of the heavy precipitation which would affect the analysis. These locations will be sampled Wednesday (the weather forecast is for dry weather).

QUALITY CONTROL ACTIVITIES INITIATED:

A duplicate sample was taken at SG-66.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November, 18, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary

High of thirtysix degrees F., sunny, clear, no precipitation, winds out of the southwest @ 10-15 mph.

WORK PERFORMED:

Performed background air monitoring with the HNU. Bored through the concrete in Area 1 to enable us to collect pore gas samples. Also attempted to use a power auger in the "north-forty" area. Collected the background pore gas samples in the Anoka County Park. Tommiann McDaniel from the COE arrived on site today.

SAMPLING PERFORMED:

Collected pore gas samples at the following locations: SG-6, SG-45, SG-46, SG-47, SG-84, SG-85, SG-86, SG-87, SG-79, SG-98, and SG-101.

FIELD ANALYSIS PERFORMED:

Performed GC analysis on all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:

At sampling location SG-46 we encountered an obstruction at several locations in the borehole so we had to move the location two feet to the north. We attempted to use a power auger to start the holes at locations SG-79, SG-80, and SG-83. We were successful at SG-79 but not at the other two locations. We tried to auger three holes at each location. These locations will need to be moved off to an area where the gravel-fill material is less dense.

QUALITY CONTROL ACTIVITIES INITIATED:

Duplicate pore gas samples were taken at locations SG-46 and SG-98.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 19, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary

High of thirtyfive degrees F., sunny to partly cloudy in the afternoon, snow in the afternoon, winds out of the northwest at 25-35 mph.

WORK PERFORMED:

Performed background air monitoring with the HNU. Located, staked, and sampled locations for pore gas analysis.

SAMPLING PERFORMED:

Sampled the following locations for pore gas analysis: SG-97, SG-102, SG-100, SG-52, SG-56, SG-105, SG-103, SG-108, SG-110, SG-111, and SG-109. A sample for headspace analysis was taken at location SG-99.

FIELD ANALYSIS PERFORMED:

GC analysis was performed on all samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:

None.

QUALITY CONTROL ACTIVITIES INITIATED:

Duplicate samples were taken and analyzed from locations SG-100 and SG-109.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 20, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: **Note: Attach Additional Sheets as Necessary**

High of twentyeight degrees F., clear, sunny, no precipitation, winds out of the northwest @ 20-25 mph.

WORK PERFORMED:

Performed background air monitoring with the HNU. Took samples for pore gas analysis and analyzed them. Located all sample locations with reference to permanent landmarks.

SAMPLING PERFORMED:

Sampled the following locations for pore gas analysis: SG-107, SG-106, and SG-104.

FIELD ANALYSIS PERFORMED:

Analyzed all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:

None.

QUALITY CONTROL ACTIVITIES INITIATED:

Performed the necessary duplicates and standards analysis on the GC.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 23, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary

High of thirtyfour degrees F., cloudy, trace amount of precipitation rain mixed with snow late afternoon with falling temperatures, winds out of the north @ 10-15 mph.

WORK PERFORMED:

Performed background air monitoring with the HNU. Calibrated the GC. Located and staked locations for pore gas sampling. Took samples from all locations staked for pore gas.

SAMPLING PERFORMED:

Took samples for pore gas analysis at the following locations: SG-90, SG-96, SG-91, SG-89, SG-88, SG-92, SG-95, SG-94, SG-93, SG-128, SG-129, SG-130, SG-131, and SG-118.

FIELD ANALYSIS PERFORMED:

GC analysis was performed on all samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:

While attempting to "pick" a hole for locations SG-91 and SG-96 with the pick axe an asphalt like material was encountered at a depth of approximately 1.5 feet. It took five and seven attempts respectively in the proposed locations until an area without the dense material was found.

At locations SG-129 and SG-130 background HNU readings taken before beginning to pick ax a hole for the probe were in the range of 1.6 to 0.8 respectively. The HNU was left on while digging a hole. The HNU readings after the holes were started were 10 to 60 respectively. Work was stopped at each hole until HNU readings were back to previous background levels.

QUALITY CONTROL ACTIVITIES INITIATED:

Duplicate samples were taken at locations SG-92 and SG-129.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 24, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary

High of thirtyeight degrees F., sunny to cloudy by afternoon, no precipitation, winds out of the southwest @5-10 mph.

WORK PERFORMED:

Performed background air monitoring. Located and staked locations for pore gas sampling. Took samples for pore gas analysis at all locations located.

SAMPLING PERFORMED:

Took samples for pore gas analysis at the following locations: SG-115, SG-123, SG-127, SG-126, SG-121, SG-124, SG-125, and SG-116.

FIELD ANALYSIS PERFORMED:

GC analysis was performed on all samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:

None.

QUALITY CONTROL ACTIVITIES INITIATED:

Duplicate samples were taken at locations SG-127 and SG-116.

Site Coordinator Signature: _____

A-E DAILY QUALITY CONTROL REPORT (DQCR)
COE-NIROP, Fridley, Minnesota
RMT, Inc. Project No. 1332 Contract No. DACA45-86-C-0015, Mod. No. P00003

DATE: November 25, 1987 AUTHOR: Catherine A. Kwiatkowski

WEATHER: Note: Attach Additional Sheets as Necessary
High of thirtyeight degrees F., mostly cloudy, no precipitation, winds out of the southeast @ 5-10 mph.

WORK PERFORMED:
Performed background air monitoring with the HNU. Located and staked locations for pore gas sampling.

SAMPLING PERFORMED:
Took samples at the following locations for pore gas analysis: SG-119, SG-114, SG-133, SG-134, SG-112, SG-113, SG-120, AND SG-117.

FIELD ANALYSIS PERFORMED:
Performed GC analysis on all the samples collected.

PROBLEMS ENCOUNTERED AND CORRECTIVE ACTIONS:
Encountered very dense compacted gravel at locations SG-112, SG-113, SG-117, and SG-120. Had to move each location 3-4 times before an area of less compacted gravel material was found. None of the moved locations was more than 4-5 feet from the original proposed location.

QUALITY CONTROL ACTIVITIES INITIATED:
A duplicate sample was taken at location SG-133.

Site Coordinator Signature: _____

APPENDIX E

RESULTS OF SOIL GAS ANALYSES
NOVEMBER 1-25, 1987

APPENDIX E

SOIL GAS SAMPLING RESULTS - FRIDLEY

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
1.	No Access					
2.	No Access					
3.	11/4	0	Trace	0.03	0.05	< 1
4.	11/4	3	0.45	BD	BD	< 1
5.	11/4	7.5-8.5	BD	BD	BD	< 1
6.	11/18	--	0.2	0.03	0.03	< 1
7.	11/9	0.2	0.29	0.01	BD	< 1
8.	11/19	0.3-0.8	0.3	1.6	0.03	1.9
9.	11/5	22-35	14.5-22.3	0.5-0.9	0.5	20
10.	11/6	16.5-34	14.9	0.62		13
	11/5	15.8	10.5	0.44	0.19	13
11.	11/5	12-15	20-25	1.5-1.8	BD	25
12.	11/6	3	3.3	0.52	BD	3.8
13.	11/6	140-205	76.3-82.6	182-195	BD	270
14.	11/9	12.2	15.4-18.2	0.73-0.81	BD	17.5
15.	11/6	17-22	14.2-18.4	0.3-0.4	BD	16
16.	11/6	6-8	0.24	0.58-0.62		0.8
17.	11/4	5-7	3.06	BD	0.05	3

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
18.	11/4,11/5	1-7	0.2-3	BD	BD	3
19.	11/3	2-5	< 0.1	BD	BD	< 0.1
20.	11/4	1	BD	BD	BD	< 1
21.	11/10	3.6	0.17-0.22	BD	BD	< 1
22.	11/10	0	0.03	BD	BD	< 1
23.	11/11	--	0.24-0.29	0.03-0.09	BD	< 1
24.	Hit Obstruction - No Sample					
25.	11/11	2.5-3.0	0.71	93.4	2.5-3.1	97
26.	11/11	7.2-7.5	0.13	88.5	1.8	90.4
27.	11/11	18.6-19.2	13-14.8	3.5-3.7	BD-0.17	17.5
28.	11/11	2.2-2.6	22.8	6.3	0.37	29.5
29	11/12	--	0.2	0.06	BD	< 1
30.	11/12	--	0.15	0.05	BD	< 1
31.	11/13	1-1.4	0.02	0.01	BD	< 1
32.	11/12	--	0.13	0.05	BD	< 1
33.	11/12	--	30.2	0.43	0.1	30.7
34.	11/12	--	6.1	3.7	BD	9.8
35.	11/12	--	0.26	0.08	BD	< 1
36.	11/12	--	137-178	192	2.8-7.1	350
37.	11/13	2-2.8	1.6	0.04	BD	1.6
38.	11/12	--	0.18	0.08	BD	< 1

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
39.	11/12	0.2-0.4	0.04	0.006	0.002	< 1
40.	11/12	--	0.22-0.25	0.09-0.15	BD	< 1
41.	11/12	--	0.02-0.18	0.002-0.1	BD-0.2	<1
42.	11/12	--	0.12	0.02	BD	< 1
43.	11/12	--	0.008	0.007	BD	< 1
44.	11/12	--	0.42	0.25	BD	< 1
45.	11/18	2.0-2.4	0.7-0.9	0.05	0.1	1
46.	11/18	1.4-1.8	0.04-0.09	BD	0.03	< 1
47.	11/18	1.4-1.6	0.15	0.07	0.07	< 1
48.	11/12	--	8.5	0.08	BD	8.5
49.	Off-Site -- No Access					
50.	Off-Site -- No Access					
51.	Off-Site -- No Access					
52.	11/19	0.4-0.6	0.2	0.02	BD	< 1
53.	Off-Site -- No Access					
54.	Off-Site -- No Access					
55.	Off-Site -- No Access					
56.	11/19	1.4-1.8	0.1	0.1	BD	< 1
57.	Off-Site -- No Access					
58.	Off-Site -- No Access					
59.	Off-Site -- No Access					

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
60.	11/16	1.2	1.3	BD	0.03	1.3
61.	Off-Site -- No Access					
62.	Off-Site -- No Access					
63.	Off-Site -- No Access					
64.	11/16	0.8-1.2	2.4	BD	0.02-0.03	2.4
65.	11/17	0.3-0.4	0.003	BD	0.005	< 1
66.	11/17	0.5-0.6	0.05-0.06	0.1	0.1	< 1
67.	11/17	1-1.8	0.1	BD	0.01	< 1
68.	11/16	0.8-1.0	0.01-0.24	0.003	0.003	<1
69.	11/16	0.8-1.7	BD	BD	0.003	< 1
70.	11/16	0.6-0.8	0.007	BD	0.003	< 1
71.	11/16	0.4-0.5	BD	BD	0.003	< 1
72.	11/13	0.4-0.6	0.2	0.01	0.004	< 1
73.	11/16	0.6-1.0	BD	0.004	0.003-0.008	< 1
74.	11/13	0.8-1.0	0.1	0.01	0.05	< 1
75.	11/16	1-1.4	0.005	0.007	0.006	< 1
76.	11/13	0.4	0.04	0.01	BD	< 1
77.	No Sample Collected					
78.	No Sample Collected					
79.	11/18	1.2-1.8	0.18	BD	0.003	< 1
80.	11/17	0.8-1.0	2.0	BD	0.1	2

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
81.	(11/17) Obstruction -- No Sample					
82.	(11/17) Obstruction -- No Sample					
83.	11/17	0.8-1.2	1.1-1.2	BD	0.03-0.05	1.2
84.	11/18	0.8-1.0	0.05	0.02	0.03	< 1
85.	11/18	0.02	0.05	BD	0.003	< 1
86.	11/18	0.8-1.0	0.03	BD	0.003	< 1
87.	11/18	--	0.04	BD	0.003	< 1
88.	11/23	98-99	35.5-36.3	3.0	0.9	40
89.	11/23	52-53	21.9	3.0	0.7	25
90.	11/23	1.8-2.0	0.6	0.06	0.02	< 1
91.	11/23	3.2-3.6	8.0	1.3	0.2	9
92.	11/23	69-70	20.3-20.9	9.5	BD	30
93.	11/23	2.8-3	2.1	0.9	BD	3
94.	11/23	200-210	74.3	38.9	BD	113
95.	11/23	420-430	299.2	(572 Off-Scale	5.9	> 300
96.	11/23	1.0-1.2	0.1	0.15	BD	< 1
97.	11/19	0.4-0.6	0.4	105	2.5-3.7	108
98.	11/18	1.0-1.4	14.7-17.1	0.54	13.8-14.6	31
99.	11/19	--	44	7	0.7	52
100.	11/19	1.2-1.8	0.2-0.6	0.2-0.4	0.1	1

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
101.	11/18	1.4-1.8	205	3.9	112	321
102.	11/19	84-86	22.5	18.1	0.8	41
103.	11/19	1.8-2.2	0.1	0.04	BD	< 1
104.	11/20	0.4-0.8	Trace	0.01	BD	< 1
105.	11/19	--	0.1	0.04	BD	< 1
106.	11/20	0.6-1.0	0.2-0.6	0.1	0.1	< 1
107.	11/20	40	9.7	0.5	0.3	10
108.	11/19	1.8-2.4	0.3	0.1	BD	< 1
109.	11/19	0.8-1.0	46.4-49.4	0.07	0.07	48
110.	11/19	2.4-2.6	0.2	0.1	BD	< 1
111.	11/19	62-68	21.5-25.5	BD	BD	24
112.	11/25	2.0-2.2	1.6 (Off Scale	0.04	BD	1.6
113.	11/25	1.0-1.8	0.3	0.06	BD	< 1
114.	11/25	2.0-2.4	1.1	0.04	BD	1.0
115.	11/24	60-62	13.9	10.5	BD	24
116.	11/24	2-2.6	0.8-1.2	0.03-0.3	BD	1
117.	11/25	3-3.6	12.8	0.2	BD	13
118.	11/23	--	2.8	9.8	BD	13
119.	11/25	0.8-1.0	40.1	1.0	BD	41
120.	11/25	5.0-5.2	10.9	0.2	BD	11

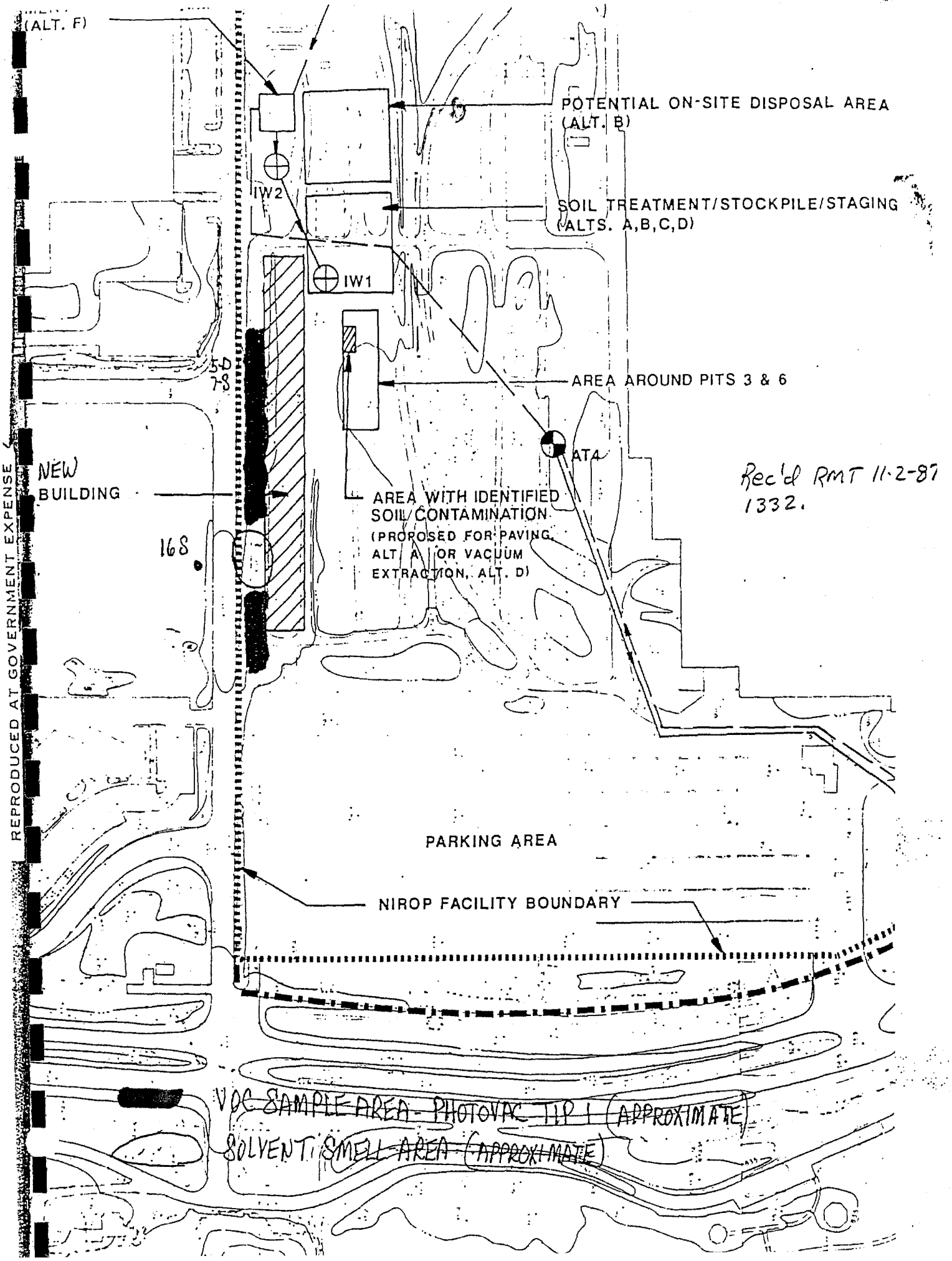
1332.50 RPT:frid0111A

Sample Number SG-	Date	HNU ppm	TCE	cis/DCE	Trans-DCE	Sum
			ppm			
121.	11/24	18.6-19	7.4	0.4	BD	8
122.	(See Site 102)					
123.	11/24	12-13	5.9-6.5	0.1	BD	6
124.	11/24	50-51	46.9	BD	BD	47
125.	11/24	5-5.8	2.2	1.2	BD	3
126.	11/24	6-6.6	10.5	3.5	BD	14
127	11/24	12.4-13.6	7.8	0.1-0.2	BD	8
128.	11/23	3-3.6	27.5	3.1	BD	31
129.	11/23	6.8-10	14.5-15.4	0.8	BD	16
130.	11/23	60-62	25.8	1.3	BD	27
131.	11/23	0.4-0.8	17.8	1.2	BD	19
132.	No Sample Collected					
133.	11/25	2.0-2.8	8.4	2.7	BD	11
134.	11/25	2.0-2.4	1.0	0.06	BD	1.0

APPENDIX F

FIELD NOTES BY MPCA PERSONNEL
DURING INSPECTION OF WATER MAIN TRENCH

OCTOBER 29, 1987



Rec'd RMT 11-2-87
1332.

REPRODUCED AT GOVERNMENT EXPENSE

TIP Survey at NAWY 1332. 9:45 10/29/87

Est: 100' E of 5D .1 .2 on wall of trench down in hole

0.00 5D .1 starting point monitor well 5D 0.00'

1.00 .00

2.00 .00

[redacted] SOLVENT SMELL AREA

4.00 0.00

5.00 0.00

6.00 0.1 0.2 off to side 10', 5, 6

re: odor observed on ~~10/28/87~~ 10/27/87 MJ.
Steve & Doug.
Oil like odor observed in soil layer 0 to 2-3' thick top soil for ~50' along trench

Doug said PVC solvent like smell

1.50 .4 random bucket samples 3 yds of soil/bucket

.3

1.75 .5

.3 } bottom of trench

.6

2.00 .3 from surface 10:30