AL JOHNSON CONSTRUCTION CO.
General Contractors
1700 NORTHWESTERN FINANCIAL CENTER
MINNEAPOLIS, MINNESOTA 55431
Telephone : 612/831-8151

October 26, 1979

Mr. Dan Greenwald
Manufacturing Engineering Manager
Ford Motor Company Twin Cities Assembly Plant
966 South Mississippi River Blvd.
St. Paul, Minnesota 55116

Dear Mr. Greenwald:

Thank you for meeting with me on, 22 October 1979, to discuss the possibility of our disposing of waste material in the area south of your steam plant. The material would consist of broken concrete, sandstone, and possibly some clean sand which would be obtained from the Ford Lock site where we have the contract for the rehabilitation of the lock.

The total quantity of concrete and sandstone that we are proposing to dispose of on your property is 29,000 cu. yd. with the possibility of an additional 18,000 cu. yd. of sand if we cannot find another use for the sand. The estimated quantities and periods of disposal are as follows:

1,000 c.y. of Concrete	November 1979
9,000 c.y. of Concrete	December 1979
9,000 c.y. of Concrete	December 1980
10,000 c.y. of Sandstone	December 1980
18,000 c.y. of Sand	April - May 1981

Attached is a drawing of the proposed fill area. The area shown to be filled is what we thought would be the best use of the waste material in developing the area as a possible storage site for your trucks. We would be willing to fill the area in any other way you wished. We would propose to bury the existing trees in the fill. Sand would be placed on top of the fill to give a smooth surface on which you could build your parking area. In addition, we would offer to pay the Ford Motor Company $.25 for every cubic yard of material actually wasted in the proposed area.

With the time being very short on our need for a disposal site in 1979, we would appreciate your early consideration in this matter. Again, thank you for your time and effort.

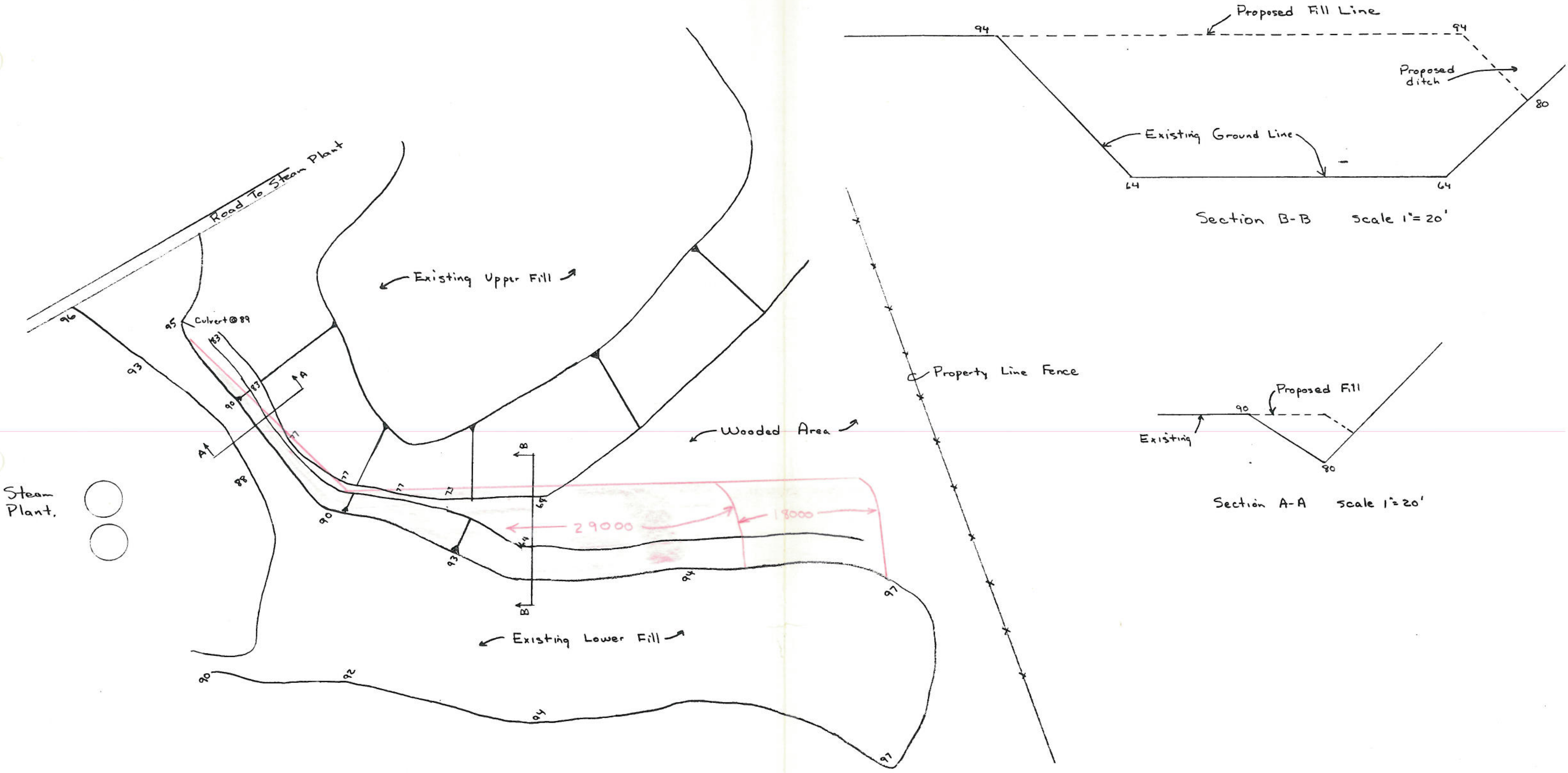
Very truly yours,

AL JOHNSON CONSTRUCTION CO.

George W Barbato

George W. Barbato
Project Manager

GWB:ck
Attachment



Plan of Proposed Fill Scale 1"= 100'

Section B-B Scale 1"= 20'

Section A-A Scale 1"= 20'

Proposed Waste Disposal Area at Ford Motor Company

Al Johnson Const
10/26/79

Twin Cities Assembly Facility
Groundwater Monitoring Wells Survey

March 3, 1982

Ford

Stationary Source Environmental Control Office

Environmental and Safety Engineering Staff

RECEIVED

MAY 07 1982

MINN. POLLUTION
CONTROL AGENCY

Twin Cities Assembly Facility
Groundwater Monitoring Wells Survey

March 3, 1982

Conducted By

Ford Motor Company
Stationary Source Environmental Control Office
Survey and Evaluation

Survey Conducted by:

E D Chraszcz
E. D. Chraszcz

T. J. Geyer
T. J. Geyer

Prepared by:

E. D. Chraszcz
E. D. Chraszcz

Concur:

J. M. Reinke, Manager

Twin Cities Assembly Plant
Groundwater Monitoring Wells Survey
March 3, 1982

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I. INTRODUCTION

As part of an investigation into potential groundwater contamination resulting from an old inactive disposal site at the Twin Cities Assembly Plant, the Minnesota Pollution Control Agency (MPCA) requested Ford Motor Company to install four (4) groundwater monitoring wells in the vicinity of the inactive site. Prior to installing the wells a hydrogeologic survey was conducted by Soil Testing Services of Minnesota, Inc. Based on the information contained in the survey, the well locations were selected and submitted to the MPCA. Following their approval Soil Testing Services installed the wells.

On March 3, 1982 representatives from Ford's Stationary Source Environmental Control Office (SSECO) conducted a sampling program of the groundwater in the wells. Mr. Douglas Day of the MPCA was present during the sampling to review the procedures used and to obtain split samples. The parameters selected for analysis were based on a joint agreement between Ford and the MPCA and included:

- USEPA volatile priority pollutants
- Xylenes
- Methylethylketone
- Methylisobutylketone
- pH
- Specific conductivity
- Dissolved heavy metals (Cd,Cr,Pb,Cu,Ni,Zn)

II. SITE DESCRIPTION AND WELL LOCATIONS

The inactive disposal site is approximately 4 acres in size and is located west of the main assembly plant building between Mississippi River Boulevard and the Mississippi River. The site was used by the plant to dispose of construction rubble, paint sludges and old paints and solvents. It has not been used since 1965. The attached Figure 1 shows the location of the site and the approximate location of the 4 groundwater monitoring wells installed. The final locations of the wells were dictated somewhat by access to the rather rugged terrain found in the disposal site area, and the presence of underlying bedrock in certain locations which prohibited sampling the uppermost groundwater, directly connecting the Mississippi River.

Installation of the wells was completed in December of 1981. The well casings are 2" schedule 80 PVC pipe with the lower 10' of casing slotted and wrapped with Miarafi 140S fabric. The Miarafi acts as a filter to limit the amount of sediment entering the wells. Detailed information on the procedures used for installing the wells and the well boring logs can be obtained from the final report of Soil Testing Services of Minnesota dated February 26, 1982. The specifics of each are listed below:

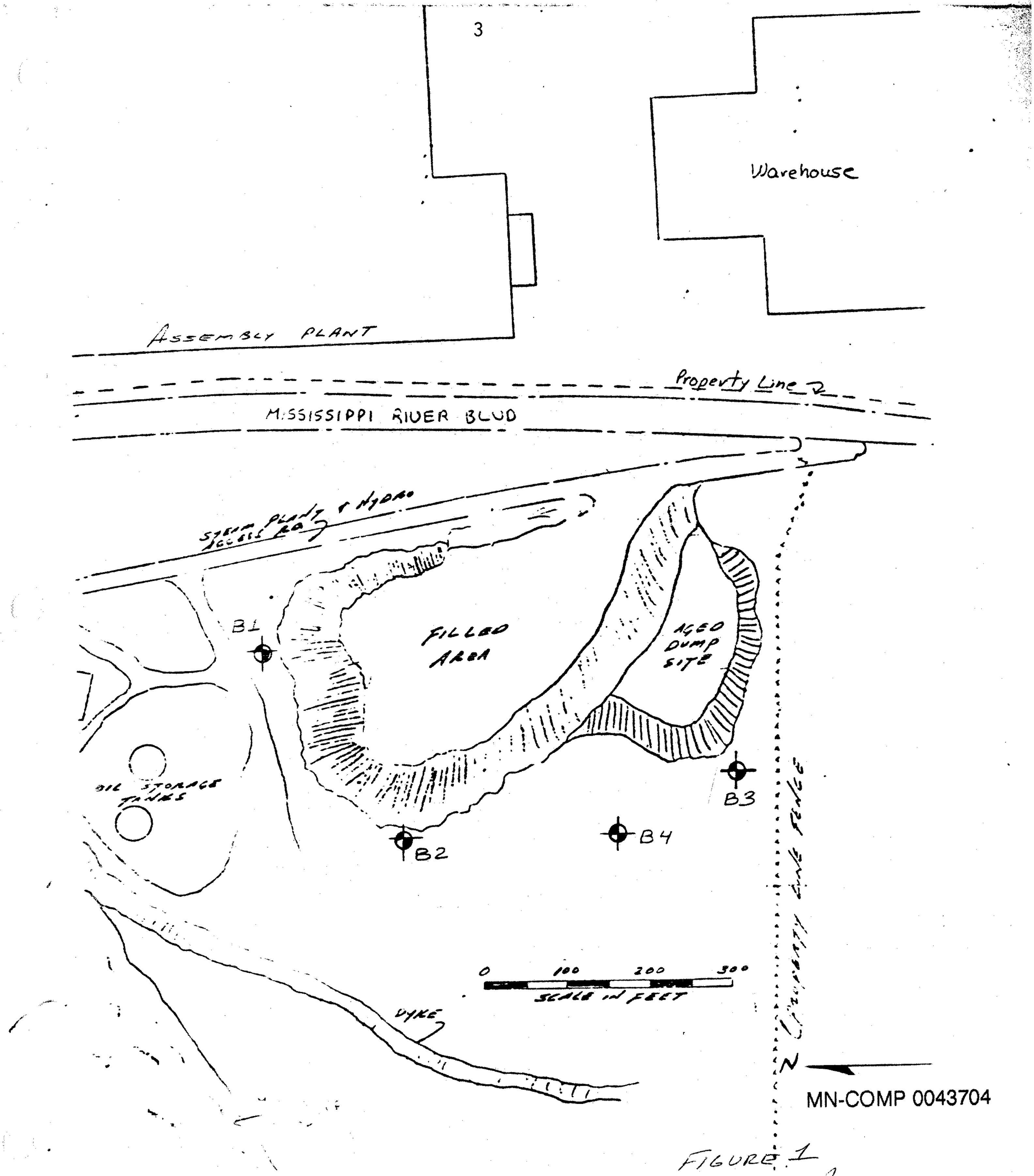


FIGURE 1
TWIN CITIES ASSEM
SITE AND WELL LOCA

Well No.	Bottom of Casing Elevation (Ft.)	Casing Length from Grade (Ft.)
B-1	678.52	51.0
B-2	671.27	44.5
B-3	672.49	24.5
B-4	675.97	29.5

On the basis of the preliminary measurements obtained by Soil Testing Services following completion of the wells, the groundwater movement in the area is to the west northwest, toward the Mississippi River. On this basis, Well No. B-1 is anticipated to be an upgradient well, or at least unaffected by the disposal site, while Wells B-2, B-3, and B-4 are downgradient of the site.

III. SUMMARY

A summary of the results from the well samplings appears in Table 1. On the basis of static water level measurements, Well B-1 can be considered the upgradient or unaffected by the disposal site and Wells B-2, B-3 and B-4 downgradient of the disposal site.

As indicated by the data, metal concentrations in the groundwater from the downgradient wells are consistently low. Only trace levels of three organic compounds were detected in three of the wells; two of which were present in the upgradient well. These findings indicate no apparent contamination due to the inactive disposal site.

Table 1

Twin Cities Assembly Plant
Groundwater Analysis Summary

		Well No.			
Dissolved Metals	Units	B1	B2	B3	B4
Copper	mg/l	0.03	0.02	0.01	0.01
Cadmium	mg/l	0.02	<0.01	<0.01	0.02
Zinc	mg/l	0.06	0.04	<0.02	0.09
Nickel	mg/l	0.07	0.04	0.02	0.05
Chromium	mg/l	<0.05	<0.05	<0.05	<0.05
Lead	mg/l	0.12	<0.05	<0.05	0.06
pH	Units	7.08	7.01	7.07	6.84
Specific Conductivity	Umhos/cm	985	1064	1666	1482
Temperature	°F.	47	45	45	46
Organics					
1,2 Dichloroethylene	μg/l	<2	15	<2	<2
Trichloroethylene	μg/l	4	5	<2	<2
Toluene	μg/l	1	1	<1	1

IV. RESULTS

Static water level measurements obtained prior to well clearing and sampling are tabulated below, together with measurements made by Soil Testing Services on January 5, 1982 following the well installations and developments:

Table 2

Groundwater Level Data

	Static Water Levels	
Well No.	1/5/82	3/3/82
B-1	688.62	688.35
B-2	688.11	687.71
B-3	688.65	688.27
B-4	688.53	688.05

The March data agrees fairly well with the previous data and tends to confirm the west to northwest groundwater movement. On this basis, Well B-1 is upgradient of the disposal site and the remaining three wells are downgradient.

The results of the dissolved metals analyses appear in Table 3. The final value represents the average of 7 consecutive readings made on each sample.

Table 4 contains the results of analyses for the volatile organic materials. Duplicate analysis showed excellent agreement; both field and well casing material blanks were satisfactory.

Specifications regarding the exact method of analysis with respect to metals and organics can be found in Appendix C together with the detection levels associated with each procedure.

Table 3
Twin Cities Assembly Plant
Groundwater Monitoring Results
Dissolved Metals
March 3, 1982

	B1	B2	B3	B4
Lead	0.12	<.05	<.05	0.06
Chromium	<.05	<.05	<.05	<.05
Nickel	0.07	0.04	0.03	0.05
Zinc	0.06	0.04	<.02	0.09
Cadmium	0.02	<.01	<.01	0.02
Copper	0.03	0.02	0.01	0.01

All values are the average of seven measurements of the same sample. Units are mg/l.

TABLE 4
Twin Cities Assembly Plant
Groundwater Monitoring Results
Volatile Organics
March 3, 1982

	B1	B1 (Dup)	B2	B2 (Dup)	B3	B3 (Dup)	B4	B4 (Dup)
1,2 Dichloroethylene	-	-	13	17	-	-	-	-
Trichloroethylene	4	3	5	5	-	-	-	-
Toluene	1	2	1	1	-	-	1	1

Duplicate field blanks showed no detectable levels of volatile organics.

Well casing blanks showed 4 PPB Toluene and 6 PPB methylene chloride, however these are attributed to the laboratory atmosphere.

Only detectable quantities are reported.

APPENDIX A

SAMPLING PROCEDURES

APPENDIX A

SAMPLING PROCEDURES

Prior to sampling, static water level determinations were made. Based on the static and the measured depth of each well, the volumes of water in each well casing calculated. Each well was then cleared to remove three times the calculated water volume. Wells B-1 and B-2 were cleared by manual methods utilizing a stainless steel bailer. Wells B-3 and B-4 were not as deep and therefore could be cleared with a peristalic pump and tygon tubing suction line. Once clearing was completed, the static water level was again determined and the samples were withdrawn from the wells with a stainless steel bailer. Table 5 represents some of the pertinent well data as it relates to the monitoring survey.

In order to avoid either cross contamination or contamination from extraneous sources, the stainless steel bailer and attached stainless cable were subjected to a thorough cleaning before being immersed in a well. The bailer and cable were first rinsed with organic free water followed by a methanol rinse and finally a second rinse with organic free water.

The wells were sampled in the following order: Wells B-1, B-2, B-4, and B-3. Well B-1 was sampled first since it was considered the upgradient well. Water level recovery was rapid, therefore samples were collected immediately after well evacuation. Samples for volatile priority pollutants plus xylenes, methylethyl ketone, and methylisobutyl ketone were

Table 5
Twin Cities Assembly Plant
Survey of Ground Water Monitoring Wells
March 3, 1982
Well Data

Well Number	Time Sampled	Elevation (Ft.)	Static Water Level (Ft.)	Casing Depth (Ft.)	Well Volume (liters)	Amount of Water Removed (liters)	Static After Bailing (ft.in.)
B1	12:00 Noon	730.52	42' 2"	53' 65"	6.2	19	41' 1"
B2	2:45 p.m.	718.96	26' 3"	46' 9"	11.1	33	31' 3"
B3	4:35 p.m.	704.85	16' 7"	27' 35"	5.8	18	16' 7"
B4	3:25 p.m.	708.63	20' 7"	30' 10"	5.6	17	20' 7.5"

collected by transferring some of the sample from the bailer to a cleaned glass beaker, and subsequently filling individual volatile organic sampling vials. Care was taken to avoid both unnecessary agitation of the sample and air bubbles trapped in the sealed vial. Volatile samples were maintained at 4^{o} C until analysis. A second portion of the sample was filtered through a 0.45 micron filter on site and the filtrate acidified to pH 2. This sample was analyzed for dissolved metals. pH, conductivity and temperature determinations which were performed on site.

APPENDIX B

Analytical Procedures

APPENDIX B

Analytical Procedures

Temperature and specific conductivity were determined on site using a Horiba Model U-7 water analyzer. pH was measured on site using an Extech Model 631 digital meter.

Metal determinations were made using an Instrument Laboratory IL 151 atomic absorption spectrometer and EPA methodology. The detection limits listed below were calculated by determining the standard deviation from a series of seven measurements of the lowest standard for each metal analyzed. The standard deviations were then multiplied by two which results in confidence limits of approximately 95%.

Metals Detection Limits (mg/l)	
Copper	0.01
Cadmium	0.01
Zinc	0.02
Nickel	0.03
Chromium	0.05
Lead	0.05

Volatile organic concentrations were measured utilizing a Hewlett Packard HP 5992 GC/MS, incorporating a thirty meter, fused Silica, thick coat, DB-5 capillary column. The GC/MS was used in conjunction with an Envirochem Unicon purge and trap device and a Hewlett Packard dual floppy disc data storage system. The detection limits listed below were determined by the lower peak area threshold limit, which is set by the analytical program used.

Priority Pollutant VOA Compound	Detection Limit(ppb)	Priority Pollutant VOA Compound	Detection Limit(ppb)
Purgeables A		Purgeables B	
Methylene Chloride	< 1	1,2 Dichloroethylene	< 2
1,1 Dichloroethylene	< 5	1,2 Dichloroethane	< 2
1,1 Dichloroethane	< 1	1,1,1 Trichloroethane	< 2
Chloroform	< 1	Bromodichloromethane	< 2
Carbon tetrachloride	< 5	trans 1,3 Dichloropropene	< 2
1,2 Dichloropropane	< 5	cis 1,3 Dichloropropene	< 2
Trichloroethylene	< 2	Benzene	< 1
1,1,2 Trichloroethane	< 5	Bromoform	< 5
Dibromochloromethane	< 5	1,1,2,2 Tetrachloroethane	< 2
Tetrachloroethylene	< 2	Toluene	< 1
Chlorobenzene	< 1	Ethyl Benzene	< 1

Priority Pollutant VOA Compound	Detection Limit(ppb)
Purgeables C	
Chloromethane	< 2
Dichlorodifluoromethane	< 5
Bromomethane	< 10
Vinyl Chloride	< 5
Chloroethane	< 5
Others	
Methyl Isobutyl Ketone	< 1
Methyl Ethyl Ketone	< 5
Xylenes	< 1

APPENDIX C

FIELD DATA SHEETS

~~GROUNDWATER MONITORING SAMPLING DATA SHEET:~~

Plant Twin Cities Assembly

Date 3/3/82

Well # B-1

Reason for Sampling Required monitoring

Person Sampling EC, TG, RB.

Laboratory Handling
Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 730.52

Casing Material PVC

Casing Depth 53 6½" (64.25)

Metal Guard Elevation None

Screen Material PVC

Casing Diameter 1 7/8

Static Water Level 42'2" (50.6')

Well Volume 6.2 Liters

Type of Well Verticle

Location of Well North edge of bluff

Up- or Downgradient Upgradient

II. Well Clearing Data

Device Used Stainless Steel Bailer

Material of Construction Stainless Steel

Volume of Water Removed 19 Liters

III. Sampling Data

Significant Weather Conditions Dry & Clear

Barometric Pressure

	Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
1.					
2.	No Odor				
3.	Static After bailing		41'1"		
4.	Time of Sampling		12:00 pm		
5.					
6.					

IV. Field Data

Well volume = 136.5 x 3.14 x .879 x .01639 = 6.2 Liters x3 = 18.5 Liters

Notes Temp of sample 47°F

pH 7.08

Conductivity At 25°C 985 micromhos/cm

~~GROUNDWATER MONITORING SAMPLING DATA SHEET:~~

Plant Twin Cities Assembly

Date 3/3/82

Well # B-2

Reason for Sampling Required monitoring

Person Sampling E.C., F.G., R.B.

Laboratory Handling Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 718.96

Casing Material PVC

Casing Depth 46'9" (561")

Metal Guard Elevation None

Screen Material PVC

Casing Diameter 1 7/8"

Static Water Level 31'3" (375")

Well Volume 8.4 Liters

Type of Well Verticle

Up- or Downgradient Downgradient

Location of Well Northwest edge of bluff

II. Well Clearing Data

Device Used Stainless Steel Bailer

Material of Construction Stainless

Volume of Water Removed 25 Liters

III. Sampling Data

Significant Weather Conditions Dry & Partly Clear Barometric Pressure

	Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
1.					
2.	Static After Sampling	31'3"			
3.	Time of Sampling	2:45 pm			
4.					
5.					
6.					

IV. Field Data

Well volume = 186" x 3.14 x .879 x .01639 = 8.4 Liters x 5 = 25 Liters

Initial Conductivity of diluted sample 551

Notes: Temp. of Sample 45°F

pH 7.01

* Conductivity At 25°C 1064 micromhos/cm

* Note Conductivity exceeds meter capability therefore sample was diluted with Distilled water of 19 micromhos/cm. 551 - 19 x 2 = 1064

21

~~GROUNDWATER MONITORING SAMPLING DATA SHEET~~

Plant Twin Cities Assembly
Date 3/3/82
Well # B-4

Reason for Sampling Required monitoring
Person Sampling E.C, T.G, R.B
Laboratory Handling
Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 708.63
Casing Material PVC
Casing Depth 30'10" (370")
Metal Guard Elevation None

Screen Material PVC
Casing Diameter 1 7/8
Static Water Level 20'7" (247")
Well Volume 5.6 Liters

Type of Well Verticle
Up- or Downgradient Downgradient

Location of Well Southwest edge of bluff

II. Well Clearing Data

Device Used Peristalic Pump
Volume of Water Removed 17 Liters

Material of Construction Tygon

III. Sampling Data

Significant Weather Conditions Dry
Barometric Pressure

	Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
1.					
2.	No odor Sample silty				
3.	Static after bailing 20'7½"				
4.	Time of Sampling 3:25pm				
5.					
6.					

IV. Field Data

Well Volume = 123" x .01639 x 3.14 x .879 = 5.6 Liters x 3 = 16.7
Initial Conductivity of diluted sample 760

Notes: Temp of Sample 46°F
pH 6.84
* Conductivity at 25°C 1482 micromhos/cm

* Note: Conductivity exceeds meter capability therefore the sample was diluted with distilled water of 19 micromhos/cm. 760-19 x 2 = 1482

~~GROUNDWATER MONITORING SAMPLING~~ DATA SHEET

Plant Twin Cities Assembly

Date 3/3/82

Well # 6-3

Reason for Sampling Required monitoring

Person Sampling E.C, T.H, R.B

Laboratory Handling Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 704.85

Casing Material PVC

Casing Depth 27' 3½" (327.5)

Metal Guard Elevation None

Screen Material Slotted PVC

Casing Diameter 1 7/8

Static Water Level 16' 7" (199)

Well Volume 5.8 Liters

Type of Well Verticle

Up- or Downgradient Downgradient

Location of Well South edge of bluff

II. Well Clearing Data

Device Used Peristalic Pump

Material of Construction Tygon

Volume of Water Removed 18 Liters

III. Sampling Data

Significant Weather Conditions Dry

Barometric Pressure

	Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
1.					
2.	No odor				
3.	Static after bailing	16'7"			
4.	Time of sampling	4:35pm			
5.					
6.					

IV. Field Data

Well volume = 128.5 x 3.14 x .879 x .01639 = 5.8 Liters x3 = 17.4 Liters

Initial Conductivity of diluted sample 852

Notes: Temp of sample 45°F

pH 7.07

*Conductivity at 25°C 1666 micro mhos/cm

* Note conductivity exceeds meter capability therefore sample was diluted with distilled water of 19 micrombos/cm. 852-19 x2 = 1666

APPENDIX D

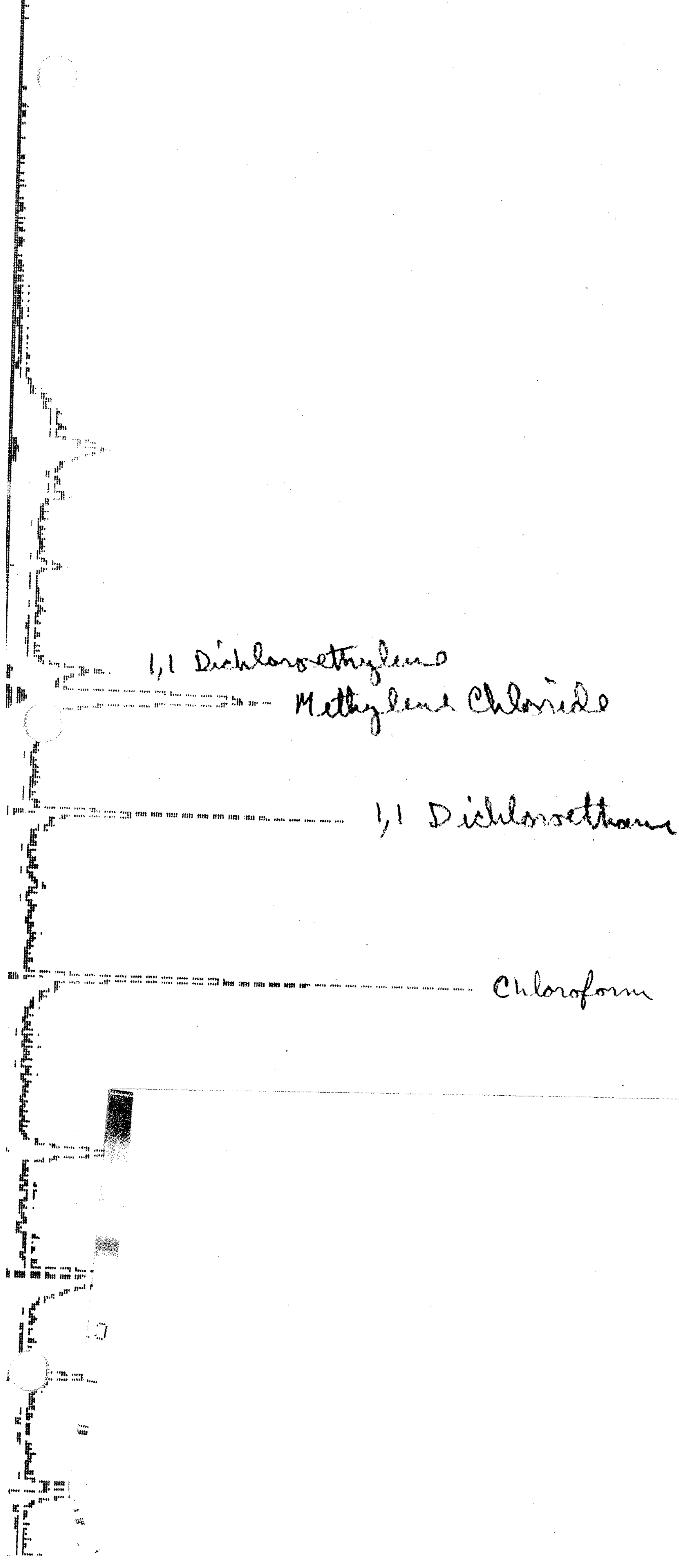
LABORATORY DATA SHEETS

with 5ml purge

0.5ul inj Purgables A

12 min sparg

5 min tube

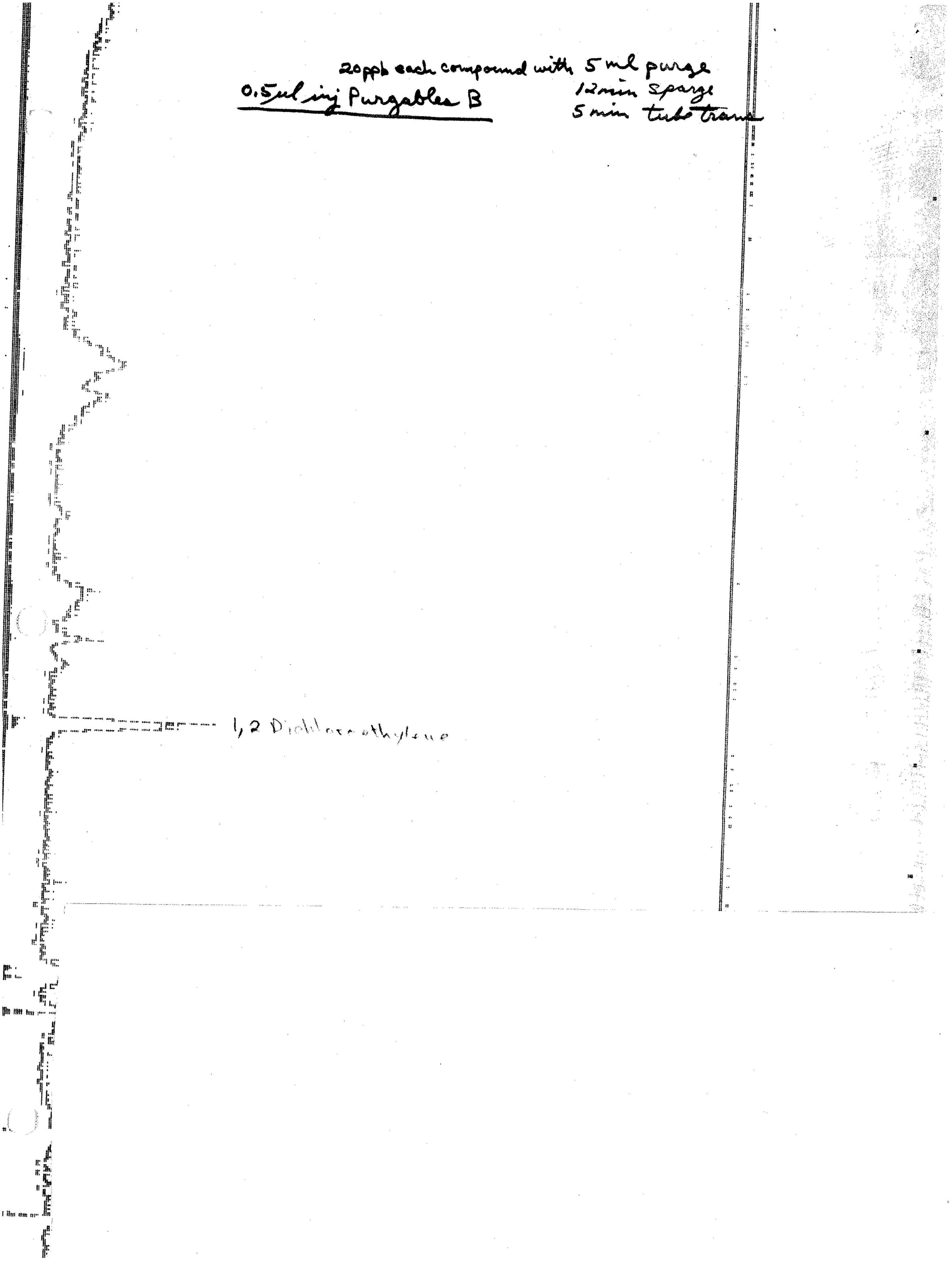


20ppb each compound with 5 ml purge

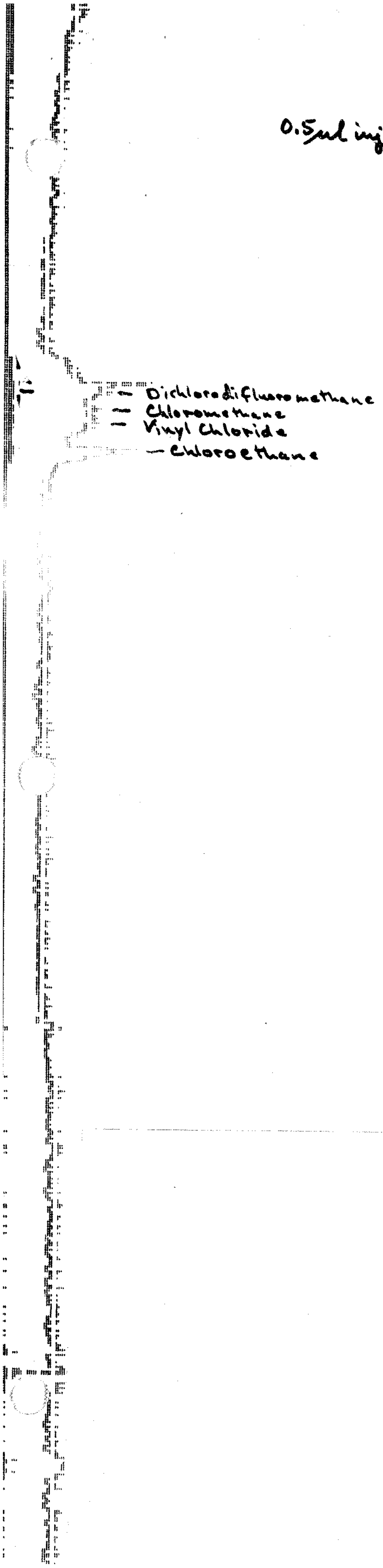
<u>0.5µl inj Purgables B</u>

12 min sparge

5 min tube trans



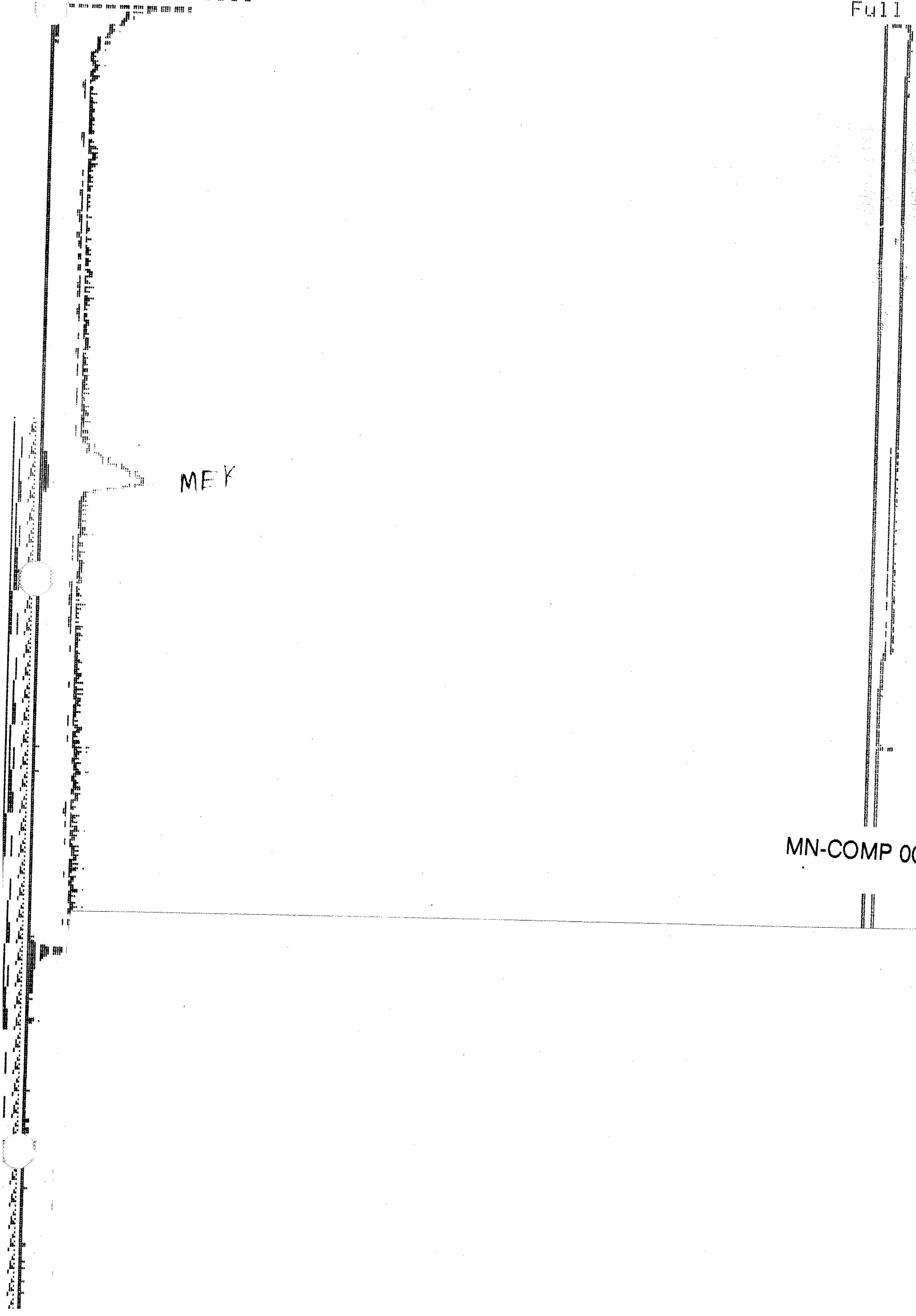
20ppb each compound with 5ml purge 12min sparge
0.5ul inj Purgables C w/surrogate spike 5min tube trans.



SAMPLE IDENTIFICATION 0.2 µl inj MEK + MIBK Std in Methanol 5 merge
129ppb & 128ppb

TOTAL ABUNDANCE FROM 40 TO 250 amu
Full Scale= 5000

ION 7
Full Scale= 500



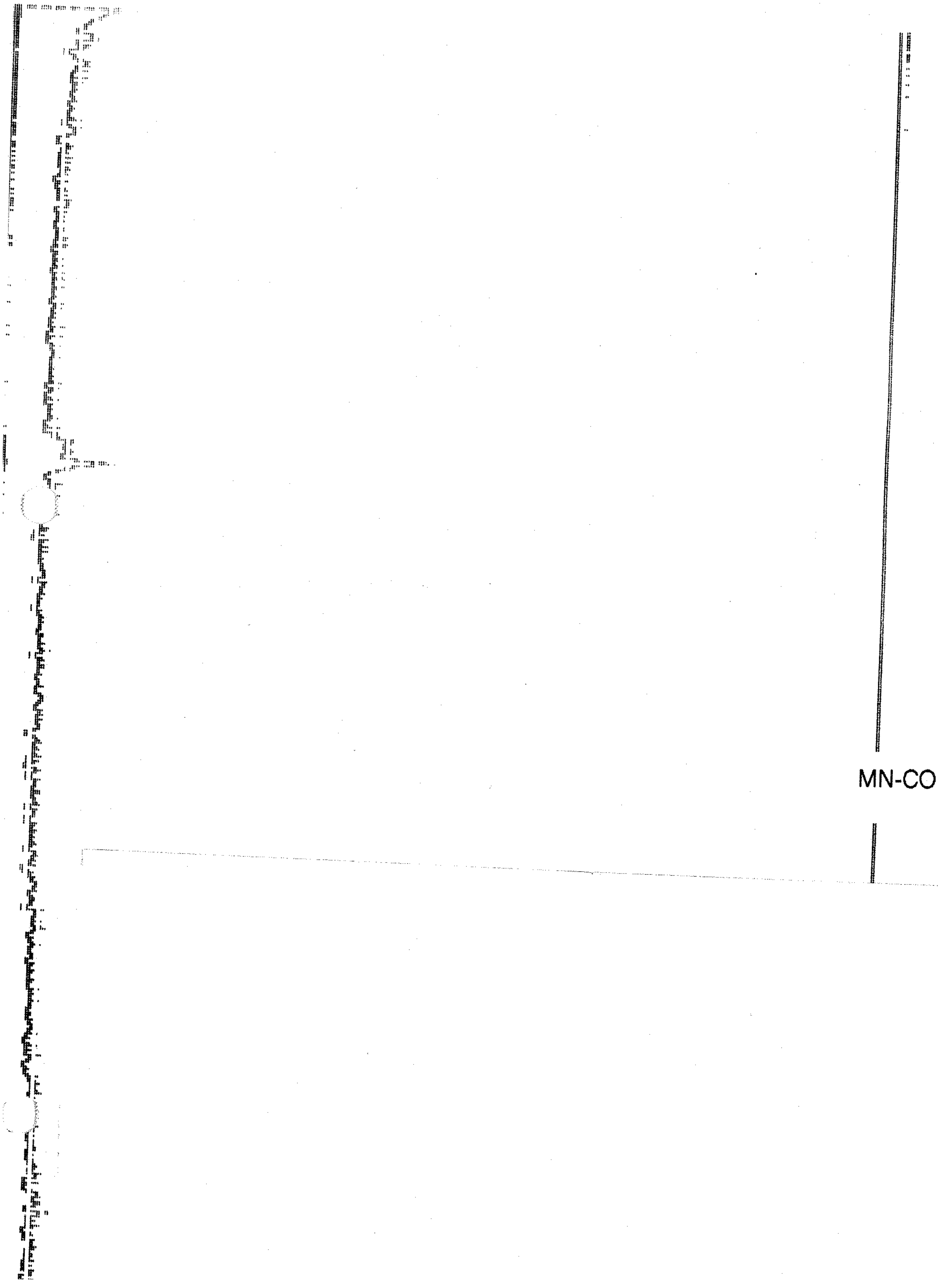
spectra recorded in PEAKFINDE

gin run SAVING ALL SPECTRA.

MPLE IDENTIFICATION 5.0ml Twin Cities - Field Blank w/Surro te Spike 5ml purge

TA ABUNDANCE FROM 35 TO 250 amu
11 cale= 5000

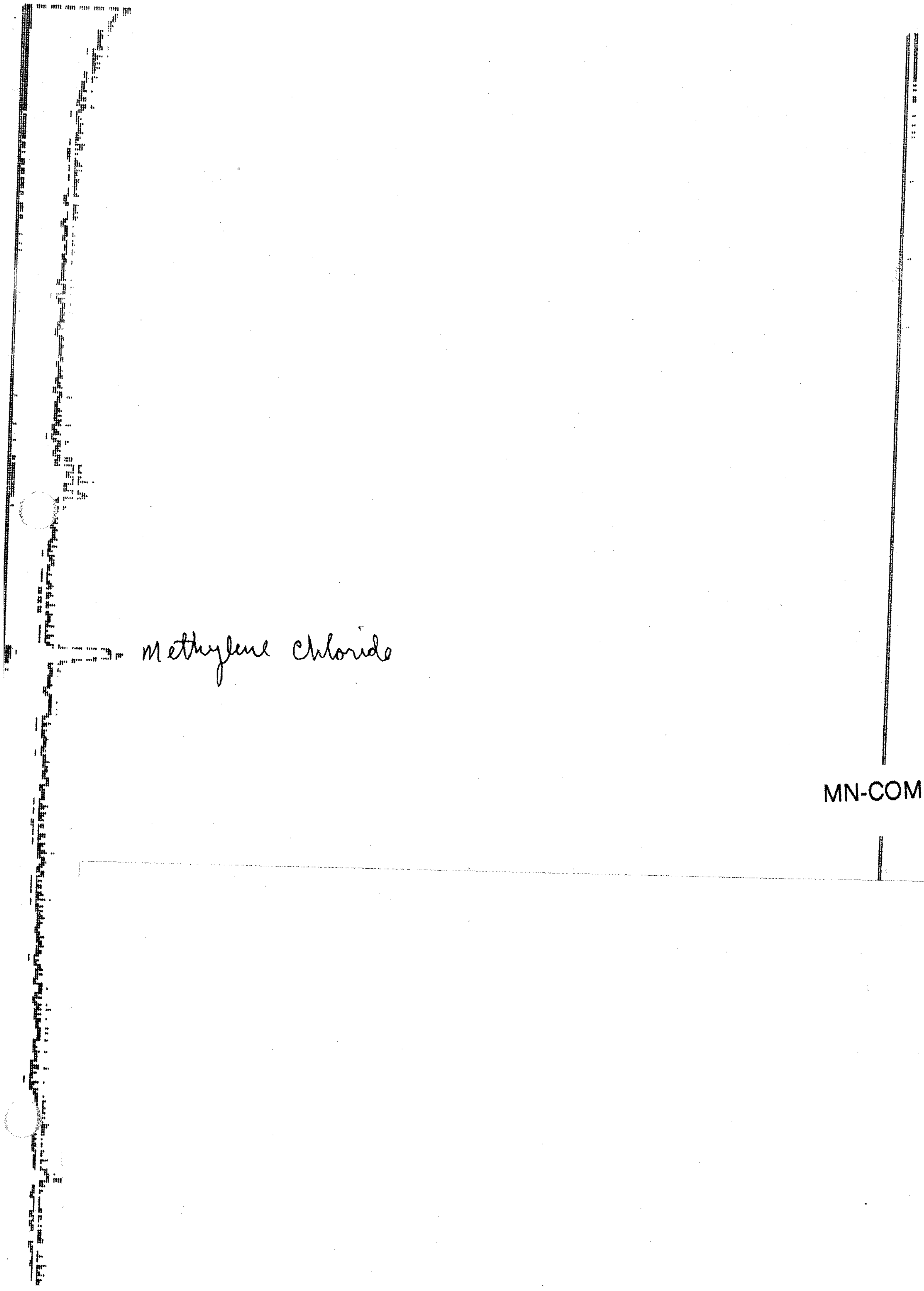
ION 91.1
Full Scale= 500



AMPLE IDENTIFICATION 5.0ml Twin Cities VOA-P sing Blank w/Surrogate Sp 5ml purg

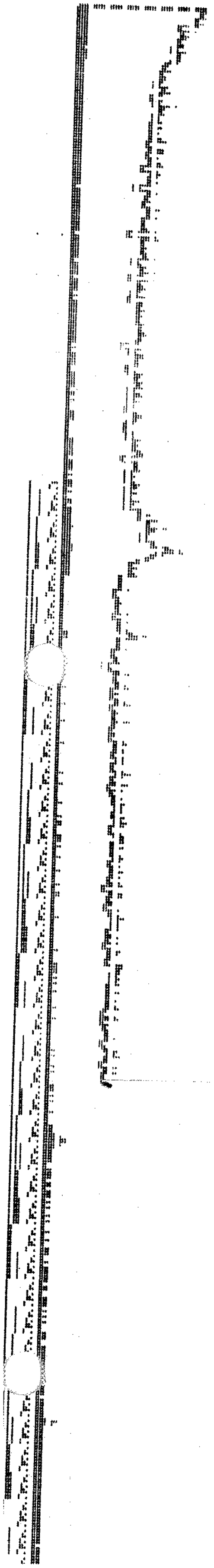
OTAL ABUNDANCE FROM 35 TO 250 amu
ull Scale= 5000

ION 51.1
Full Scale= 500

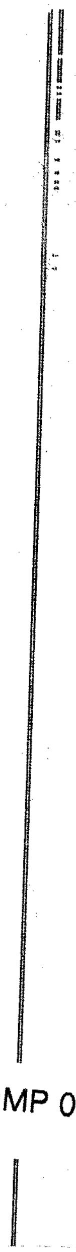


SAMPLE IDENTIFICATION same Twin Cities sampled B-1 82 w/Surrogate Sp purge 5 m

TOTAL ABUNDANCE FROM 35 TO 250 amu
Full Scale= 5000



ION 51.1
Full Scale= 500



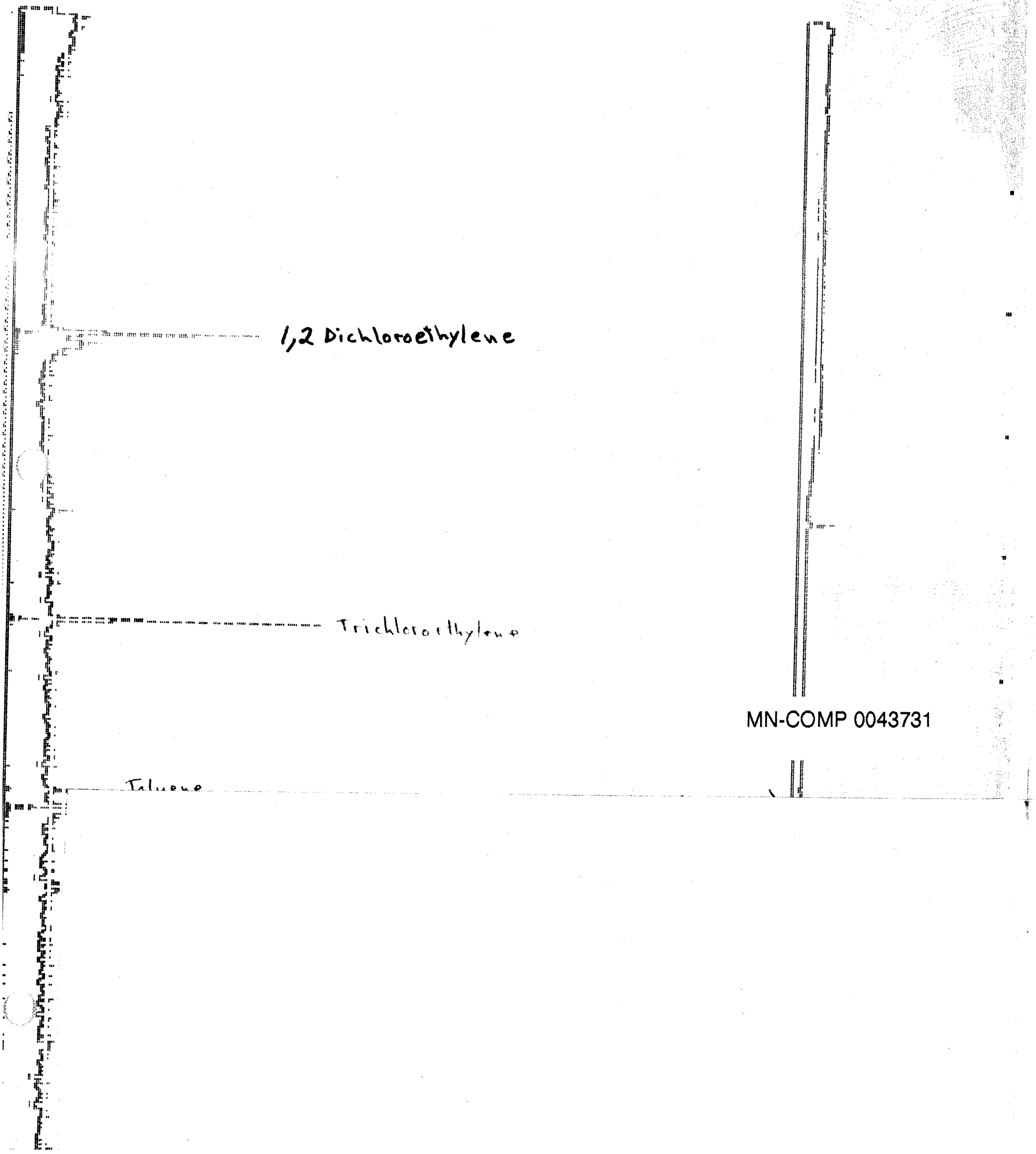
5ml purge

MPLE IDENTIFICATION_Twin Cities Well B w/25ppb 1Chloro2Bromopropane (Surrogate Spik

sampled 3-3-8

TAL ABUNDANCE FROM 45 TO 250 amu
ll Scale= 5000

ION 78.0
Full Scale= 500



seconds when saving all spe
nstripped and stripped spectra recorded in PEAKFINDER mode
egin run in PEAKFINDER MODE.

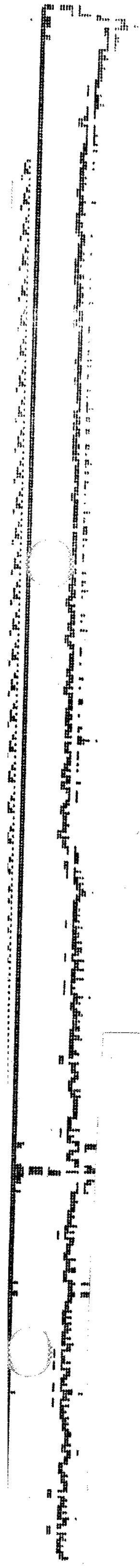
Duplicate

5ml purge

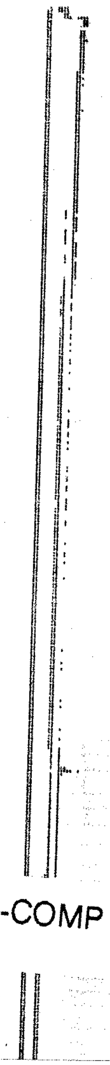
AMPLE IDENTIFICATION 5.0ml Twin Cities B-3 w/25 ppb 1chloro 2Bromo propane

[illegible] B-3 [illegible]

O ABUNDANCE FROM 45 TO 250 amu
ull Scale= 5000



ION 78.0
Full Scale= 500

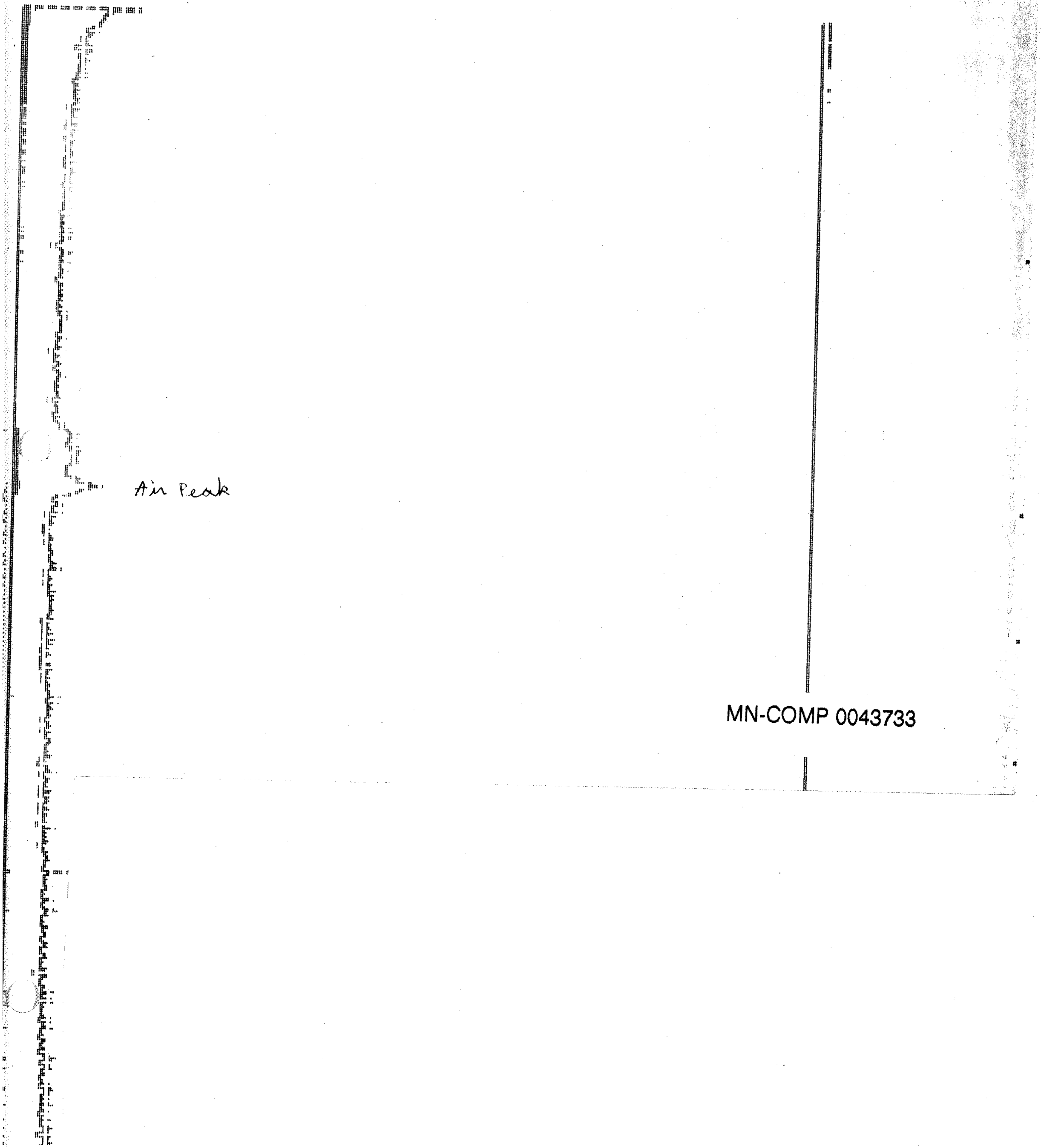


.... seconds saving all spectra.
nstripped and stripped spectra recorded in F INDER mode
egin run in PEAKFINDER MODE.

AMPLE IDENTIFICATION 5.0 ml Twin Cities Well B-4 Sampled 3-1-82 / Surrogate Spike 5ml purg

OT ABUNDANCE FROM 35 TO 250 amu
ull Scale= 5000

ION 91.1
Full Scale= 500



Standardization VCA Std 3-12-82

- 1-5ul each 1,2 Dichloroethylene, Trichloroethylene, Toluene + Xylenes in 20 mls Methanol
- 0.2ul injected into 5.0ml H_2O to be purged, giving concentrations and peak areas listed below.

Compound	Concentration in Methanol	(0.2ul inj) Concentration in 5.0ml H_2O purge	Major ions of interest ①	②	③	Peak Area under Ion ① curve
s1,2 Dichloroethylene	1.265mg/ml	50.6 ppb	95.90	60.95	98.0	2824
richloroethylene	1.4556mg/ml	58.2 ppb	129.85	132.0	95.0	6274
Toluene	0.86694mg/ml	34.7 ppb	91.05	92.0	65.0	9499
Xylenes (3 isomers)	0.8685mg/ml	34.74 ppb	106	91.05	78.0	4120
loro 2Bromopropane (Surrogate)	0.2mg/ml	125ul inj ~25 ppb	77	79	49	2121

nalytical Data - analyzed on 3/9/82

Compound		Well B-1 w/Surrogate	Well B-2 w/Surrogate	Well B-3	Well B-4 w/Surrogate
2 Dichloroethylene	PA	<100	711	<100	100
	Conc	<2 ppb	12.7 ppb	<2 ppb	<2 ppb
Trichloroethylene	PA	373	516	<100	<100
	Conc	3.5	4.8	<2	<2
Toluene	PA	390	216	<100	393
	Conc	1.4	0.8	<1	1.4
ylenes (3 isomers)	PA	<100	<100	<100	<100
	Conc	<1	<1	<1	<1

ll other VOA compounds were not detected. See Supelco A+B Std Runs for comparison page 52

loro 2Bromopropane (Surrogate)	PA	2254	2073		2044
	Conc.	~27	~24		~24

tandardization and concentration calculations were done using primary ion ① peak areas and known standard concentrations.

To Page

iessed & Understood by me,	Date	Invented by	Date
		Recorded by T. Geyer	3-12-82

TITLE Twin Cities - Groundwater & VOAs

Project No.

Book No. 2

Page No.

Data - Duplicate Runs for Samples plus Blanks

For standards values and tabulation see page 52, this bo

- Samples for Wells B-2 and B-3 were rerun on 3/17/82
Samples for Wells B-1, B-4, Field Blank & Casing Blank were run 4/12/8

Compounds		Duplicate well B-1 w/surrogate	Duplicate well B-2 w/surrogate	Duplicate well B-3 w/surrogate	Duplicate well B-4 w/surrogate	Field Blank No surrogate	Duplicate Field Blank (w/surrogate)	PVC Blank casing w/surrogate	PVC Bl casin w/surrog
1,2 Dichloroethylene	PA	<100	940	<100	<100	<100	<100	<100	<100
	Conc	<2	17.1	<2	<2	<2	<2	<2	<2
Trichloroethylene	PA	307	609	<100	<100	<100	<100	<100	<100
	Conc	2.6	5.1	<2	<2	<2	<2	<2	<2
Toluene	PA	515	274	<100	257	<100	<100	931	97
	conc.	2.0	1.0	<1	1.0	<1	<1	3.7	3.
Xylenes	PA	<100	<100	<100	<100	<100	<100	133	23
	conc.	<1	<1	<1	<1	<1	<1	<1	<1
Chloro 2 Bromopropane (Surrogate)	PA	3103	4660	4588	3234	—	4528	3648	382
	Conc								

All other VOA compounds were Less than Detection Limit, see page 52
MEK and MIBK also less than Detection Limit " "
Except Methylene Chloride (see below)

Methylene Chloride	PA	<100	<100	<100	<100	<100	<100	667	75
	Conc	<1	<1	<1	<1	<1	<1	6.0	6.

To Page

Witnessed & Understood by me	Date	Invented by	Date
			4-15-82

n Page No. Using thick coated DB-5 Fused silica capillary column and Unicon purge+trap system with 5ml purge volume

Priority Pollutant VOA compound	Concentration of Standard (ug/l)	Standard Peak Area	Primary Ion of Interest	Peak Area Threshold	Detection Limit (ug/l)
Purgables A					
Methylene Chloride	20	2210	49	100	0.9 (<1)
1,1 Dichloroethylene		504	96		4.0 (<5)
,1 Dichloroethane		2114	63		0.9 (<1)
Chloroform		2122	83		0.9 (<1)
Carbon tetrachloride		883	117		2.3 (<5)
1,2 Dichloropropane		732	63		2.7 (<5)
Trichloroethylene		2390	129.95		1.4 (<2)
,1,2 Trichloroethane		505	99		4.0 (<5)
Dibromochloromethane		734	127		2.7 (<5)
Tetrachloroethylene		1251	165.8		1.6 (<2)
Chlorobenzene		3689	112		0.5 (<1)
Purgables B					
1,2 Dichloroethylene		1098	96		1.8 (<2)
1,2 Dichloroethane		1647	62		1.2 (<2)
1,1 1 Trichloroethane		1102	97		1.8 (<2)
Bromodichloromethane		1340	83		1.5 (<2)
rans 1,3 Dichloropropene		2959	75		0.7 (<1)
s 1,3 Dichloropropene		1303	75		1.5 (<2)
Benzene		4500	78		0.4 (<1)
Bromoform		491	173		4.1 (<5)
1,2,2 Tetrachloroethane		1215	83		1.6 (<2)
Toluene		5032	91.05		0.4 (<1)
Ethyl Benzene		5876	91.05		0.3 (<1)
Purgables C					
Chloromethane		1089	50		1.8 (<2)
ichlorodifluoromethane		714	85		2.8 (<5)
Bromomethane		200	94		10.0 (<10)
Vinyl Chloride		897	62		2.2 (<5)
Chloroethane		896	64		2.2 (<5)
Others					
ethyl Isobutyl ketone	128	3208	58		0.6 (<1)
thyl Ethyl Ketone	129	426	72		4.7 (<5)
Xylenes	20	4968	91.05		0.4 (<1)

Recorded by Tom Geyer 4-15-82

Twin Cities Assembly Plant
Groundwater Monitoring Wells Survey

December 1, 1982

Stationary Source Environmental Control Office
Environmental and Safety Engineering Staff

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Schedule Number:	11.3

Twin Cities Assembly Plant
Groundwater Monitoring Wells Survey

December 1, 1982

Conducted By

Ford Motor Company
Stationary Source Environmental Control Office
Survey and Evaluation

Survey Conducted By:

E.D. Chraszcz
E. D. Chraszcz

T.J. Geyer
T. J. Geyer

Prepared By:

E.D. Chraszcz
E. D. Chraszcz

Concur:

Reinke
J. M. Reinke, Manager

RECEIVED

FEB 14 1983

MINN. POLLUTION
CONTROL AGENCY

Ford Motor Company
Environmental and Safety
Engineering Staff

One Parklane Boulevard
Dearborn, Michigan 48126

February 11, 1983

Mr. Douglass N. Day
Minnesota Pollution Control Agency
Regulatory Compliance Section
Solid and Hazardous Waste Division
1935 West County Road B2
Roseville, MN 55113

Subject: Twin Cities Assembly Plant
Waste Disposal Site--Groundwater Investigation

Dear Mr. Day:

Attached for your review is our final report covering the groundwater and Mississippi River samplings performed December 1, 1982 in the vicinity of the inactive waste disposal site at the Twin Cities Assembly Plant.

The results of groundwater elevation measurements confirm our earlier contention of a westerly groundwater flow to the Mississippi River. Accordingly, both Wells B1 and B5 can be considered upgradient wells, unaffected by the disposal site. The similarity of groundwater elevation with the Mississippi River also confirms a hydraulic connection between the two. Thus any contribution of the disposal site would undoubtedly flow into the River.

Dissolved metals in both the groundwaters and River were well below U.S. EPA Interim Drinking Water Standards. Only trace levels of five organics were detected in the groundwaters, three of which were also detected in the River upstream of the disposal site. 1,2 Dichloroethylene was detected in downgradient wells B2 and B4 at concentrations of 21 ugm/l and 8 ugm/l respectively, however none was detected in any River water samples.

In their February 26, 1982 Hydrogeologic Engineering Evaluation, Soils Testing Services estimated the groundwater flow past the disposal site to be approximately 15,000 gallons per day. Recent groundwater elevational data supports the hydraulic gradient used in their estimate. On this basis, and an estimated River flow of 6.5×10^9 gallons per day at this location, a groundwater dilution factor of 4.3×10^5 would be achieved. Thus the trace levels of 1,2 dichloroethylene detected could not present a problem to any potential user.

These findings, establish that the disposal site is not adversely affecting any water supplies and no further investigations of this site is warranted.

Very truly yours,

J.M. Reinke, Manager
Survey and Evaluation
Stationary Source Environmental
Control Office

jb
Attachment
cc: R.M.Major

Twin Cities Assembly Plant
Groundwater Monitoring Wells Survey
December 1, 1982

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I. Introduction

As part of a continuing investigation into potential groundwater contamination resulting from an old inactive disposal site at the Twin Cities Plant, the Minnesota Pollution Control Agency (MPCA) requested Ford Motor Company to install an additional groundwater well (B5) to be monitored in conjunction with the four wells currently in place. The additional well location was approved by the MPCA prior to installation. In addition, samples and elevation data of the Mississippi River were also obtained for informational purposes.

On December 1, 1982 representatives from Ford's Stationary Source Environmental Control Office (SSECO) conducted a sampling program of the groundwater in the wells. Mr. Douglas Day of the MPCA was present during the sampling to review the procedures used and to obtain split samples. As in the first survey on March 3, 1982, the parameters selected for analysis were based on a joint agreement between Ford and the MPCA and included:

- USEPA volatile priority pollutants
- Xylenes
- Methylethylketone
- Methylisobutylketone
- pH
- Specific conductivity
- Dissolved heavy metals (Cd,Cr,Pb,Cn,Ni,Zn)

II. Site Description and Well Locations

The disposal site was used by the plant to dispose of construction rubble, paint sludges and old paints and solvents. It has not been used since 1965. For a thorough description of the plant site, refer to the report dated March 3, 1982.

Figure 1 shows the location of the original 4 monitoring wells and the location of the recently installed 5th well. Well B5 was installed on November 30, 1982. The well casing is 2" schedule 80 PVC pipe with the lower 10' of casing slotted and wrapped with Miarafi 140S fabric. Detailed information on the procedures used for installing the well and the well boring log can be obtained from the report of Soil Testing Services of Minnesota dated December 14, 1982 contained in Appendix D.

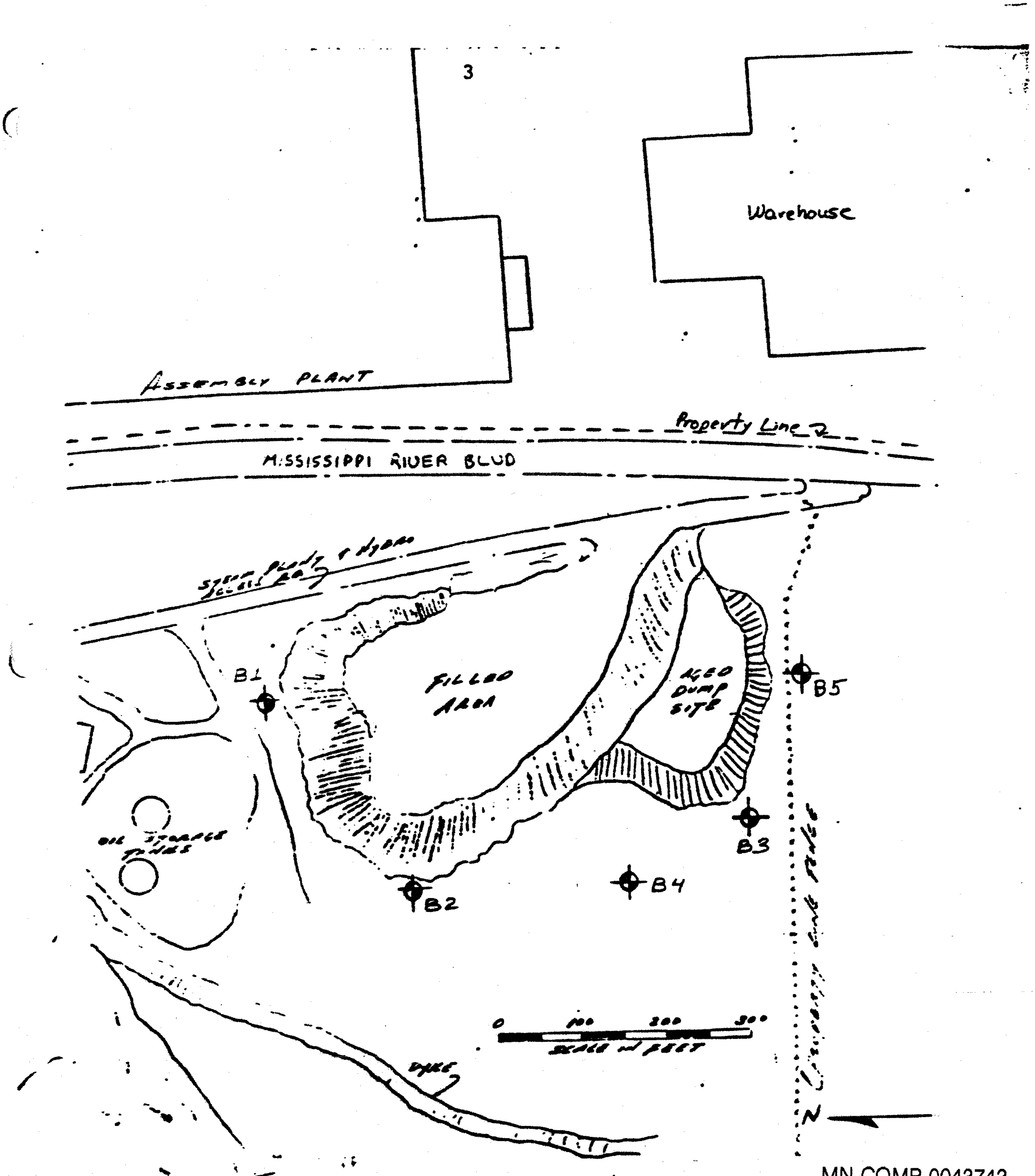


Figure 1
Twin Cities Assembly Plant
Site and Well Location

III. Summary

A summary of the results from the well and river sampling appears in Table I. On the basis of static water level measurements, Wells B1 and B5 should be considered upgradient wells. These wells appear to be unaffected by the disposal site while Wells B2, B3 and B4 are downgradient of the disposal site.

As indicated by the data, metals concentrations in the groundwater from the wells and the samples from the river are consistently low, significantly below USEPA Interim Drinking Water Standards. Only trace levels of five volatile organic compounds were detected in the wells, three of which were also detected in the river both upstream and downstream of the site.

Table 1

Groundwater Analysis Summary
December 1, 1982

		Well					River		
Dissolved Metals		B1	B2	B3	B4	B5	R1[1]	R2[1]	R3[1]
Copper	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	mg/l	0.003	0.003	0.003	0.005	<0.001	<0.001	0.001	
Zinc	mg/l	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05
Nickel	mg/l	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	mg/l	0.005	0.005	0.004	0.006	0.003	<0.002	<0.002	<0.002
pH	Units	7.1	8.6	9.0	8.2	8.4	8.5	8.6	
Specific Conductivity	Umhos/cm	982	1210	1260	1580	942	377	380	
Temperature	°F.	47	51	52	53	51	34	33	
Volatile Organics Detected									
1,2-Dichloroethylene	µg/l	ND	22.0	< 2	6.7	ND	ND	ND	ND
Benzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/l	2.1	<1	<1	<1	<1	3	<1	<1
Chlorobenzene	µg/l	ND	ND	<1	<1	ND	ND	ND	ND
Xylene(3 isomers)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1

averaged from 2 samples

Note 1:

R1--Mississippi River upstream of Ford Power Plant.
R2--Mississippi River near southern property boundary.
R3--Mississippi River in park approx. 200 yds. south of Ford property.

IV. Results

At the time of Well B5 installation, the PVC casings of all wells were resurveyed by Soil Testing Services. This information was used to determine if any settling of well casings had occurred. The survey was completed on December 1, 1982. Static head measurements taken on December 1, in conjunction with updated well elevations, now provide a clearer picture of groundwater flow direction. Listed below are both the new and original casing elevations.

Table 2

Well Casing Elevations

	January 1982	December 1982
Well B1	730.52	730.49
B2	718.96	718.75
B3	704.85	704.67
B4	708.63	708.48
B5		703.81
*BM-1		691.75
*BM-2		691.81
*Lath		698.57

*BM-1 In river approximately 20' from southern fence line.
*BM-2 In river approximately 50' north of BM-1.
*Lath On river bank near BM-2.

Additionally, three locations were established in and along the river to monitor river elevations. STS installed a lath on the river bank and two metal benchmark stakes in the river. The site plan in the attached STS report illustrates the location of the new benchmarks.

IV. Results (Cont.)

Listed below are the static water levels as measured on December 1, 1982.

Table 3

Groundwater Level Data

Well No.	Static Water Levels 12/1/82
B1	691.85
B2	691.13
B3	691.42
B4	691.58
B5	691.96
River	
BM-1	691.42

Based on the groundwater elevations, the flow appears to be moving westerly toward the river as illustrated in Figure 2. This direction supports our original contention that Well B1 is an upgradient well and, in addition, confirms that Well B5 is likewise an upgradient well.

The river elevation was determined at 9:00 am on December 1, (691.21) and at 2:15 pm (691.42). Although the elevation increased by .21 the water level in Well B4 showed no appreciable change. There may be a delay, however, associated with correlating river and well elevations which could not be determined during this survey.

On December 1, 1982 SSECO collected samples of Mississippi River water in order to analytically compare river water to well water. Samples were collected upstream of the Ford powerplant and downstream near the southern boundary of Ford property and approximately 200 yards

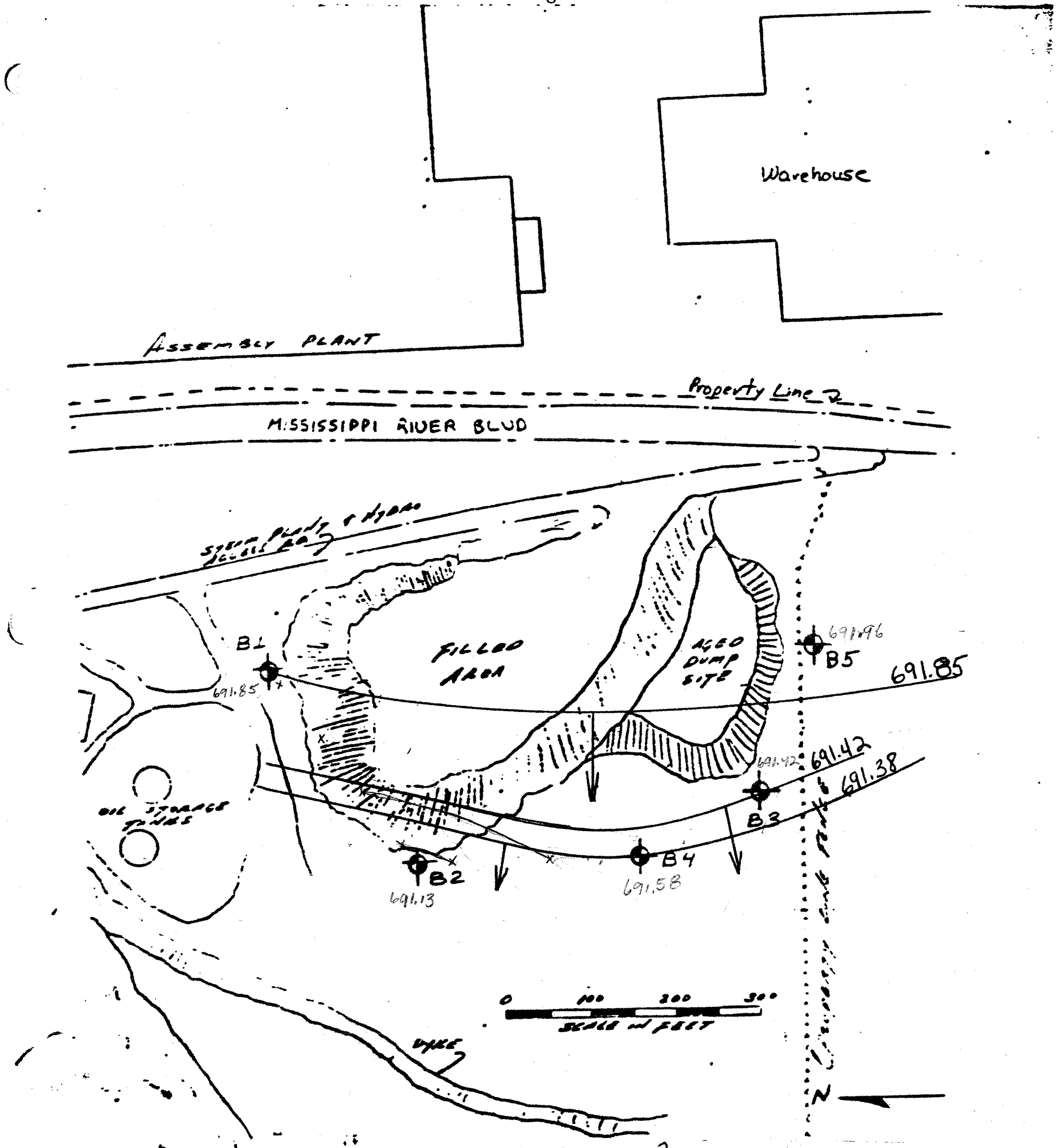


Figure 2
Twin Cities Assembly Plant
Ground Water Elevations And Flow Direction

IV. Results (Cont.)

south of the property, in the park. The results are shown in Table 4. Only trace levels of these organics were detected. Dissolved metals were all below detectable levels.

Specifications regarding the exact method of analysis with respect to metals and organics can be found in Appendix B together with the detection levels associated with each procedure.

The results of the dissolved metals analyses appear in Table 5 .

Table 6 contains the results of analyses for the volatile organic compounds. As indicated, the samples were run in duplicate and the results show acceptable agreement.

Table 4

Twin Cities Assembly Plant
River Sampling Results
December 1, 1982

	Units	River Upstream of Power Plant	River Downstream on Ford Property	River Downstream in Park
Dissolved Metals				
Copper	mg/l	<0.05	<0.05	<0.05
Cadmium	mg/l	<0.001	0.001	
Zinc	mg7l	<0.05	<0.05	<0.05
Nickel	mg/l	<0.02	<0.02	
Chromium	mg/l	<0.05	<0.05	<0.05
Lead	mg/l	<0.002	<0.002	<0.002
pH	units	8.5	8.6	
Specific Conductivity	umhos/cm	377	380	
Temperature	°F.	34	33	
Volatile Organics				
1,2-Dichloroethylene	μg/l	ND	ND	ND
Benzene	μg/l	<1	<1	<1
Toluene	μg/l	3.0	<1	<1
Chlorobenzene	μg/l	ND	ND	ND
Xylene	μg/l	<1	<1	<1

Table 5

Twin Cities Assembly Plant
Groundwater Analysis Summary
Dissolved Metals Results

Dissolved Metals	Units	B1	B2	B3	B4	B5
Copper	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/l	0.003	0.003	0.003	0.005	<0.001
Zinc	mg/l	<0.05	<0.05	<0.05	0.06	<0.05
Nickel	mg/l	0.06	<0.02	<0.02	<0.02	<0.02
Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	mg/l	<0.005	0.005	0.004	0.006	0.003
pH	Units	7.1	8.6	9.0	8.2	8.4
Specific Conductivity	Umhos/cm	982	1210	1260	1580	942
Temperature	°F.	47	51	52	53	51

Table 6

Twin Cities Assembly Plant
Groundwater Analysis Summary
Volatile Organic Results

	Units	B1	B1 Duplicate	B2	B2	B3	B3	B4	B4	B5	B5
1,2-Dichloroethylene	µg/l	ND	ND	21.3	22.6	ND	<2	8.1	5.3	ND	ND
Benzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/l	1.9	2.2	1.1	<1	<1	1.6	0.6	<0.1	0.6	0.5
Chlorobenzene	µg/l	ND	ND	ND	ND	<1	<1	<1	<1	ND	ND
Xylene (3 isomers)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Appendix A

Sampling Procedures

Appendix A

Sampling Procedures

Prior to sampling, static water level determinations were made. Based on the static and the depth of each well, the volumes of water in each well casing was calculated. Each well was then cleared to remove three times the calculated water volume. Wells B1, B2 and B5 were cleared by manual methods utilizing a stainless steel bailer. Wells B3 and B4 were not as deep and therefore could be cleared with a peristalic pump and Tygon tubing suction line. Once clearing was completed, the static water level was again determined and the samples were withdrawn from the wells with a stainless steel bailer. Table 7 represents some of the pertinent well data as it relates to the monitoring survey.

In order to avoid either cross contamination or contamination from extraneous sources, the stainless steel bailer was subjected to a thorough cleaning before being immersed in a well. The bailer was first rinsed with organic free water followed by a methanol rinse and finally a second rinse with organic free water. Also, at each well a new section of braided nylon line was attached to the bailer for sampling purposes.

The wells were sampled in the following order: Wells B3, B4, B2, B1, and B5. Well B3 was sampled first since the first sampling indicated no detectable levels of trace organics. Samples for volatile priority pollutants plus xylenes, methylethyl ketone, and methylisobutyl ketone were collected by transferring some of the sample from the bailer to the individual volatile organic sampling vials. Care was taken to avoid

Table 7

Twin Cities Assembly Plant
Survey of Groundwater Monitoring Wells
December 1, 1982
Well Data

Well Number	Time Sampled	Casing Top Elevation (ft)	Static Water Level (ft)	Casing Depth (ft)	Well Volume (liters)	Amount Water Removed (liters)	Static After Bailing (ft)
B1	12:05 pm	730.49	38'7-3/4"	53'6½"	8	24	38'7"
B2	11:45 am	718.75	27'7-7/16"	46'9"	10	30	27'6-3/4"
B3	10:55 am	704.67	13'3"	27'3½"	7.6	23	13'2-5/8"
B4	11:20 am	708.48	17'1¼"	30'10"	7.4	22	17'1"
B5	12:40 pm	703.81	11'10¼"	24'8"	6.9	21	11'11"

Appendix A (Cont.)

both unnecessary agitation of the sample and air bubbles trapped in the sealed vial. Volatile samples were maintained at 4°C. until analysis. A second portion of the sample was filtered through a 0.45 micron filter on site and the filtrate acidified to pH2. This sample was analyzed for dissolved metals. PH, conductivity and temperature determinations were performed on site.

Appendix B

Analytical Procedures

Temperature, pH and specific conductivity were determined on site using a Horiba Model U-7 water analyzer. Metals determinations were made using an Instrument Laboratory (IL) 151 atomic absorption spectrometer. Additionally, a Model 453 IL graphite furnace was employed for the determination of lead. Listed below are the detection limits:

Metals Detection Limits (mg/l)

Copper	0.05
Lead	0.002
Cadmium	0.001
Zinc	0.05
Nickel	0.02
Chromium	0.05

The low detection limits for nickel and cadmium were achieved on the flame unit by concentrating the sample by a factor of 10.

Appendix B (Cont.)

Volatile organic concentrations were measured utilizing a Hewlett Packard HP 5992 GC/MS, incorporating a thirty meter, fused Silica, thick coat, DB-5 capillary column. The GC/MS was used in conjunction with an Envirochem Unicon purge and trap device and a Hewlett Packard dual floppy disc data storage system. The detection limits listed below were determined by the lower peak area threshold limit, which is set by the analytical program used.

Priority Pollutant VOA Compound	Detection Limit(ppb)	Priority Pollutant VOA Compound	Detection Limit(ppb)
Purgeables A		Purgeables B	
Methylene Chloride	< 1	1,2 Dichloroethylene	< 2
1,1 Dichloroethylene	< 5	1,2 Dichloroethane	< 2
1,1 Dichloroethane	< 1	1,1,1 Trichloroethane	< 2
Chloroform	< 1	Bromodichloromethane	< 2
Carbon tetrachloride	< 5	trans 1,3 Dichloropropene	< 2
1,2 Dichloropropane	< 5	cis 1,3 Dichloropropene	< 2
Trichloroethylene	< 2	Benzene	< 1
1,1,2 Trichloroethane	< 5	Bromoform	< 5
Dibromochloromethane	< 5	1,1,2,2 Tetrachloroethane	< 2
Tetrachloroethylene	< 2	Toluene	< 1
Chlorobenzene	< 1	Ethyl Benzene	< 1

Priority Pollutant VOA Compound	Detection Limit(ppb)
Purgeables C	
Chloromethane	< 2
Dichlorodifluoromethane	< 5
Bromomethane	< 10
Vinyl Chloride	< 5
Chloroethane	< 5
Others	
Methyl Isobutyl Ketone	< 1
Methyl Ethyl Ketone	< 5
Xylenes	< 1

Appendix C

Field Data Sheets

GROUNDWATER MONITORING SAMPLING DATA SHEET

Plant Twin Cities

Date 12-1-82

Well # B-1

Reason for Sampling Required monitoring

Person Sampling E.C., T.G.

Laboratory Handling

Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 730.49

Casing Material PVC

Casing Depth 53'6½" (642.5")

Metal Gaurd Elevation None

Screen Material PVC

Casing Diameter 1⅞"

Static Water Level 38'7¾" (463.75")

Well Volume 8 Liters

Type of Well Verticle

Location of Well North edge of bluff

Up- or Downgradient

II. Well Clearing Data

Device Used stainless steel bailer

Material of Construction stainless steel

Volume of Water Removed 24 Liters

III. Sampling Data

Significant Weather Conditions

Barometric Pressure

Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
VOA		VOA vials	Cool to 4°C	14 days
Diss Metals		250ml plastic	HNO_3	6 mos

IV. Field Data

Well Volume (3.14 x .01639 x r^2 x h) 3.14 x .01639 x .879 x 178.75 = 8 Liters

Analytical Results: Temperature 47°F Ph 7.08 Conductivity 982 micromhos/cm

Notes: static before sampling 38'7" Time of sampling 12:05 pm

GROUNDWATER MONITORING SAMPLING DATA SHEET

Plant Twin Cities
Date 12-1-82
Well # B-2

Reason for Sampling Required monitoring
Person Sampling E.C., T.G.
Laboratory Handling
Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 718.75
Casing Material PVC
Casing Depth 46'9" (561")
Metal Gaurd Elevation None

Screen Material PVC
Casing Diameter 1 7/8
Static Water Level 27'7 7/16" (331.44")
Well Volume 10 Liters

Type of Well Verticle
Location of Well Northwest edge of bluff

Up- or Downgradient

II. Well Clearing Data

Device Used stainless steel bailer
Material of Construction stainless steel
Volume of Water Removed 30 Liters

III. Sampling Data

Significant Weather Conditions
Barometric Pressure

Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
VOA		VOA vials	Cool to 4°	14 days
Diss. metals		250 ml plastic	HNO_3	6 mos

IV. Field Data

Well Volume (3.14 x .01639 x r^2 x h) 3.14 x .01639 x .879 x 229.56 = 10 Liters

Analytical Results: Temperature 51°F Ph 8.6 Conductivity 1210 microhms/cm

Notes: static before sampling 27'6 3/4" Time of sampling 11:45 am

GROUNDWATER MONITORING SAMPLING DATA SHEET

Plant Twin Cities
Date 12-1-82
Well # B-3

Reason for Sampling Required monitoring
Person Sampling E.C., T.G
Laboratory Handling
Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 704.67
Casing Material PVC
Casing Depth 27'3½" (327.5")
Metal Gaurd Elevation None
Type of Well Verticle
Up- or Downgradient

Screen Material PVC
Casing Diameter 1 7/8"
Static Water Level 13'3" (159")
Well Volume 7.6 Liters
Location of Well South edge of bluff

II. Well Clearing Data

Device Used Peristalic Pump
Material of Construction silicon tubing
Volume of Water Removed 23 Liters

III. Sampling Data

Significant Weather Conditions
Barometric Pressure

Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
VoA		VoA vials	Cool to 4°C	14 days
Diss Metals		250ml plastic	HNO_3	6 mos

IV. Field Data

Well Volume (3.14 x .01639 x r^2 x h) 3.14x .01639 x .879 x 168.5 = 7.6 Liters

Analytical Results: Temperature 52°F Ph 9.0 Conductivity 1260 mkrohms/cm

Notes: static before sampling 13'2 5/8" Time of samping 10:55 AM

GROUNDWATER MONITORING SAMPLING DATA SHEET

Plant Twin Cities

Date 12-1-82

Well # B-4

Reason for Sampling Required monitoring

Person Sampling E.C., T.G.

Laboratory Handling

Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 708.48

Casing Material PVC

Casing Depth 30'10" (370")

Metal Gaurd Elevation None

Screen Material PVC

Casing Diameter 1 7/8"

Static Water Level 17'1¼" (205.25")

Well Volume 7.4 Liters

Type of Well Verticle

Location of Well Southwest edge of bluff

Up- or Downgradient

II. Well Clearing Data

Device Used Peristalic Pump

Material of Construction Silicon Tubing

Volume of Water Removed 22 Liters

III. Sampling Data

Significant Weather Conditions

Barometric Pressure

Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
VOA		VOA vials	Cool to 4°C	14 days
Diss. metals		250 ml plastic	HNO_3	6 mos

IV. Field Data

Well Volume (3.14 x .01639 x r^2 x h) 3.14 x .01639 x .879 x 164.75 = 7.4 Liters

Analytical Results: Temperature 53°F Ph 8.2 Conductivity 1580 mkRohms/cm

Notes: Static before sampling 17'1" Time of sampling 11:20 am

GROUNDWATER MONITORING SAMPLING DATA SHEET

Plant Twin Cities

Date 12-1-82

Well # B-5

Reason for Sampling Required monitoring

Person Sampling E.C., T.G

Laboratory Handling Analysis SSECO

I. Well Data USGS Coordinates

Casing Elevation 703.81

Casing Material PVC

Casing Depth 24'8" (296")

Metal Gaurd Elevation None

Screen Material PVC

Casing Diameter 1 7/8"

Static Water Level 11'10¼" (142.25")

Well Volume 6.9 Liters

Type of Well Verticle

Location of Well South edge of bluff off property

Up- or Downgradient

II. Well Clearing Data

Device Used Stainless Steel bailer

Material of Construction Stainless steel

Volume of Water Removed 21 Liters

III. Sampling Data

Significant Weather Conditions

Barometric Pressure

Sample Parameters	Sample Equipment	Container and Volume	Sample Preservative	Holding Time
VOA		VOA vials	cool to 4°C	14 days
Diss. metals		250 ml plastic	HNO_3	6 mos

IV. Field Data

Well Volume (3.14 x .01639 x r^2 x h) 3.14 x .01639 x .879 x 153.75 = 6.9 Liters

Analytical Results: Temperature 51°F Ph 8.4 Conductivity 942 microhms/cm

Notes: Static before sampling 11'11" Time of sampling 12:40 pm

Appendix D

STS Consultants Well Drilling Report

STS Consultants Ltd.
2405 Annapolis Lane
Minneapolis, Minnesota 55441
(612) 559-1900

December 14, 1982

Mr. David Cloutier
Ford Motor Company
Twin Cities Assembly Plant
966 S. Mississippi River Blvd.
St. Paul, Minnesota 55101

STS Job No. 92776-B

RE: Installation of Monitoring Well B-5A at the Twin Cities Assembly Plant's Steam Plant.

Dear Mr. Cloutier:

In accordance with your Purchase Order No. 763889 dated October 25, 1982, we have completed the soil boring and monitoring well installation at location B-5A. We have also resurveyed the top of the 2 inch ID Schedule 80 PVC monitoring wells at locations B-1, B-2, B-3 and B-4. In addition, we have established three vertical control points near the bank of the Mississippi River west of the disposal site.

Three copies of this letter have been sent to the above address and carbon copies have been sent to the personnel designated below. The letter is accompanied by the Log of Boring No. B-5A, the Monitoring Well Construction Diagram for location B-5A, a site plan showing the new well location and new vertical control points along the bank of the Mississippi River, and a summary of the elevation survey completed November 30, 1982.

If we can be of further assistance to you, please do not hesitate to contact us.

Yours very truly,

STS CONSULTANTS, LTD.

Harvey A. Gullicks

Harvey A. Gullicks, P.E.
Project Engineer

James H. Overtoom

James H. Overtoom, P.E.
Principal Engineer

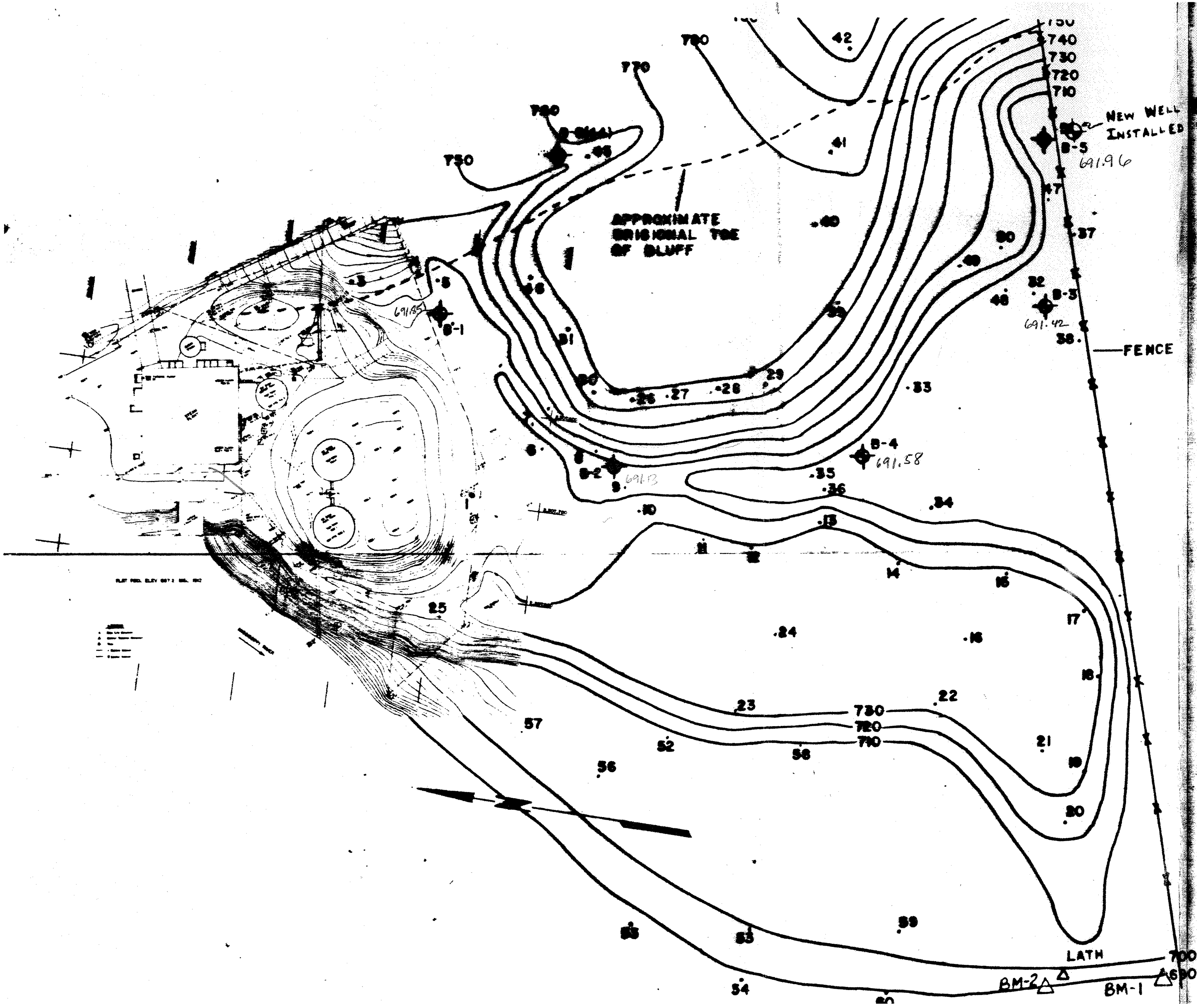
HAG/aec

Enclosures: Site Plan
Boring Log B-5A
Well Construction Diagram B-5A
Elevation Survey Results
General Notes
Unified Soil Classification System
ASTM Specification D-1586

cc: Mr. Jim Reinke, Manager - Survey and Evaluation
Stationary Source Environmental Control Office
Ford Motor Company - Suite 628
Parkland Towers West
Dearborn, Michigan 48126

Mr. A. M. Twilley
Ford Motor Company
Body and Assembly General Office
P. O. Box 1586 - Room C-280
Dearborn, Michigan 48121

Mr. Nick Eliades
Ford Motor Company
Body and Assembly General Office
P. O. Box 1586
Dearborn, Michigan 48121



SCALE IN FEET

0 50 100 150 200 250

LEGEND

SOIL BORING

GROUND SURFACE CONTOUR

SOIL BORING AND MONITORING WELL INSTALLATION

△ BENCHMARK ESTABLISHED AT MISSISSIPPI RIVER 11/30/82

SITE PLAN
FORD MOTOR COMPANY
TWIN CITIES ASSEMBLY PLANT
DATE: 1-21-82
STS JOB NO. 92776

REVISED 12/13/82 [illegible]

LOG OF BORING NO. B-5A

OWNER
FORD MOTOR COMPANY, St. Paul, MN

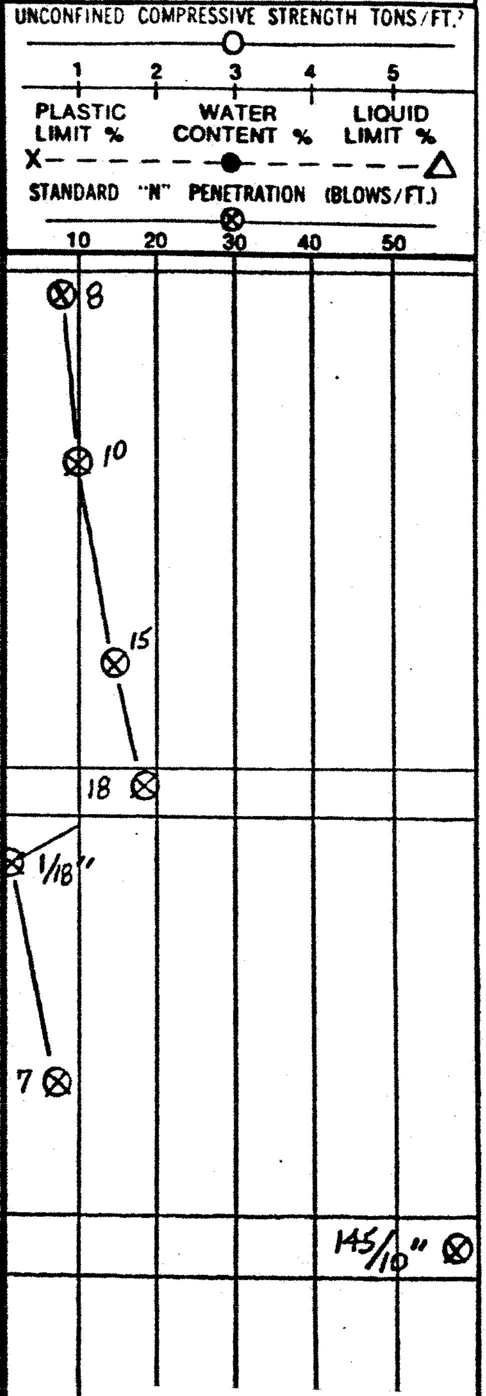
ARCHITECT-ENGINEER

SITE
Twin Cities Assembly Plant
966 S. Mississippi River Blvd.

PROJECT NAME
Hydrogeologic Study

SURFACE ELEVATION ↴ 702

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
	1	SS			Topsoil - silty sand - (OL)	
	1A	SS				
5.0'	2	SS			Fine to coarse sand, little to some gravel, trace to little cobbles, trace silt - brown - moist - medium dense - (SP)	
10.0'	3	SS				
	4	SS				
	4A	SS			Silty fine to coarse sand, some gravel and trace clay and cobbles - light brown to yellowish brown - wet to saturated - medium dense - (SM-SC)	
15.0'	5	SS				
20.0'	6	SS			Silty fine to medium sand, some gravel, little clay, trace cobbles - yellowish brown - saturated - loose to medium dense - (SC-ML) Note: With thin clean seams of fine sand - PROBABLE Weathered and Reworked ST. PETER SANDSTONE	
25.0' 25.4	7	SS			St. Peter Sandstone	
30.0'					End of boring at 25.4 ft. Boring augered to full depth using hollow stem augers. No wash water used while drilling. 2 inch ID PVC well installed (see attached diagram).	

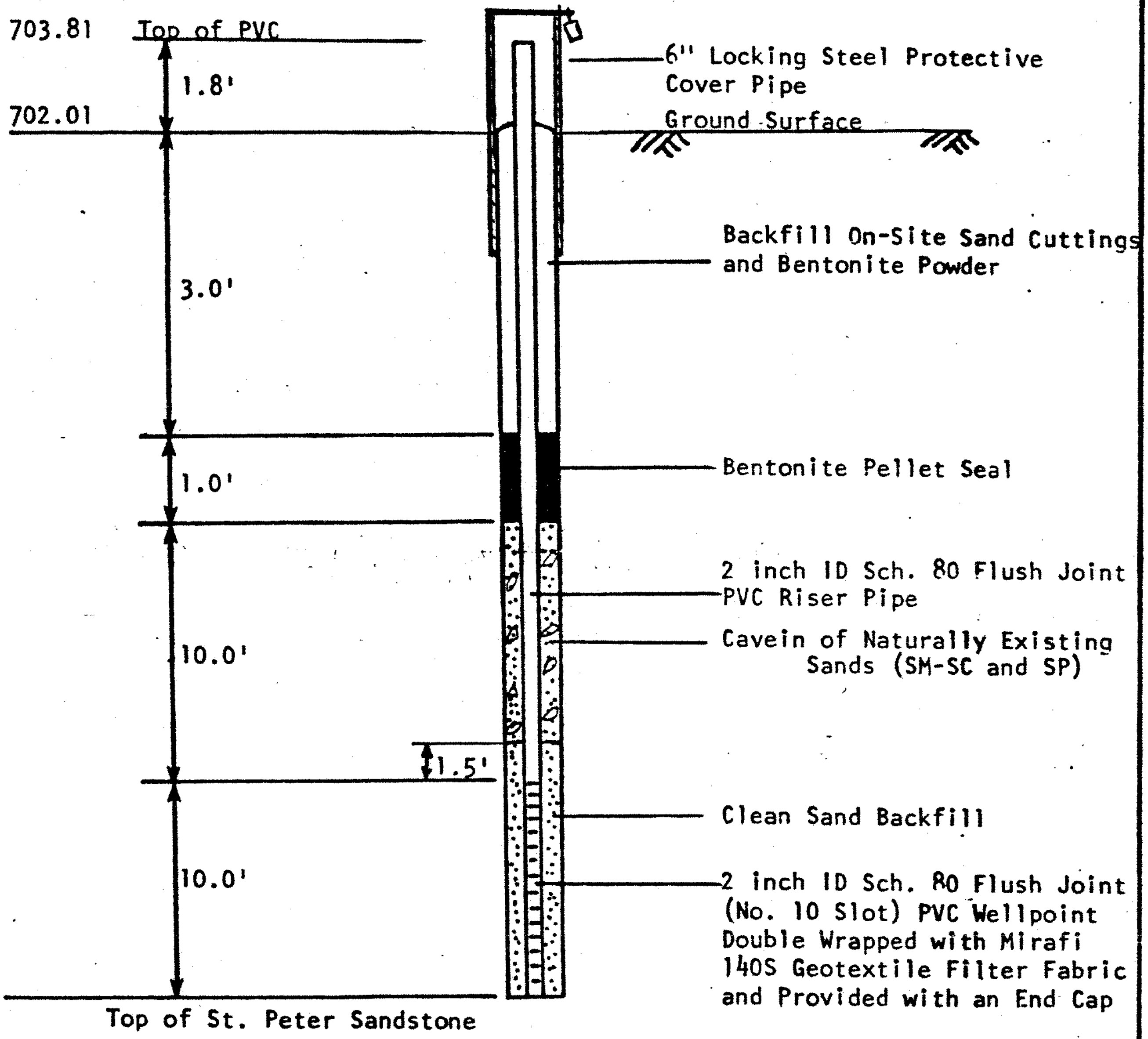


WATER LEVEL OBSERVATIONS		
W.L.	13.5 ft. WS	
W.L.	B.C.R.	A.C.R.
W.L.		

STS CONSULTANTS, LTD.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED	11/30/82		
BORING COMPLETED	11/30/82		
RIG	CME-75	FOREMAN	DW
DRAWN	HAG	APPROVED	HAG
JOB #	92776-B	SHEET	1 of 1

The stratification lines represent the approximate boundary



CONSTRUCTION DIAGRAM

No Scale

FORD MOTOR COMPANY
Monitoring Well B-5A
Installed 11/30/82

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

HAG		92776-B	12/13/82

ELEVATION SURVEY
11/30/82
FORD MOTOR COMPANY
STS Job No. 92776-B

Station	Point of Reference	Elevation
B-1	Top of PVC Pipe	730.49*
B-2	Top of PVC Pipe	718.75*
B-3	Top of PVC Pipe	704.67
B-4	Top of PVC Pipe	708.48
B-5A (New Well)	Top of PVC Pipe	703.81
	Ground Surface	702.01
BM-1 South One at River	Top of Metal Tube	691.75
BM-2 North One at River	Top of Metal Tube	691.81
River Elevation on 11/30/82		691.35
Top of Lathe on Bank of River		698.57

Note: Starting point of survey B-1 top of PVC assumed to be 730.52 ± 0.1 ft. on 11/30/82 based on previous survey. All other elevations relative to B-1 top of PVC.

* Elevation after cutting off:

0.03 ft. at B-1
0.10 ft. at B-2

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon - 1 3/8" I.D., 2" O.D. Unless otherwise noted
ST : Shelby Tube - 2: O.D., Unless otherwise noted
PA : Power Auger
DB : Diamond Bit - NX, BX, AX
AS : Auger Sample
JS : Jar Sample
VS : Vane Shear
OS : Osterberg Sampler - 3" Shelby Tube
HS : Hollow Stem Auger
WS : Wash Sample
FT : Fish Tail
RB : Rock Bit
BS : Bulk Sample
PM : Pressuremeter Test, In-Situ
GS : Giddings Sampler

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WS : While Sampling
WD : While Drilling
AB : After Boring
WCI : Wet Cave In
DCI : Dry Cave In
BCR : Before Casing Removal
ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of ground water elevations may not be possible, even after several days of observations; additional evidence of ground water elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY:

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component Of Sample	Size Range	Descriptive Term Of Components Also Present in Sample	Percent Of Dry Weight
Boulders	Over 8 in. (200 mm)	Trace	1 - 9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10 - 19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20 - 34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35 - 50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

CONSISTENCY OF COHESIVE SOILS:

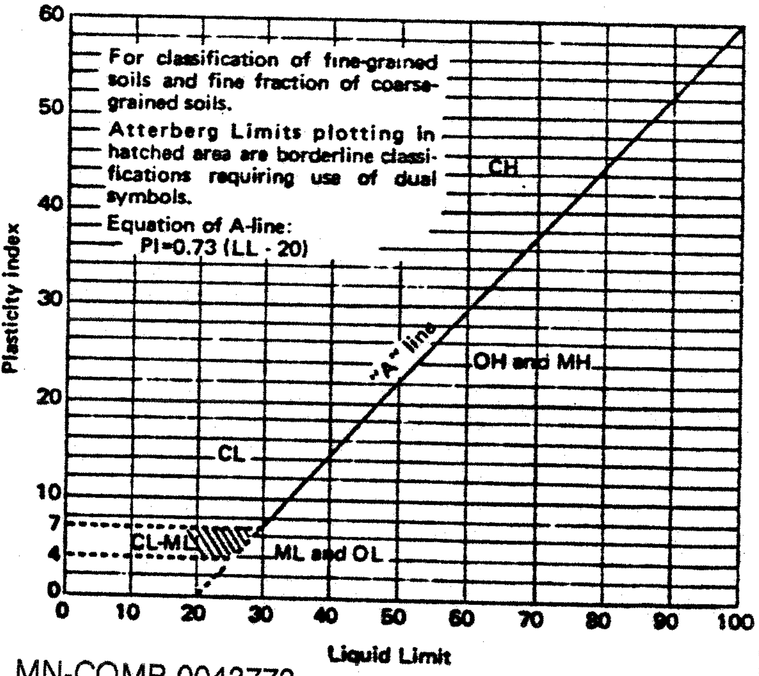
Unconfined Compressive Strength, Qu, tsf	Consistency
< 0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Medium (Firm)
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
4.00 - 8.00	Hard
> 8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS:

N - Blows per ft.	Relative Density
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
80+	Extremely Dense

UNIFIED SOIL CLASSIFICATION SYSTEM

Major divisions			Group symbols		Typical names	Laboratory classification criteria		
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent . . . . .GW, GP, SW, SP More than 12 per cent . . . . .GM, GC, SM, SC 5 to 12 per cent . . . . *Borderline* cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM	d	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	d	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half of material is *smaller* than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
Highly organic soils			Pt		Peat and other highly organic soils			



For classification of fine-grained soils and fine fraction of coarse-grained soils.

Atterberg Limits plotting in hatched area are borderline classifications requiring use of dual symbols.

Equation of A-line:
PI=0.73 (LL - 20)

lasticity Chart

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
Reprinted from Copyrighted 1968 Book of ASTM Standards, Part 11

Standard Method for

PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS[1]

ASTM Designation: D 1586 – 67

This Standard of the American Society for Testing and Materials is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 This method describes a procedure for using a split-barrel sampler to obtain representative samples of soil for identification purposes and other laboratory tests, and to obtain a measure of the resistance of the soil to penetration of the sampler.

2. Apparatus

2.1 *Drilling Equipment*—Any drilling equipment shall be acceptable that provides a reasonably clean hole before insertion of the sampler to ensure that the penetration test is performed on undisturbed soil, and that will permit the driving of the sampler to obtain the sample and penetration record in accordance with the procedure described in 3. Procedure. To avoid "whips" under the blows of the hammer, it is recommended that the drill rod have a stiffness equal to or greater than the A-rod. An "A" rod is a hollow drill rod or "steel" having an outside diameter of $1\frac{5}{8}$ in. or 41.2 mm and an inside diameter of $1\frac{1}{8}$ in. or 28.5 mm, through which the rotary motion of drilling is transferred from the drilling motor to the cutting bit. A stiffer drill rod is suggested for holes deeper than 50 ft (15 m). The hole shall be limited in diameter to between $2\frac{1}{4}$ and 6 in. (57.2 and 152 mm).[2]

2.2 *Split-Barrel Sampler*—The sampler shall be constructed with the dimensions indicated in Fig. 1. The drive shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. The coupling head shall have four $\frac{1}{2}$-in. (12.7-mm) (minimum diameter) vent ports and shall contain a ball check valve. If sizes other than the 2-in. (50.8-mm) sampler are permitted, the size shall be conspicuously noted on all penetration records.

2.3 *Drive Weight Assembly*—The assembly shall consist of a 140-lb (63.5-kg) weight, a driving head, and a guide permitting a free fall of 30 in. (0.76 m). Special precautions shall be taken to ensure that the energy of the falling weight is not reduced by friction between the drive weight and the guides.

2.4 *Accessory Equipment* — Labels, data sheets, sample jars, paraffin, and other necessary supplies should accompany the sampling equipment.

3. Procedure

3.1 Clear out the hole to sampling elevation using equipment that will ensure that the material to be sampled is not disturbed by the operation. In saturated sands and silts withdraw the drill bit slowly to prevent loosening of the soil around the hole. Maintain the water level in the hole at or above ground water level.

3.2 In no case shall a bottom-discharge bit be permitted. (Side-discharge bits are permissible.) The process of jetting through an open-tube sampler and then sampling when the desired depth is reached shall not be permitted. Where casing is used, it may not be driven below sampling elevation. Record any loss of circulation or excess pressure in drilling fluid during advancing of holes.

3.3 With the sampler resting on the bottom of the hole, drive the sampler with blows from the 140-lb (63.5-kg) hammer falling 30 in. (0.76 m) until either 18 in. (0.45 m) have been penetrated or 100 blows have been applied.

3.4 Repeat this operation at intervals not longer than 5 ft (1.5 m) in homogeneous strata and at every change of strata.

3.5 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fractions thereof. The first 6 in. (0.15 m) is considered to be a seating drive. The number of blows required for the second and third 6 in. (0.15 m) of penetration added is termed the penetration resistance, *N*. If the sampler is driven less than 18 in. (0.45 m), the penetration resistance is that for the last 1 ft (0.30 m) of penetration (if less than 1 ft (0.30 m) is penetrated, the logs shall state the number of blows and the fraction of 1 ft (0.30 m) penetrated).

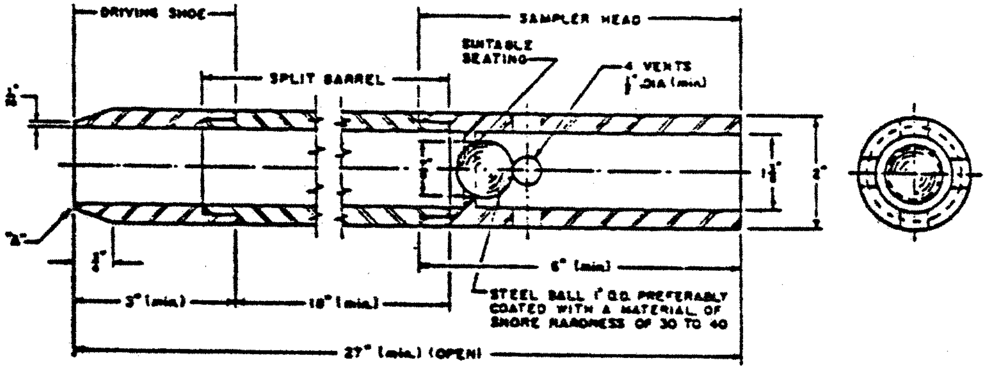
3.6 Bring the sampler to the surface and open. Describe carefully typical

---

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee D-18 on Soil and Rock for Engineering Purposes. A list of members may be found in the ASTM Year Book.

Current edition accepted Oct. 20, 1967. Originally issued 1958. Replaces D 1586 – 64 T.

[2] Hvorslev, M. J., *Surface Exploration and Sampling of Soils for Civil Engineering Purposes*, The Engineering Foundation, 345 East 47th St., New York, N. Y. 10017.



NOTE 1—Split barrel may be 1½ in. inside diameter provided it contains a liner of 16-gage wall thickness.

NOTE 2—Core retainers in the driving shoe to prevent loss of sample are permitted.

NOTE 3—The corners at *A* may be slightly rounded.

TABLE OF METRIC EQUIVALENTS

in.	mm	cm	in.	mm	cm
1/16 (16 gage)	1.5	...	2	...	5.08
½	12.7	...	3	...	7.62
¾	19.0	1.90	6	...	15.24
⅞	22.2	2.22	18	...	45.72
1⅜	34.9	3.49	27	...	68.58
1½	38.1	3.81			

FIG. 1—Standard Split Barrel Sampler Assembly

samples of soils recovered as to composition, structure, consistency, color, and condition; then put into jars without ramming. Seal them with wax or hermetically seal to prevent evaporation of the soil moisture. Affix labels to the jar or make notations on the covers (or both) bearing job designation, boring number, sample number, depth penetration record, and length of recovery. Protect samples against extreme temperature changes.

4. Report

4.1 Data obtained in borings shall be recorded in the field and shall include the following:

4.1.1 Name and location of job,

4.1.2 Date of boring—start, finish,

4.1.3 Boring number and coordinate, if available,

4.1.4 Surface elevation, if available,

4.1.5 Sample number and depth,

4.1.6 Method of advancing sampler, penetration and recovery lengths,

4.1.7 Type and size of sampler,

4.1.8 Description of soil,

4.1.9 Thickness of layer,

4.1.10 Depth to water surface; to loss of water; to artesian head; time at which reading was made,

4.1.11 Type and make of machine,

4.1.12 Size of casing, depth of cased hole,

4.1.13 Number of blows per 6 in. (0.15 m),

4.1.14 Names of crewmen, and

4.1.15 Weather, remarks.

RECEIVED

OCT 25. 88

MPCA, Ground Water
and Solid Waste Div.

ASSESSMENT OF FILL AREAS

Ford Motor Company
Twin Cities Assembly Plant

PRINTED ON

OCT 25 1988

October 1988
Ref. No. 2191

CONESTOGA-ROVERS & ASSOCIATES

Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

October 25, 1988

Reference No. 2191

Mr. Jerome Amber
FORD MOTOR COMPANY
15201 Century Drive
Dearborn, Michigan 48120

Dear Mr. Amber:

RE: Assessment of Fill Areas
Ford Motor Company
Twin Cities Assembly Plant

We have enclosed our report, "Assessment of Fill Areas, Ford Motor Company, Twin Cities Assembly Plant".

Should you have any questions, please do not hesitate to contact us.

Yours Truly,

CONESTOGA-ROVERS AND ASSOCIATES

Jon. L. Christofferson

JLC/kk

cc: J. Kallaus
A. Van Norman

RECEIVED
OCT 25 88

TABLE OF CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

The Ford Motor Company, Twin Cities Assembly Plant (Plant) is located in St. Paul, Minnesota, at 966 South Mississippi River Boulevard. The Plant complex includes buildings on both sides of Mississippi River Boulevard. Buildings west of Mississippi River Boulevard are located below the river bluff on the river valley floor. Buildings east of Mississippi River Boulevard are located above the river bluff on the adjacent sand plains. The Plant location is presented on Figure 1.1.

The Plant was originally used to manufacture glass over 50 years ago. Since then the Plant has been expanded several times and is used to assemble motor vehicles. Presently the Plant is used to assemble pick-up trucks.

At different times during the Plant's history prior to 1970, paint sludges/wastes were deposited in a relatively small area on Plant property, west of Mississippi River Boulevard (Site C). This waste deposit was identified to U.S. EPA by Ford during the Superfund notification process. A hydrogeologic investigation was commissioned by Ford in 1981. Since that investigation was completed,

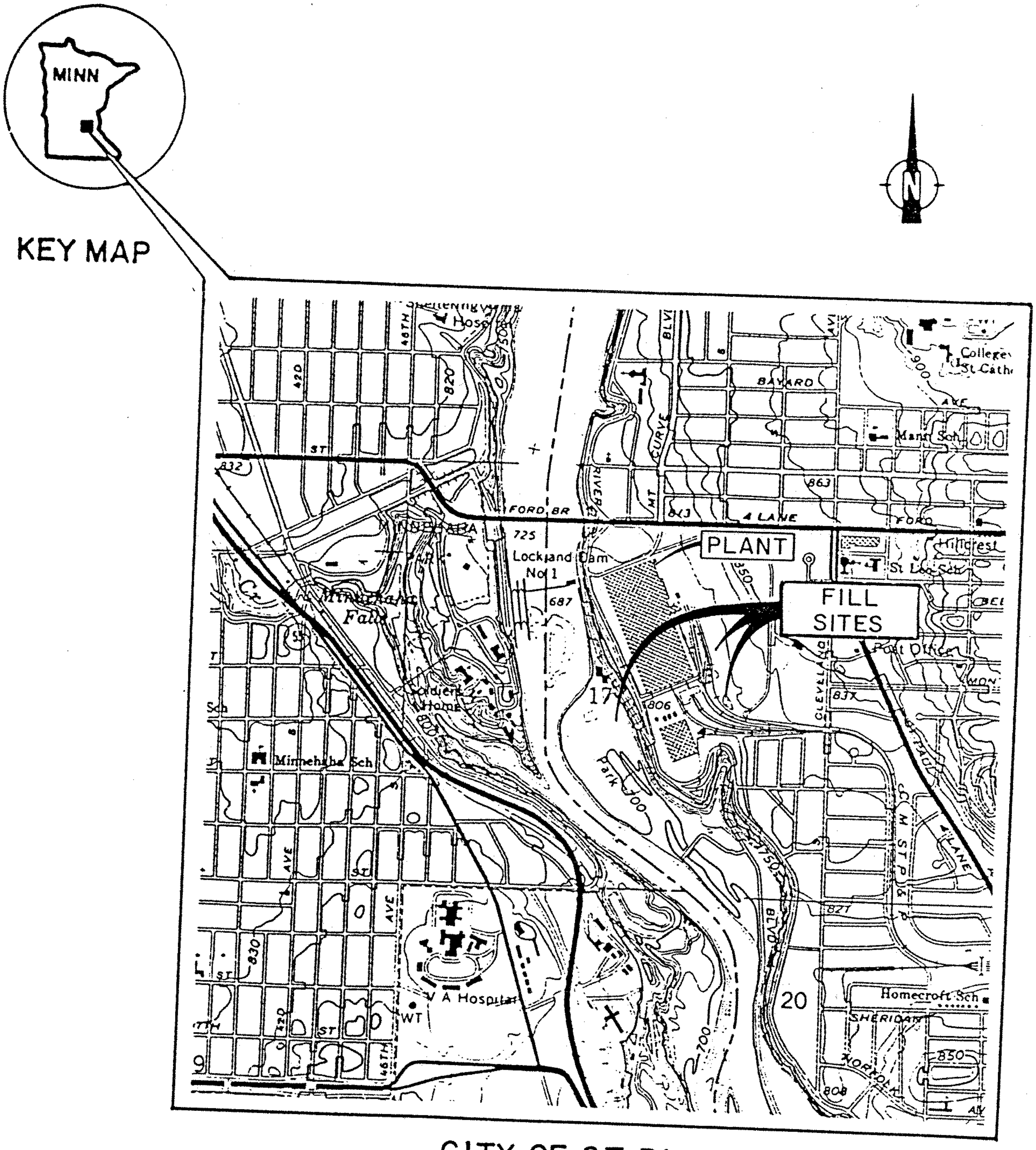


FIGURE 1.1
LOCATION PLAN
Ford Motor Company

CRA

2191 –22/09/87–1–D–0

additional earth fill has been placed over part of the waste fill. The area is now used as a parking lot for tractor trailer truck units. Excavated materials from two other sites (Sites A and B) were subsequently moved to Site C. The locations of the fill Sites are also presented on Figure 1.1 and presented in more detail on Figure 1.2.

In an effort to address environmental issues that may be associated with past waste handling and disposal practices, Ford Motor Company (Ford) hired Conestoga-Rovers & Associates (CRA) to conduct an assessment of the wastes deposited at these sites. This assessment consisted of a file review, hydrogeologic evaluation, test hole excavation (test pits), stadia survey and waste characterization sampling. From these tasks an assessment and evaluation of site conditions was conducted. The results of these efforts are provided in the following sections of this report.

2.0 BACKGROUND

At different times during the Plant's history, construction rubble and paint sludges/wastes were deposited in a relatively small area (Site C - approximately four acres in size) on Plant property west of Mississippi River Boulevard between the Boulevard and the Mississippi River. The majority of this material was deposited during the years 1950 through 1965. This practice was discontinued in 1965. During the years 1965 and 1966, construction debris was deposited in large quantities on top of this fill at Site C. The United States Corps of Engineers also deposited additional rubble between the Ford disposal Site and the river during reconstruction of the Lock and Dam No. 1 near the "Ford Bridge".

This Site C waste deposit was identified to the USEPA by Ford during the Superfund notification process. A hydrogeologic investigation was commissioned by Ford in 1981. Since the investigation was completed, additional fill has been placed over part of the Site C waste fill. Earth fill and construction rubble continue to be being brought to Site C including broken concrete and road excavation rubble from the construction of Mississippi River Boulevard. A major portion of the top of the fill has been paved with 8 inches of concrete and is now being used as a parking lot for tractor-trailer truck units. The remaining top area of Site C is being used as a snow dump during winter months for snow removed from area streets and parking lots.

Excavated materials from Site A and Site B areas were subsequently moved to Site C. Information regarding this process was noted during CRA's file review and is discussed in the section that follows.

3.0 FILE REVIEW

A file review was conducted to compile information related to the Plant's pre-1965 waste generation, disposal practices, investigations and activities on or near the Plant facilities. Plant files were reviewed on November 17, 1987. The Minnesota Pollution Control Agency (MPCA) files were reviewed on December 4, 1987. The majority of the information and correspondence in the Plant files is dated between and including the years 1980 and 1984. The information in the MPCA files is for the most part duplication of the Ford files with the addition of internal MPCA memos and reports.

It was noted that MPCA's files contain a separate file of all the groundwater monitoring data to date that has been submitted by Ford.

The file review indicates for Site C that cardboard, wood and scrap metal may also be present in the waste deposit. Batteries, used light ballasts and capacitors were specifically excluded from the fill material and were sent to alternate off-site disposal. Undated copies of photographs show exposed drums and what appears to be paint sludge at various locations.

Two additional waste deposits are identified in the file. The first area (noted in a October 6, 1982 letter from Ford to MPCA in the files as Site A) was located at the south end of a former test track east of the assembly plant. Paint sludges/wastes were deposited in this area from around 1943 until 1960. Quantities were not reported. This area was excavated in 1966 during a railroad car loading "tri-level" expansion. Sludge and "eastern materials"* were deposited in the Site C area.

The second area (noted in a October 6, 1982 letter from Ford to MPCA in the file as Site B) was located approximately 800 feet south and east of the main assembly building. It was reported that the area was used for burning waste and burial of factory waste during early plant operations up until 1945. Exact operational dates and quantities were not reported. The area was excavated as part of a paved parking lot expansion in 1962. Excavated materials were placed in the fill area "at the steam plant" now called Site C.

The October 6, 1982 letter from Ford to MPCA, noted above, is provided as Appendix A.

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* A typographical error is suspected and "earthen materials" probably describes the excavated material.

In addition to the fill areas presently under review by CRA, a smaller waste deposit below the river bluff north of the steam plant was exavated and removed to a hazardous waste landfill (Wayne Disposal Inc., Bellville, Michigan) in July 1983 during construction of the wastewater treatment plant. Approximately 77 cubic yards was excavated and shipped. All waste observed as well as visibaly contaminated soils were removed. Analytical results of testing conducted by Ford confirmed that the waste did not exhibit hazardous waste characteristics. This effort was the subject of Ford's Amended Superfund Notification to USEPA dated August 16, 1983.

Aerial photographs from both files were used to prepare a plan illustrating the progression of fill at Site C from the access road westward. The limit of fill in 1945, 1956, 1958 and 1962 is illustrated on the Site Plan (enclosed). Filling with paint sludges/waste ceased in 1965. The limit of the paint sludges/wastes is expected to be close to the 1962 limit. Substantial filling with demolition rubble and excavation soil has occurred since 1965. The present limit of fill is also presented on the Site Plan. The paint sludges/wastes are buried beneath approximately 30 feet of rubble including large blocks of reinforced concrete. Total fill thickness throughout the area is approximately 60 feet. The fill thickness was estimated by constructing a cross section from topographic survey data and borehole logs. This information will be presented in Section 4.0.

Due to the relocation of the materials from Site A and B to Site C, the discussions dealing with hydrogeologic conditions and field activities in Sections 4.0 and 5.0 respectively, deal primarily with Site C.

4.0 PRELIMINARY HYDROGEOLOGIC EVALUATION

4.1 GEOLOGY

Site C is located on a point bar adjacent to the Mississippi River (see Site Plan). A point bar is a fluvial deposit, usually sand and gravel, located on the inward bend of a river channel. Behind Site C is a river bluff which consists of bedrock overlain by unconsolidated sediments.

Geologic description of Site C is based on soil borings performed by Soil Testing Services (STS) in 1981*. Soil boring logs are presented in Appendix B. Their locations are illustrated on the Site Plan.

At Site C, the first bedrock unit encountered is the St. Peter Sandstone. The St. Peter Sandstone is encountered at soil boring B5 at an approximate elevation of 683 feet AMSL. The St. Peter Sandstone is a white fine to medium grained quartz arenite. The sandstone has a maximum

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* Final Report, Hydrogeologic Engineering Evaluation, Ford Assembly Plant, St. Paul, Minnesota, Soil Testing Services of Minnesota, Inc. February 26, 1982.

thickness of 150 feet. At the base of the St. Peter is a shale and siltstone unit that ranges in thickness from 5 to 50 feet (Guswa and others, 1982)*.

The Platteville Limestone, which overlies the St. Peter Sandstone, is present in the river bluffs. At the Site C, the Platteville Limestone is eroded away.

Overlying the St. Peter sandstone are consolidated sediments. At Site C, the sediment is described as an interbedded mixture of sand, silt and gravel with little clay. The sediment ranges in thickness from 25 feet to greater than 50 feet.

The sand and gravel deposit at Site C is overlain by artificial fill. The fill is composed of construction refuse, fire brick, slag and railroad ties intermixed with sand and gravel. Clean fill including construction rubble, broken concrete and soil continues to be placed west of Site C. In 1981, the Site C fill, as reported in the February 1982 STS report, ranged in thickness from 14 to 25 feet.

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* Preliminary Evaluation of the Groundwater Flow Systems in the Twin Cities Metropolitan Area, Minnesota, U.S. Geological Survey Water Resources Investigation Report 82-44.

Based on the soil borings, a geologic cross section of the Site C area has been constructed. The location of the cross section is presented in Figure 4.1 and the cross section is presented in Figure 4.2. The cross section indicates a maximum fill thickness in excess of 60 feet.

4.2 HYDROGEOLOGY

Groundwater is encountered in the unconsolidated sand and gravel at an approximate elevation of 690 feet AMSL. Well construction details and groundwater elevations are summarized in Table 4.1. Well locations are presented on Figure 4.1 and the Site Plan.

Groundwater elevations measured by CRA are presented on Figure 4.1 and indicate that groundwater flows towards the Mississippi River in a northwesterly direction.

The groundwater elevation at well B4 is considered anomalous. The well casing has been broken at depth permitting infiltration through the casing. The broken parts will not fit back-together indicating possible horizontal displacement. Well B2 has an obstruction in the well. The obstruction prohibits access to the water level by water measuring instruments.

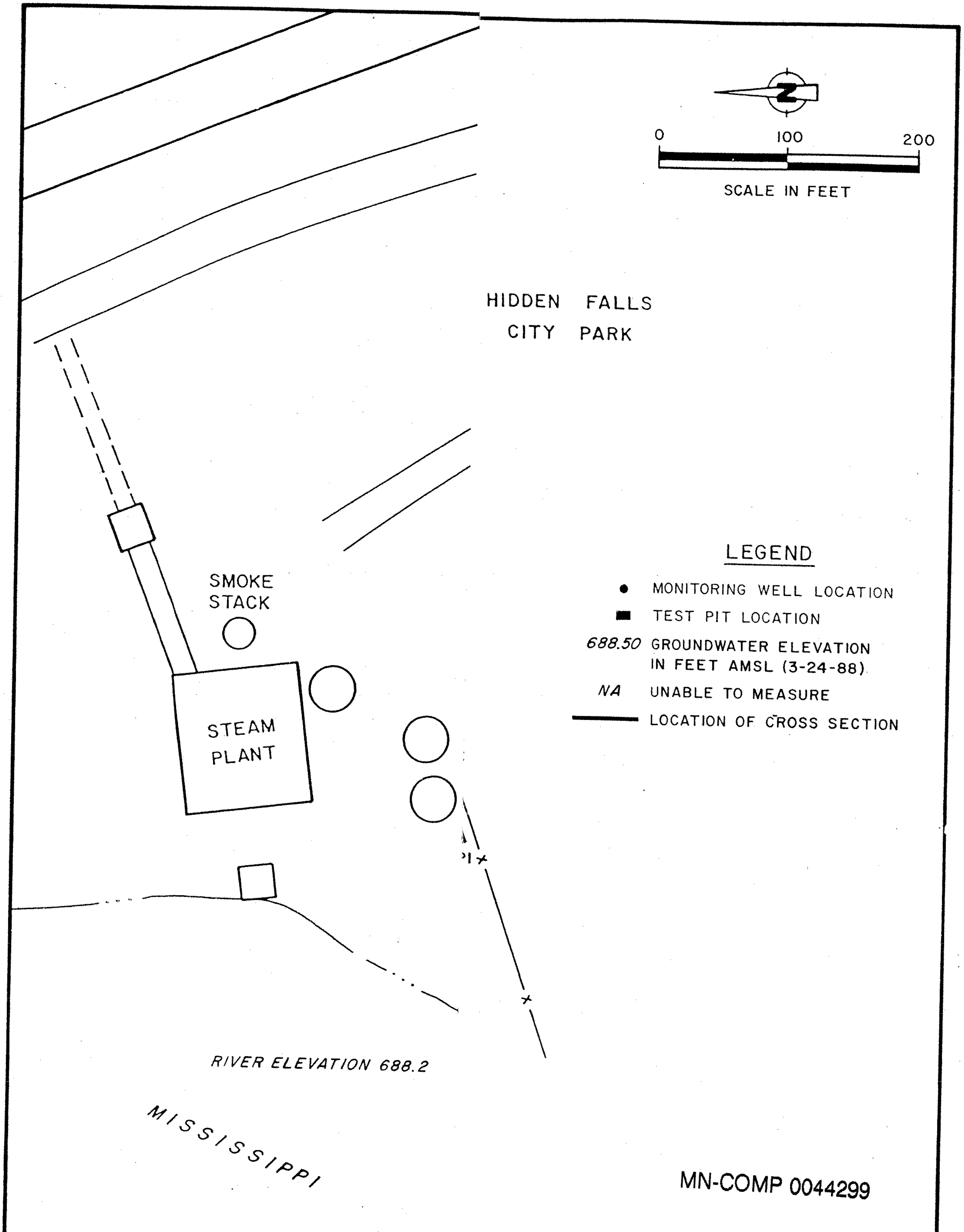
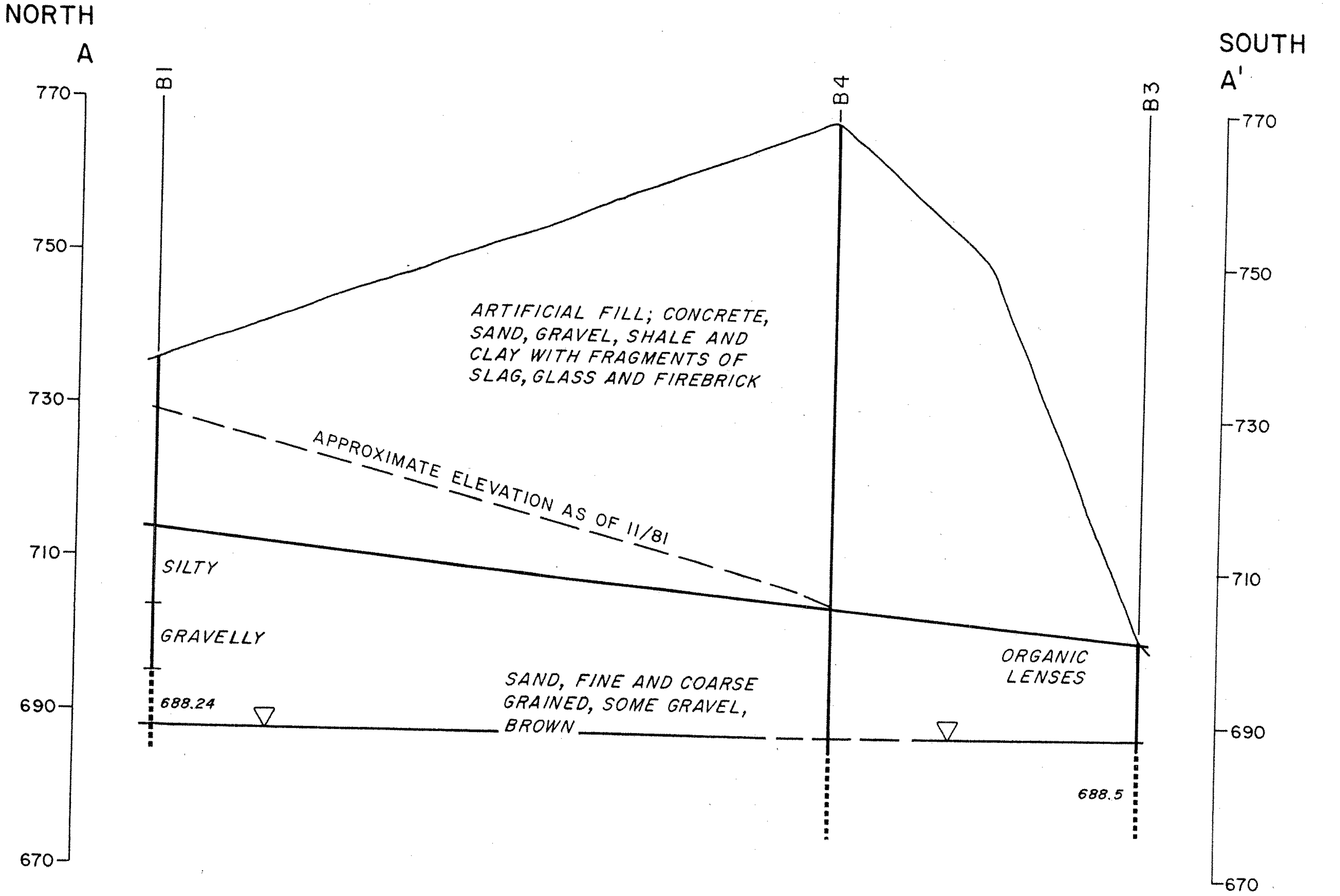


figure 4.1
GROUNDWATER ELEVATIONS
Ford Motor Company

CRA

2191-25/03/88-M



SCALE: 1" = 100' HOR.; 1" = 20' VER.

GROUNDWATER ELEVATIONS TAKEN 3-24-88

CRA

figure 4.2
HYDROGEOLOGIC CROSS SECTION A-A'
Ford Motor Company

2191-25/03/88-M

TABLE 4.1

WELL CONSTRUCTION DETAILS AND GROUNDWATER ELEVATIONS

Well	Date Installed	Installed By	Material	Depth (ft. bgs)	Approiximate Ground Elevation (ft. AMSL)	Top of Casing Elevation (ft. AMSL)	Mid Screen Elevation (ft. AMSL)	Water Level Elevations (3/24/88)
B1	12/31/81	STS	2" PVC	57.7	736.3	739.32*	683.6	688.24
B2	11/18/81	STS	2" PVC	98.7	770.0	773.17*	676.3	NA**
B3	11/17/81	STS	2" PVC	24.5	702.0	704.67	682.5	688.50
B4	11/19/81	STS	2" PVC	92.5	768.5	769.50*	681.0	714.05***
B5	11/30/82	STS	2" PVC	25.4	702.1	703.81	681.7	689.61

Notes:

* Resurveyed by CRA (2/16/88)
** Obstruction in well at 23.5' below top of casing
*** Anomolous, see text, Section 4

Groundwater is also encountered in the St. Peter Sandstone. The St. Peter aquifer is hydraulically connected to the overburden. The St. Peter aquifer has an average hydraulic conductivity of 2.3×10^{-3} ft/s and a transmissivity ranging from 18,000 to 45,000 gallons/day/foot (Walton and others, 1981)*. In the vicinity of the Site, the St. Peter is expected to discharge to the river and upward vertical gradients are expected to exist. Aqueous transport of any constituents in groundwater will be towards the river.

4.2.1 Site Hydraulic Conductivity

Grain size distribution curves are presented in the 1982 STS report. The grain size distribution can be used to estimate the permeability of the unconsolidated sand and gravel using Hazen's equation. Hazen's equation is an empirical formula that estimates permeability based on grain size distribution. Where:

$$K = Ad_{10}^{2}$$

K is the permeability in cm/s,

A is an empirical coefficient equal to 1.0 and

d_{10} is the grain size (in mm) of the 10 percent retained.

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* Engineering Geology of the St. Paul Energy Park and Vicinity, Minnesota Geology Survey, Reprint Series 44.

Estimated hydraulic conductivity values are presented in Table 4.2. The geometric mean hydraulic conductivity is 2×10^{-2} cm/sec. This is a relatively high hydraulic conductivity consistent with the sand and gravel soils.

Groundwater velocity can be estimated using the equation:

$$\overline{v} = \frac{Ki}{n}$$

where: $\overline{v}$ is the average groundwater linear velocity,

K is the hydraulic conductivity, (2×10^{-2} cm/sec)

i is the hydraulic gradient (0.002) and

n is the porosity (0.3).

The assumed porosity is 0.3, which is common for this type of sediment. The average hydraulic gradient is 0.002, based on groundwater elevations measured by CRA and presented on Figure 4.1.

By use of the above parameters, the average linear groundwater velocity is estimated to be 1.3×10^{-4} cm/sec, or 0.4 ft/day. In the approximately 40 years since materials have been deposited here, groundwater would have moved approximately one mile. The Mississippi River is within 200 feet of the present limit of fill, but was approixmately 800 feet away in 1945. In either case, groundwater from beneath Site C is entering the Mississippi River.

TABLE 4.2

HAZEN'S PERMEABILITY

Borehole	Depth (ft. bgs)	d_{10} (mm)	K (cm/sec)
BH1	39.5 - 41	0.08	6×10^{-3}
BH2	19.5 - 21	0.25	6×10^{-2}
BH2	29.5 - 31	0.30	9×10^{-2}
BH2	34.5 - 36	0.075	5×10^{-3}
BH3	19.5 - 21	0.2	4×10^{-2}
BH5	10 - 11.5	0.08	6×10^{-3}
		Average =	2×10^{-2}

4.2.2 Hydrology

Another factor in groundwater flow is the influence of the Mississippi River, which fluctuates seasonally. Upstream from the Site is Lock and Dam No. 1. Lock and Dam No. 1 is used for waterway traffic and not for flood control.

According to the U.S. Army Corps of Engineers, which operates the dam, the tail stream elevation ranges from 691 to 687 feet AMSL.

The tail stream flooding frequency at Lock and Dam No. 1 was investigated, since the Site is located on a flood plain. The frequency and tail stream elevation provided by the Corps of Engineers are:

Frequency	Elevations (ft. AMSL)
10 years	707
50 years	714
100 years	717
500 years	724

Based on ground level elevations, it should be expected that wells B3 and B5 would be submerged on an average frequency of once every ten years. Submergence could have a very significant effect on groundwater quality measured in these wells.

The tail stream elevation during the flood that occurred during April of 1965 was 719.02.

4.3 GROUNDWATER QUALITY

Groundwater samples were collected from the on-site monitoring wells on March 3, 1982, and December 1, 1982 by representatives from Ford's Stationary Source Environmental Control Office (SSECO). The results of this monitoring conducted by Ford are presented in the reports titled "Twin Cities Assembly Facility Groundwater Monitoring Wells Survey" and dated March 3, 1982 and December 1, 1982. The tables from these reports that summarize the monitoring data are provided for reference in Appendix C (for March 1982) and Appendix D (for December 1982). The samples were analyzed for USEPA Volatile Priority Pollutants, xylenes, methyl ethyl ketone, methyl isobutyl ketone, pH, specific conductivity and dissolved heavy metals (Cd, Cr, Pb, Cu, Ni, Zn).

Dissolved metals concentrations were low and within the range of typical groundwater concentrations*. Three VOC parameters, 1,2-Dichloroethylene, Trichloroethylene

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* Handbook on the Toxicology of Metals Vol.2 Friberg, Nordberg and Vouk, Elseview Science Publishers, 1986.

and Toluene, were reported at low concentrations at three of the monitoring wells in place in March 1982. Total VOC at any individual location was less than 25 ug/L.

The same parameter list was monitored in December 1982. Dissolved metals were again typical of natural groundwater concentrations*. The concentration of 1,2-Dichloroethylene increased slightly in monitoring well B2, but the total VOC remained below 25 ug/L. Two additional VOC parameters, chlorobenzene and xylene, were reported at trace concentrations.

As expected, no measurable impact was defined upstream and downstream in the Mississippi River monitoring conducted by SSECO on December 1, 1982. Three VOC reported downstream of the Ford plant at trace concentrations were also reported at equal or higher concentrations upstream from the property.

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* Handbook on the Toxicology of Metals Vo.1.2 Friberg, Nordberg and Vouk, Elseview Science Publishers, 1986.

5.0 FIELD ACTIVITIES

5.1 TEST PITS

On December 4, 1987, CRA and its subcontractor mobilized a rubber tired backhoe at Site C along the river. An attempt was made to gain access to the low land areas south of the trailer storage pad. Several attempts were made to reach the bluff, but on each attempt the backhoe got stuck. One test pit (TP1), shown on the Site Plan, was successfully completed. No evidence of past disposal (i.e. visual or odor) was noted at this test pit location.

On January 19, 1988, a second attempt was made to access this area. A track mounted backhoe was used this time and mobility was not as difficult due to frozen conditions. A total of 10 test pits were excavated to an approximate depth of nine feet below ground surface.

The individual test pit logs are presented in Appendix E. The test pit locations are presented on the Site Plan.

Physical evidence of waste presence (i.e. odor or visual) was noted only at test pits TP3 and TP8. Test pit TP3 exibited soil with a gray/black color having a paint like odor and test pit TP8 showed visual evidence of the same gray/black color as TP3, but without the odor. No evidence of waste presence was noted at the other test pits. The steep side slopes and 30 foot thickness of rubble fill over the pre-1965 materials prevented collection of a samples.

Table 5.1 provides a summary of the analytical results of detected parameters for leachate analysis from test pits TP3 and TP8. A copy of the laboratory report of analysis is presented in Appendix F. Leachate analysis of the sample from test pit TP3 was conducted by Toxicity Characteristic Leachate Procedure (TCLP). The leachate for sample TP8 was obtained by the Extraction Procedure (EP) Toxicity Leachate Method.

The sample from TP3 was collected from a sand seam that exhibited a strong paint waste like odor. The strong paint waste like odor suggests migration from the adjacent fill material. The flash point of a soil sample collected from TP3 was reported to be 140°F. The flash point for determining ignitability defined by RCRA regulations of less than 140°F does not apply since the waste is not a liquid.

TABLE 5.1

SUMMARY OF DETECTED INORGANIC PARAMETERS AND SAMPLE CHARACTERISTICS

→ Cr

	EPA/Minnesota EP Toxicity Leachate Criteria	Test Pit 3 (TP3)**	Test Pit 8 (TP8)**
Arsenic (ug/L)	5,000	10	ND
Barium (mg/L)	100	1.5	0.2
Cadmium (mg/L)	1.0	ND	ND
Copper (mg/L)	100*	0.02	ND
Lead (mg/L)	5.0	0.3	ND
Zinc (mg/L)	500*	0.92	0.03
Flash Point (°F)	NA	140	>200
Sulfide, Reactive (mg/kg)	NA	ND	61
pH	NA	7.6	7.9

↓ Organics ?

Notes:

NA - Not Applicable
ND - Not Detected
* - State of Michigan Leachate Criteria Only
** - TP-3 sample analyzed using TCLP whereas the TP-8 sample was analyzed using EP Toxicity Leachate Procedure

A sample from TP8 was leached and analyzed for the EP Toxicity metals. All results were well within criteria values as indicated on Table 5.1. Thus, the material would not be considered a hazardous waste under USEPA or MPCA hazardous waste regulations.

Organic results reported above detection methods in the sample leachate for TP3 are presented on Table 5.2. The sample from Test Pit 3 was extracted by the TCLP method. The sample from Test Pit 8 was analyzed for total VOC and all results were reported as below method detection limits. Therefore, no results are tabulated.

5.2 SITE SURVEY

On February 16, 1988, a stadia survey was completed of the Site C area to reelevaluate three wells which were extended vertically during the expansion of the trailer storage area. Table 4.1 shows the new elevations for these three wells (B1, B2 and B4) as well as the old elevations for wells B3 and B5 which were not extended and, for the purpose of the survey, assumed to be correct.

A base line was surveyed from existing buildings along Mississippi River Boulevard through the trailer storage area. Measurements were taken both north and

TABLE 5.2

SUMMARY OF DETECTED ORGANIC PARAMETERS (ug/L)

	Test Pit 3 (TP3)*
Toluene	180
Ethyl Benzene	85
M-Xylene	2,600
O & P Xylene	3,700

Notes:

* - TP3 sample was analyzed using TCLP

south of this line to plot the present edge of the fill area. The surveyed edge of fill is presented on the Site Plan (enclosed) and Figure 4.1.

Due to the large amount of snow that had been piled along the top of the fill and the high seasonal snowfall, it was not possible to survey the low land areas and the test pit locations, or to accurately locate the top of the fill area.

Top fill area/pavement
elevations should be
added to site plan

6.0 SUMMARY

File review indicates that two small waste deposits identified as Sites A and B were excavated during plant expansions in 1966 and 1962 respectively and moved to the river bluff fill area (Site C). Appendix A presents a 1982 Ford letter to MPCA found during the file review, that includes a figure that indicates the approximate locations of these sites. This report has dealt primarily with Site C due to the relocation of the material from Sites A and B to Site C.

As indicated on the Site Plan (enclosed), original base grade elevations under the fill pile were on the order of 710 to 720 ft. AMSL. Presently, the maximum elevation of the fill area is over 770 feet AMSL indicating that there is up to 60 feet of fill material present. Near the steam plant access road, paint sludges/waste are present in the lower half of the fill area. Small areas of exposed paint sludges/wastes on the steep bank suggest that the paint sludges/wastes are on the order of 25 feet thick.

A foot print of the area containing paint sludges/wastes can be composited from the 1958 and 1962 limits of fill. Assuming that there is 25 feet of waste and related fill over this area, there is a volume of approximately 30,000 cubic yards of waste material believed to be non-hazardous industrial waste based on the analyses conducted.

The paint sludges/wastes are buried beneath approximately 30 feet of rubble fill including large blocks of reinforced concrete. Exposing the paint sludges/wastes and related material would require removal of a concrete parking lot and excavation of approximately 50,000 cubic yards of fill. Any such excavation would be difficult and costly due to the limited access to the Site, the need to use remote temporary fill storage, the numerous oversize pieces of concrete in the material and disruption to plant operations.

Existing 8 inch concrete pavment covers most of the waste fill and limits infiltration through this material. The low concentration of VOC in groundwater under the Site is not expected to produce a measurable effect in the Mississippi River.

All of which is respectfully submitted,

CONESTOGA-ROVERS & ASSOCIATES

A. Van Norman

Alan Van Norman, P. Eng.

Don Haycock

Donald H. Haycock, P. Eng.

APPENDIX A

LOCATION OF SITES A AND B

(From Ford Letter to MPCA Dated October 6, 1982)

Circ: VHS/ABMH/JSA/HMS
JNT/KEM/EDC/TJG

bcc: D. Cloutier
P. Lewandowski
A. Twilley

DISPOSE C
(Black St
RETAIN F
(Red Sta
Schedule N

207

Ford Motor Company
Environmental and Safety
Engineering Staff

One Parklane Boulevard
Dearborn, Michigan 48126

October 6, 1982

Mr. Douglas N. Day
Minnesota Pollution Control Agency
Regulatory Compliance Section
Solid and Hazardous Waste Division
1935 West County Road B2
Roseville, MN 55113

Subject: [redacted] Cities Assembly Plant
[redacted] Disposal Sites

Dear Mr. Day:

This letter is in response to your letter of August 19, 1982 and confirms our agreements reached during our meeting of September 23, 1982.

The two old disposal sites located near the main assembly building are shown on the attached map and are labeled "A" and "B" for clarification and subsequent reference. Site "A" was located at the southern end of an old test track located east of the assembly building. This site was excavated in 1966 and our inspection of the site during our meeting confirmed that approximately 15-20 feet of earth has been removed to bring the parking lot level (now covering the area) down to the assembly plant grade. This was visibly apparent due to the remaining section of higher level test track area. In view of this, you agreed that no further soil boring in this area would be required.

To the best of our knowledge Site "B" was located approximately 800 feet south and east of the old main assembly plant building. This location was noted on an old photograph, however, plant personnel have difficulty believing the site was so distant from the assembly operations. The area is presently used as a railroad yard. In an attempt to better define the exact location of the site, old aerial photographs have been obtained and will be examined to try and pinpoint the site. Following our review we will meet with you to discuss our findings and the need for soil borings in this area.

With respect to the disposal site located near the steam plant (Site "C"), we agreed to postpone any decision regarding the installation of an upgradient well until the additional work described below is completed. This was based on the questionable value of a well at Location B6 (Former attempted boring location) and difficulty in boring into the St. Peter formation.

Ford agreed to install an additional monitoring well near old Boring B5, off plant property and within the City Park confines. The approximate location of the well is shown on the attached sketch of the disposal site. The well will be placed 10 feet into the water table and screened over the entire 10 feet. The well will be constructed of 2" PVC pipe as was used for the previously installed wells. Soil samples will be obtained during the boring.

Following the new well installation and development, all of the wells at the site will be re-surveyed to re-establish the casing top elevations. The wells will be measured for static water elevations and Mississippi River water elevations also obtained to determine its influence on the water table elevations. The wells, as well as the river, will be resampled and analyzed for dissolved heavy metals and volatile priority pollutants to obtain additional data on water quality.

Following this resampling and analyses we will meet with you to discuss further the need for additional investigation of this site and the necessity to install an upgradient well.

Our present schedule for this additional work is dependent upon obtaining your approval of the proposed location of the new well. Funding is being approved and we anticipate installing the well within two weeks of obtaining your concurrence with the well location. Samplings will be performed within two weeks of well completion and surveying and a report of our findings will be transmitted within four weeks of the sampling.

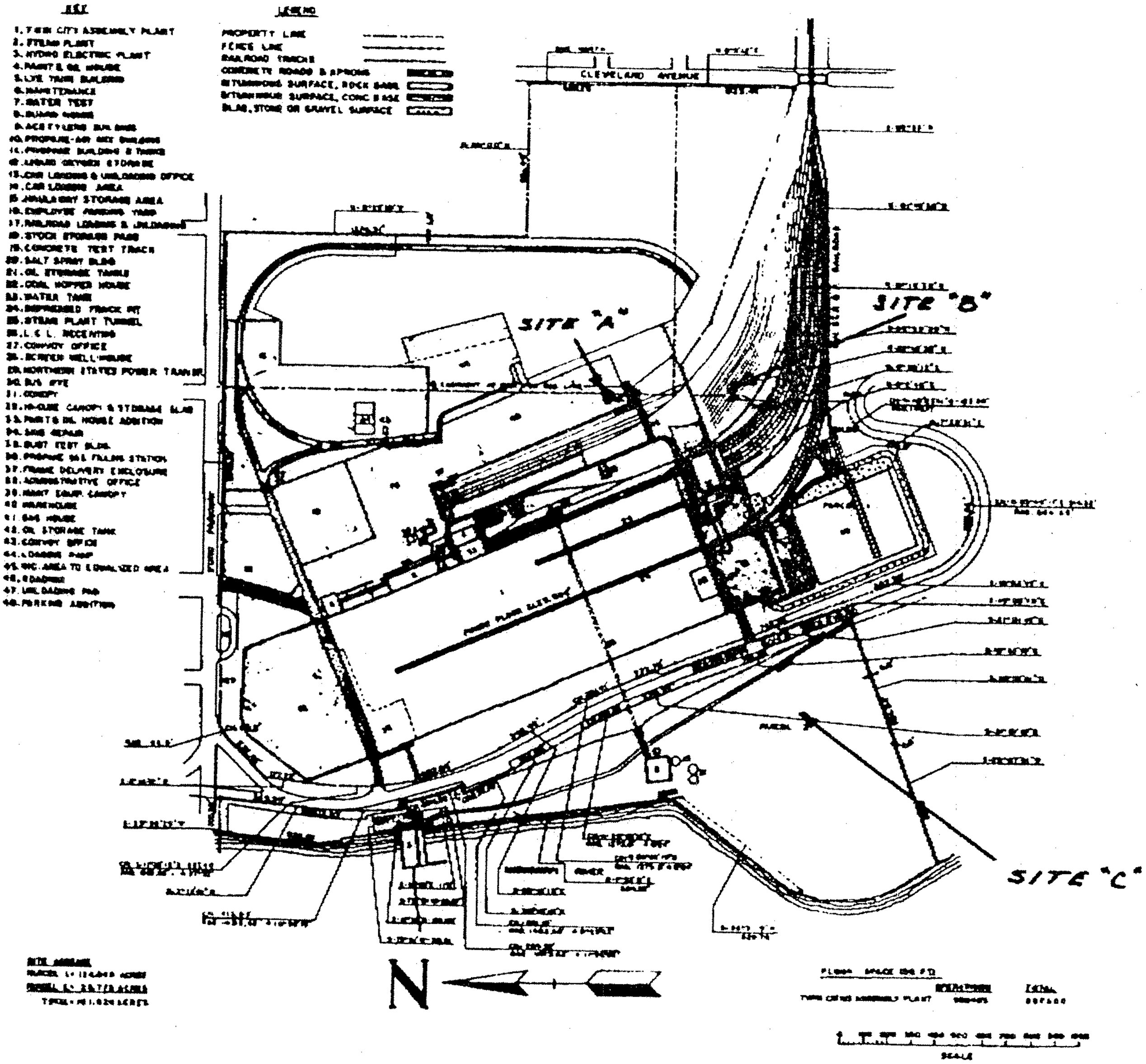
In addition, during the meeting, you agreed that Ford could remove some of the visible debris from the disposal site "C" in order to improve the appearance of the area. Any materials removed would be handled and disposed of in accordance with applicable regulations.

Kindly let me know as soon as possible of your decision regarding the well location. We would like to complete the sampling prior to the anticipated inclement weather your area is well noted for. If you have any questions please call me at 313/322-8852.

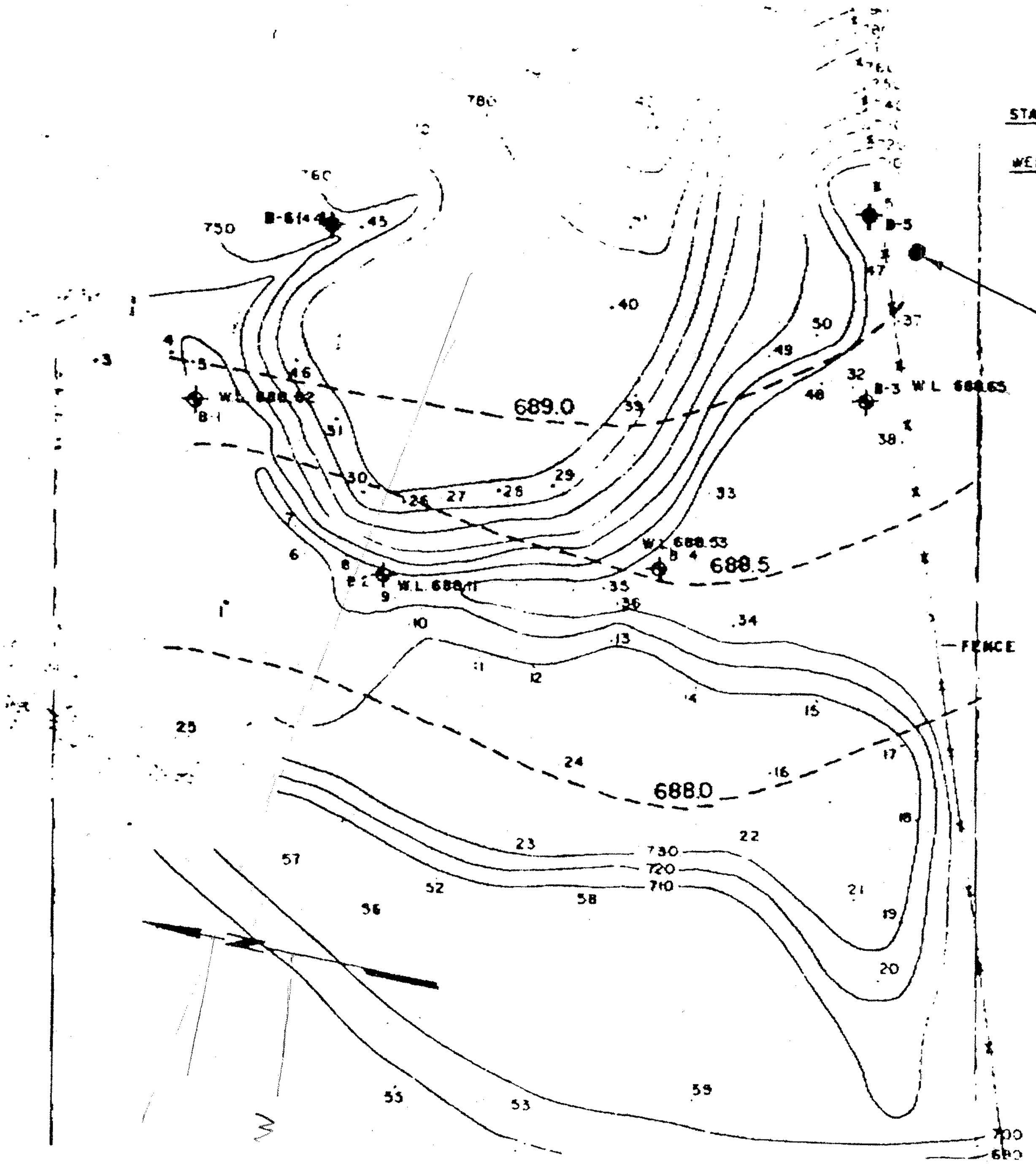
Very truly yours,

D. M. Reinke, Manager
Survey and Evaluation
Stationary Source Environmental
Control Office

Attachment
cc: R. M. Majors



TWIN CITIES ASSEMBLY PLANT



PROPOSED NEW WELL

STATIC WATER LEVEL DATA FOR 1-5-82

WELL NO	WATER LEVEL
B-1	688.62
B-2	688.11
B-3	688.65
B-4	688.53

SCALE IN FEET

0 50 100 150 200 250

LEGEND

- SOIL BORING
- GROUND SURFACE CONTOUR
- WATER SURFACE CONTOUR
- SOIL BORING AND MONITORING WELL INSTALLATION

GROUND WATER CONTOUR MAP
FORD MOTOR COMPANY
TWIN CITIES ASSEMBLY PLANT
DATE: 1-22-82
STS JOB NO. 92776

APPENDIX B

SOIL BORING LOGS

LOG OF BORING NO. B-1

OWNER
Ford Motor Company

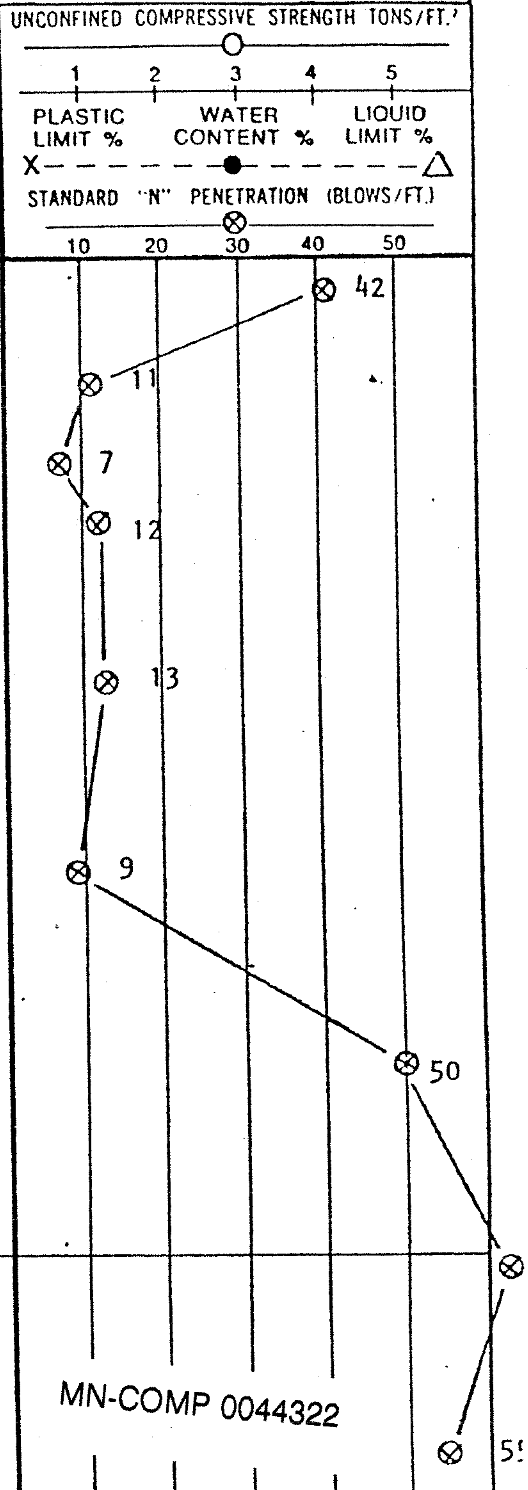
ARCHITECT-ENGINEER

SITE
Twin Cities Assembly Plant

PROJECT NAME
Ford Hydrogeologic Study

SURFACE ELEVATION ↴ 729.52

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
	1	SS				
	2	SS				
5.0	3	SS				
	4	SS				
10.0	5	SS			Fill; sand, gravel, silt, Decorah shale and clay, with fragments of slag, glass, firebrick, etc. - moist	
15.0	6	SS				
20.0	7	SS				
25.0	8	SS			River deposits Thinly interbedded grayish brown sandy silts and very fine sands - (SM-ML) - moist	
30.0	9	SS				
					Continued	



WATER LEVEL OBSERVATIONS
W.L. 42.0' W.D.
W.L. B.C.R. A.C.R.
W.L.

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 12/28/81
BORING COMPLETED 12/31/81
RIG CME-45 FOREMAN RM
DRAWN DW APPROVED RJK
JOB # 92776 SHEET 1 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. B-1

OWNER: Ford Motor Company

ARCHITECT-ENGINEER:

SITE: Twin Cities Assembly Plant

PROJECT NAME: Ford Hydrogeologic Study

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50

SURFACE ELEVATION

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3	STANDARD "N" PENETRATION (BLOWS/FT.)
30.0	9	SS			River deposits Thinly interbedded grayish brown sandy silts and very fine sands - (SM-ML) - moist		55
35.0	10	SS			Light brown very fine sand with little gravel, little silt - (SM)		30
40.0	11	SS			Grayish brown fine to coarse sand and gravel with little silt - (GM-SM) - moist to wet		64
45.0	12	SS			Light brown gravel, little sand, little silt - (GM) - saturated		32
50.0	13	SS			Light brown very fine sand, some silt, little gravel - (SM) - sat.		27
51.0					End of boring at 51.0 feet. 2" PVC well installed		

WATER LEVEL OBSERVATIONS

W.L. 42.0' W.D.

W.L. B.C.R. A.C.R.

W.L.

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 12/28/81

BORING COMPLETED 12/31/81

RIG CME-45 FOREMAN RM

DRAWN DW APPROVED RJK

JOB # 92776 SHEET 2 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. 2

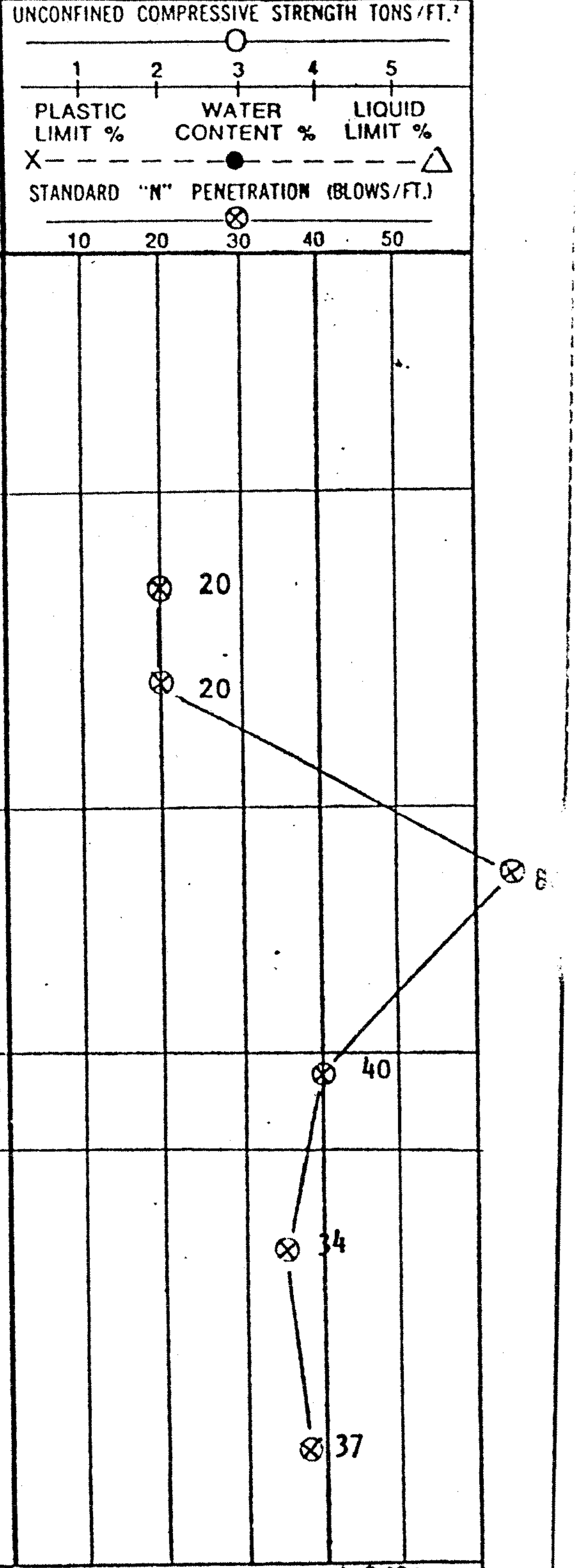
OWNER
Ford Motor Company

ARCHITECT-ENGINEER

SITE
Twin Cities Assembly Plant

PROJECT NAME
Ford Hydrogeologic Study

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION → 715.77'	UNIT DRY WT. LBS./FT. 3
					Boulders, cobble and concrete block from 0'-6.0' Removed with backhoe	
5.0						
	1	SS			Fill, dark brown gravel, slag, sand and clay, moist	
10.0	2	SS				
15.0	3	SS			Dark brown fine to coarse sand, trace silt - (SP), moist	
20.0	4	SS			Light brown, very fine to medium sand, trace silt - (SP), wet	
25.0	5	SS			Light brown fine to coarse sand with some gravel, trace silt - (SW-SP), wet to saturated	
30.0	6	SS				
					Continued	



WATER LEVEL OBSERVATIONS		
W.L.	29.5' W.S.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/18/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 2

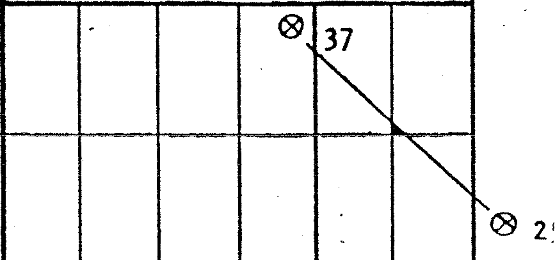
The stratification lines represent the approximate boundary

LOG OF BORING NO. 2

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT. 3
30.0					(SW-SP)	
35.0	7	SS			Brown, fine to coarse sand with little gravel, extremely dense - (SW), saturated	
40.0						
44.5					End of boring at 44.5 feet. 2 " PVC well installed	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○
1 2 3 4 5
PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △
STANDARD "N" PENETRATION (BLOWS/FT.) ⊗
10 20 30 40 50



WATER LEVEL OBSERVATIONS		
W.L.	29.5' W.S.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/18/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 2 of 2

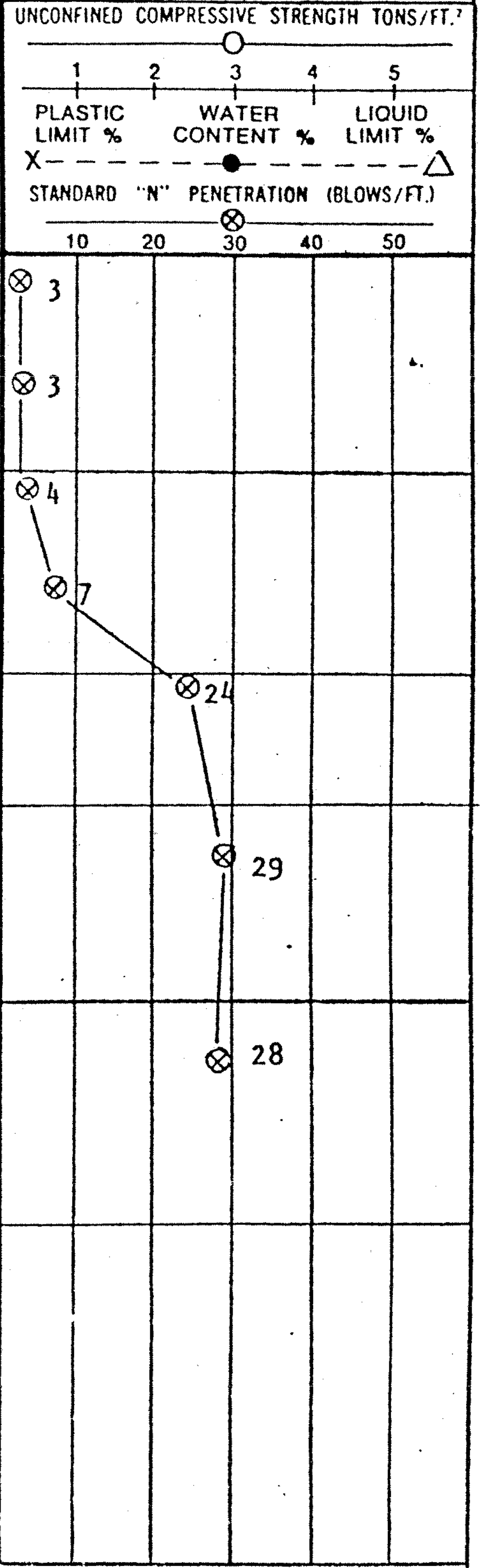
The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. 3

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

SURFACE ELEVATION 701.99

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3	STANDARD "N" PENETRATION (BLOWS/FT.)
	1	SS	Dark brown very fine sand, trace to some silt, trace to some organic - (SM-OL), moist		3
	2	SS			3
5.0	3	SS	Light brown, very fine sand, trace silt - (SP), moist		4
	4	SS			7
10.0	5	SS	Brown fine to medium sand, trace to little gravel - trace silt - (SP)- moist to wet		24
15.0	6	SS	Brown medium to coarse sand, with some gravel, trace silt - shell fragments - (SW) - saturated		29
20.0	7	SS	Gray fine to coarse sand, trace silt, some gravel and cobble - (SW) - saturated		28
25.0			End of boring at 24.5 ft. 2" PVC well installed		



MN-COMP 0044326

WATER LEVEL OBSERVATIONS		
W.L.	14.0' W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/17/81	
BORING COMPLETED 11/17/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 1

The stratification lines represent the approximate boundary

LOG OF BORING NO. 4

OWNER
Ford Motor Company

SITE
Twin Cities Assembly Plant

ARCHITECT-ENGINEER

PROJECT NAME
Ford Hydrogeologic Study

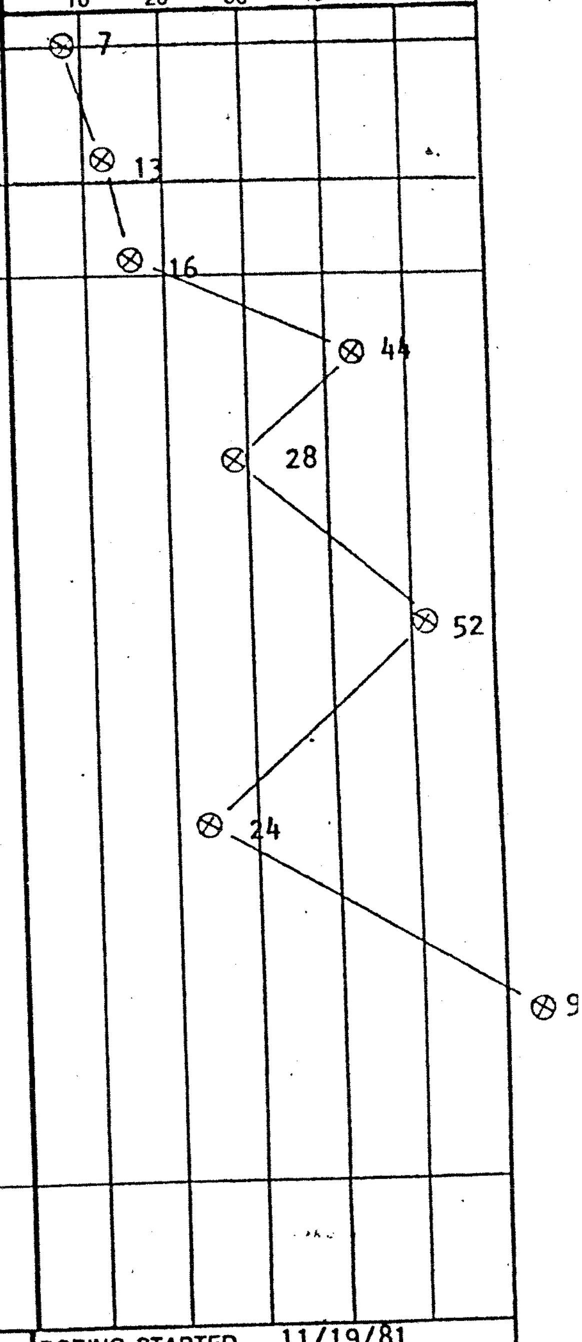
SURFACE ELEVATION → 705.47'

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
			Brown clay with some very fine *	
	1	SS	Brown very fine sand, trace silt (SP) Lenses of black organic silt (OL) - moist	
	2	SS		
5.0	3	SS	Black fill - fine to medium sand with graveland slag, moist	
	4	SS	Brown fine to coarse sand with some gravel, trace silt - (SW-SP) - wet to saturated	
10.0	5	SS		
15.0	6	SS		
20.0	7	SS		
25.0	8	SS		
30.0			End of boring at 29.5 ft. 2" PVC well installed *sand (CL)- moist	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50



WATER LEVEL OBSERVATIONS

W.L. 19.5' W.S.
W.L. B.C.R. A.C.R.
W.L.

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/19/81
BORING COMPLETED 11/19/81
RIG CME-45
FOREMAN RM
DRAWN DW
APPROVED RJK
JOB # 92776
SHEET 1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. 5

OWNER
Ford Motor Company

ARCHITECT-ENGINEER

SITE
Twin Cities Assembly Plant

PROJECT NAME
Ford Hydrogeologic Study

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ (1 2 3 4 5)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ (10 20 30 40 50)

SURFACE ELEVATION 701.5'

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	STANDARD "N" PENETRATION (BLOWS/FT.)
	1	SS	Dark brown topsoil, organic silt with some coarse sand and gravel - *	18
	2	SS	Brown medium to coarse sand, trace silt, some gravel - (SP) - moist	36
5.0				
	3	SS	Gravel and cobble, some fine sand, trace silt - (GP), moist	40
	4	SS	Dark brown very fine sand, trace to little silt - (SM-SP) - moist	20
10.0	5	SS	Dark brown silt with trace to little very fine sand, horizontal seams and lenses of black silt - ((ML) - moist	13
			Gray very fine to fine sand, with trace to little silt - (SP-SM) SOLVENT ODOR, moist	
			Black fine sand with some silt (SM) Strong Solvent Odor - wet to sat.	
15.0	6	SS	Gray gravel and cobble, little sand and little clay - (GC) - saturated	6
	7	SS	Light brown gravel and cobble, trace sand and trace clay (GW-GC) - saturated	
20.0			End of boring at 19.5 feet. Boring grouted from bottom to ground surface.	

*(OL-GM)

MN-COMP 0044328

WATER LEVEL OBSERVATIONS

W.L.	14.0' W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11-20-81	
BORING COMPLETED 11-20-81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 1

The stratification lines represent the approximate boundary

LOG OF BORING NO. B-6

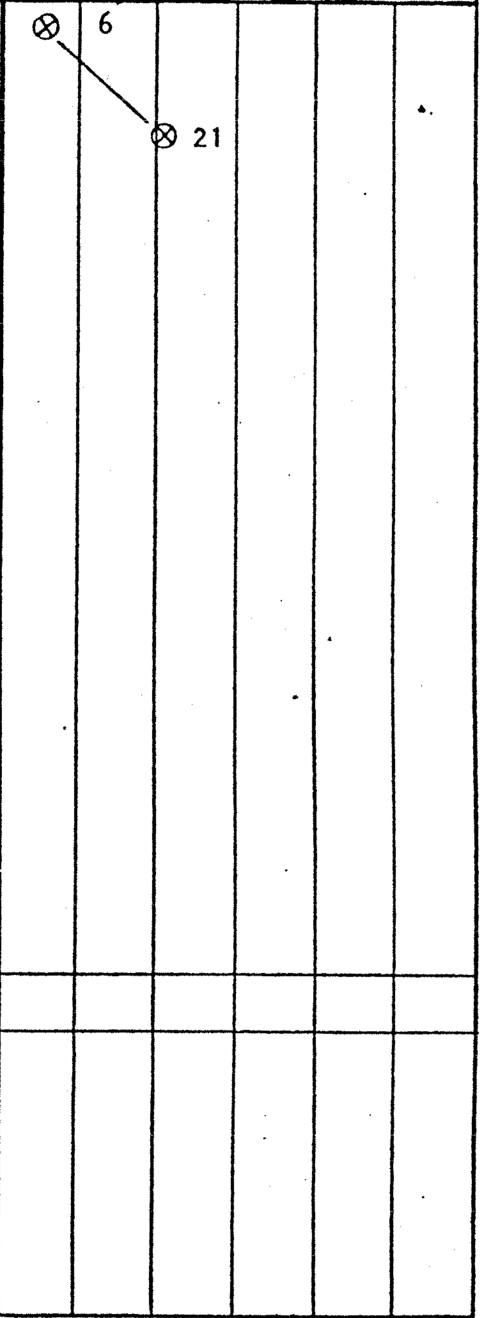
OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
					SURFACE ELEVATION 759.93'	
	1	SS				
	2	SS				
5.0	3	RB				
10.0					Fill; rubble, cobble, gravel, sand and green shale (Decorah) clay - moist	
15.0						
20.0						
25.0					Boulder (Limestone)	
					White Sandstone St. Peter Formation	
30.0						
					Continued	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50



WATER LEVEL OBSERVATIONS		
W.L.	Dry	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/24/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. B-6

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
30.0					SURFACE ELEVATION ↴	
	3	RB			White Sandstone St. Peter Formation	
35.0					End of boring at 34.8 feet. Boring grouted from bottom to ground surface	

WATER LEVEL OBSERVATIONS		
W.L.	Dry	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/24/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB #92776	SHEET 2 of 2

The stratification lines represent the approximate boundary ... and the transition may be gradual.

APPENDIX C

MONITORING DATA FROM FORD REPORT
DATED MARCH 3, 1982

(PAGES 6, 8 AND 9)

Table 1

Twin Cities Assembly Plant
Groundwater Analysis Summary

from 3/3/82?

		Well No.					
Dissolved Metals	Units	B1	B2	B3	B4	RAL mg/L	
Copper	mg/l	0.03	0.02	0.01	0.01		
Cadmium	mg/l	0.02	<0.01	<0.01	0.02	0.005	
Zinc	mg/l	0.06	0.04	<0.02	0.09		
Nickel	mg/l	0.07	0.04	0.02	0.05	0.15	
Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	0.12	
Lead	mg/l	0.12	<0.05	<0.05	0.06	0.02	
pH	Units	7.08	7.01	7.07	6.84		
Specific Conductivity	Umhos/cm	985	1064	1666	1482		
Temperature	°F.	47	45	45	46		
Organics							
1,2 Dichloroethylene	µg/l	<2	15	<2	<2	70	
Trichloroethylene	µg/l	4	5	<2	<2	31	MCL/5
Toluene	µg/l	1	1	<1	1	2420	

? check

Table 3
Twin Cities Assembly Plant
Groundwater Monitoring Results
Dissolved Metals
March 3, 1982

	B1	B2	B3	B4
Lead	0.12	<.05	<.05	0.06
Chromium	<.05	<.05	<.05	<.05
Nickel	0.07	0.04	0.03	0.05
Zinc	0.06	0.04	<.02	0.09
Cadmium	0.02	<.01	<.01	0.02
Copper	0.03	0.02	0.01	0.01

All values are the average of seven measurements of the same sample. Units are mg/l.

on previous page concn is 0.02 mg/l

TABLE 4
Twin Cities Assembly Plant
Groundwater Monitoring Results
Volatile Organics
March 3, 1982

	B1	B1 (Dup)	B2	B2 (Dup)	B3	B3 (Dup)	B4	B4 (Dup)
1,2 Dichloroethylene	-	-	13	17	-	-	-	-
Trichloroethylene	4	3	5	5	-	-	-	-
Toluene	1	2	1	1	-	-	1	1

Duplicate field blanks showed no detectable levels of volatile organics.

Well casing blanks showed 4 PPB Toluene and 6 PPB methylene chloride, however these are attributed to the laboratory atmosphere.

Only detectable quantities are reported.

APPENDIX D

MONITORING DATA FROM FORD REPORT
DATED DECEMBER 1, 1982

(PAGES 5, 10, 11 AND 12)

Table 1

Groundwater Analysis Summary
December 1, 1982

		Well					River			
Dissolved Metals		B1	B2	B3	B4	B5	R1[1]	R2[1]	R3[1]	RAL
Copper	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Cadmium	mg/l	0.003	0.003	0.003	0.005	<0.001	<0.001	0.001		0.005
Zinc	mg/l	<0.05	<0.05	<0.05	0.06	<0.05	<0.08	<0.08	<0.05	
Nickel	mg/l	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.15
Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.12
Lead	mg/l	0.005	0.005	0.004	0.006	0.003	<0.002	<0.002	<0.002	0.02
pH	Units	7.1	8.6	9.0	8.2	8.4	8.5	8.6		
Specific Conductivity	Umhos/cm	982	1210	1260	1580	942	377	380		
Temperature	°F.	47	51	52	53	51	34	33		
Volatile Organics Detected										
		B1	2	3	4	5				
1,2-Dichloroethylene	µg/l	ND	22.0	< 2	6.7	ND	ND	ND	ND	
Benzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	
Toluene	µg/l	2.1	<1	<1	<1	<1	3	<1	<1	
Chlorobenzene	µg/l	ND	ND	<1	<1	ND	ND	ND	ND	
Xylene(3 isomers)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	

Note 1:

R1--Mississippi River upstream of Ford Power Plant.
R2--Mississippi River near southern property boundary.
R3--Mississippi River in park approx. 200 yds. south of Ford property.

Twin Cities Assembly Plant
River Sampling Results
December 1, 1982

	Units	River Upstream of Power Plant	River Downstream on Ford Property	River Downstream in Park
Dissolved Metals				
Copper	mg/l	<0.05	<0.05	<0.05
Cadmium	mg/l	<0.001	0.001	
Zinc	mg7l	<0.05	<0.05	<0.05
Nickel	mg/l	<0.02	<0.02	
Chromium	mg/l	<0.05	<0.05	<0.05
Lead	mg/l	<0.002	<0.002	<0.002
pH	units	8.5	8.6	
Specific Conductivity	umhos/cm	377	380	
Temperature	OF.	34	33	
Volatile Organics				
1,2-Dichloroethylene	µg/l	ND	ND	ND
Benzene	µg/l	<1	<1	<1
Toluene	µg/l	3.0	<1	<1
Chlorobenzene	µg/l	ND	ND	ND
Xylene	µg/l	<1	<1	<1

Table 5

Twin Cities Assembly Plant
Groundwater Analysis Summary
Dissolved Metals Results for 12/82 ?

Dissolved Metals	**Units**	**B1**	**B2**	**B3**	**B4**	**B5**
Copper	mg/l 3/82	< 0.05 .03	<0.05 .02	<0.05 .01	<0.05 .01	<0.05
Cadmium	mg/l 3/82	0.003 .02	0.003 < .01	0.003 < .01	0.005 .02	<0.001 ← ok. detection limit
Zinc	mg/l 3/82	< 0.05 .06	<0.05 .04	<0.05 < .02	0.06 .09	<0.05
Nickel	mg/l 3/82	0.06 .07	< 0.02 .04	< 0.02 .02	<0.02 .05	<0.02
Chromium	mg/l 3/82	< 0.05 <	< 0.05 <	<0.05 <	<0.05 <	<0.05
Lead	mg/l 3/82	<0.005 0.12	0.005 < .05	0.004 < .05	0.006 .06	0.003
pH	Units	7.1	8.6	9.0	8.2	8.4
Specific Conductivity	Umhos/cm	982 985	1210 1064	1260 1666	1580 1482	942
Temperature	^{o}F.	47	51	52	53	51

is ✓ detection limit <.005
or <0.05

Compare to summary
table 2pg previous

Table 6

Twin Cities Assembly Plant
Groundwater Analysis Summary
Volatile Organic Results

for 12/82??

	Units	B1	B1 Duplicate	B2	B2	B3	B3	B4	B4	B5	B5
1,2-Dichloroethylene	µg/l	ND	ND	21.3	22.6	ND	<2	8.1	5.3	ND	ND
Benzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/l	1.9	2.2	1.1	<1	<1	1.6	0.6	<0.1	0.6	0.5
Chlorobenzene	µg/l	ND	ND	ND	ND	<1	<1	<1	<1	ND	ND
Xylene (3 isomers)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

why <1 on summary table if can detect concn below 1

vs 2.1 on summary table

vs. <1 on summary

avg not used in summary

avg used on summary

where is rest of analytical?

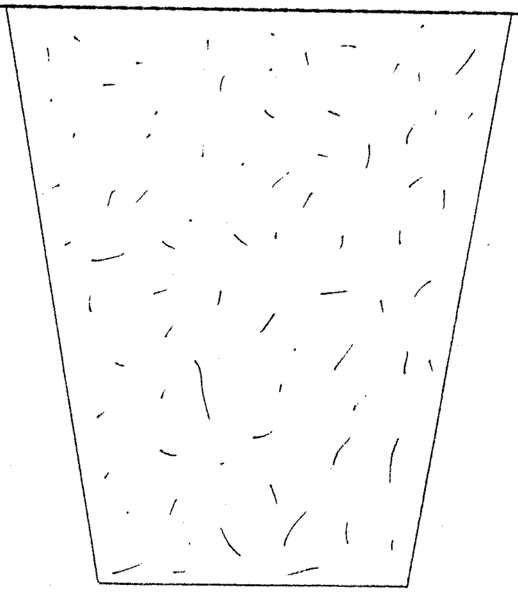
APPENDIX E

TEST PIT LOGS

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

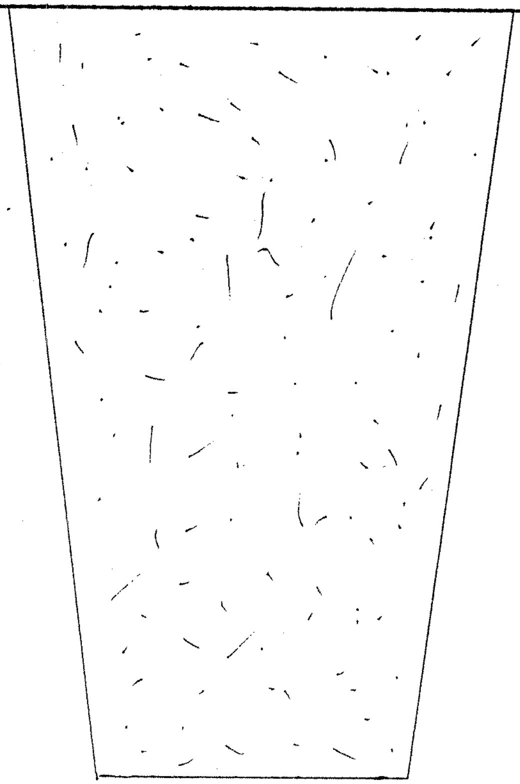
HOLE DESIGNATION: TP1-87
DATE COMPLETED: 12/4/87
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SP) SAND, fine to medium grained, trace silt, trace gravel, dry.		
2			
3			
4	Occasional seams of sandy silt (ML)		
5			
6			
7			
8			
9			
10	End of Test Pit at 9.0' BGS		
11	Hole backfilled		
12			
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

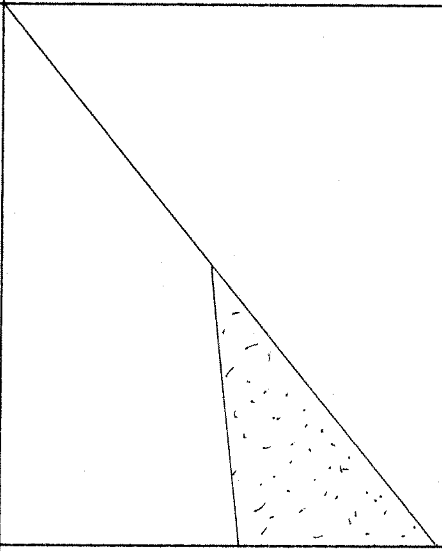
HOLE DESIGNATION: TP2-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SM) SAND, silty, some limestone, some well rounded gravel and cobbles		
2			
3			
4			
5			
6			
7			
8	Layered silt (ML) and clay (CL), brown to light brown		
9			
10			
11	(SP) SAND, very fine grained, brown to light brown		
12			
13	End of Test Pit at 12.0' BGS, Hole backfilled		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP2A - 88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

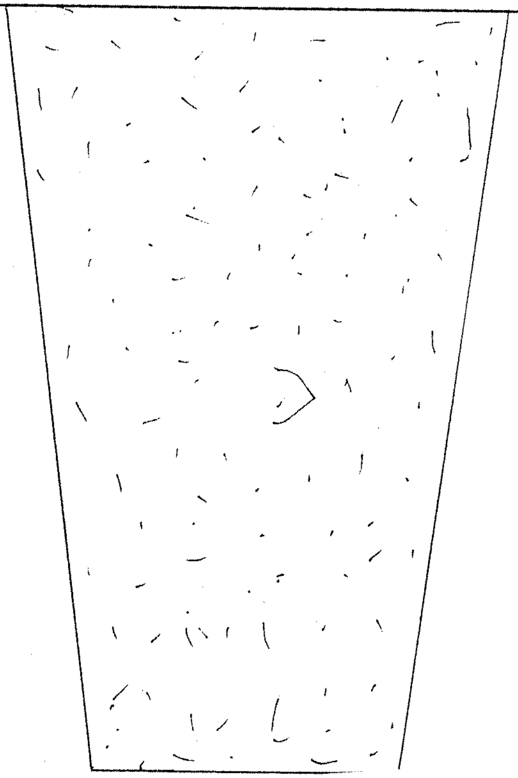
FT ABV. GRADE	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
7			
6			
5			
4			
3	(Test Pit dug into side of bluff)		
2	Building rubble: very large pieces of concrete (>3'0) glass, iron, lumber		
1			
0	Grade		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP3-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

7

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0		702.1	
1	(SM) SAND, some gravel, silty, brown to light brown		
2			
3	seam of black/gray silty sands (SM), very strong odor from 2.0' to 3.0' BGS (sample taken)		
4			
5			
6	clean silty sands (SM) from 3.0' to 4.5' BGS		
7			
8	(SM) SAND, gray, some odor as 2.0' to 3.0' BGS soil		
9			
10			
11			
12			
13	End of Test Pit at 12.0' BGS gray color and odor to 12.0 BGS Hole Backfilled	∇ 689.61	

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191

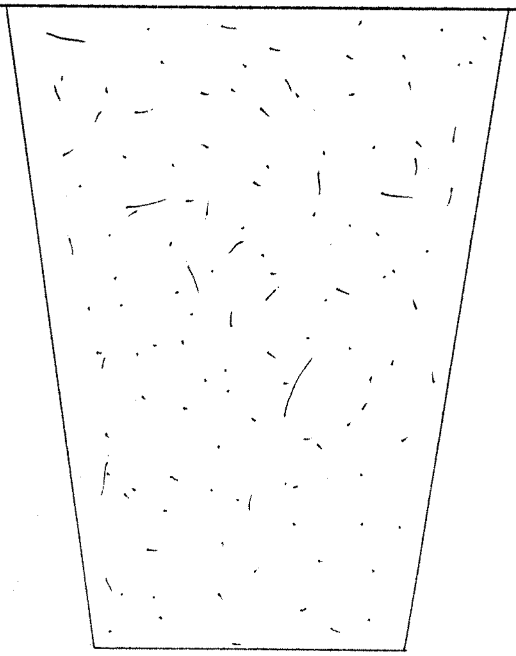
CLIENT: FORD MOTOR COMPANY

LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP4-88

DATE COMPLETED: 1/19/88

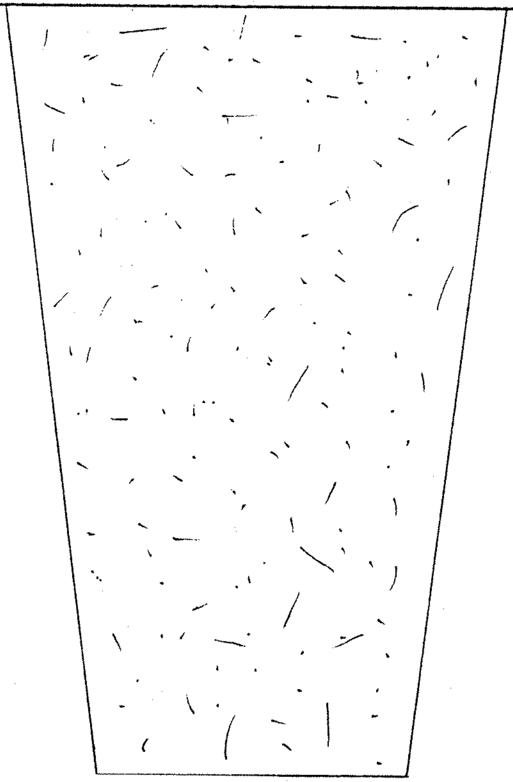
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SP) SAND, very fine grained, some silt, moist		
2			
3	occasional lenses of sandy silt (ML)		
4			
5			
6			
7			
8			
9			
10			
11	End of Test Pit at 10.0' BGS Hole Backfilled		
12			
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP5-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1			
2	(CL-ML) CLAY and SILT, sandy, gray to gray/blue, moist		
3			
4			
5			
6	(SP) SAND, fine to very fine grained, trace silt, trace gravel, light brown to brown		
7			
8			
9			
10			
11			
12			
13	End of Test Pit at 12.0' BGS Hole Backfilled		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS

PROJECT NO.: 2191

CLIENT: FORD MOTOR COMPANY

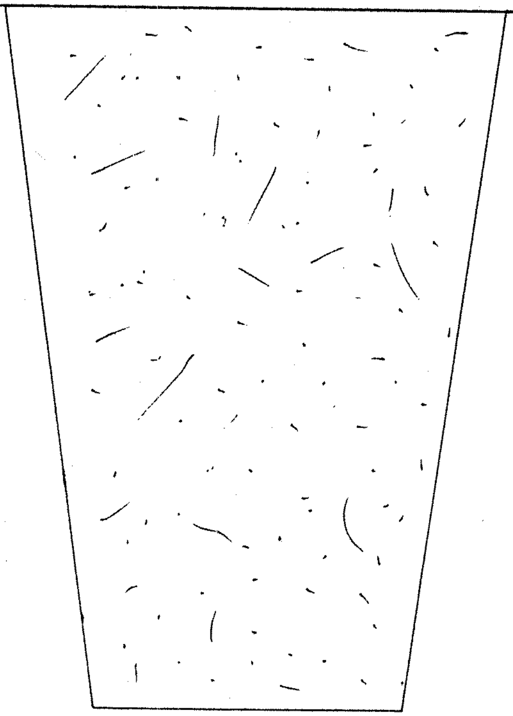
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP6-88

DATE COMPLETED: 1/19/88

EXCAVATION METHOD: BACKHOE - CAT 211 LC

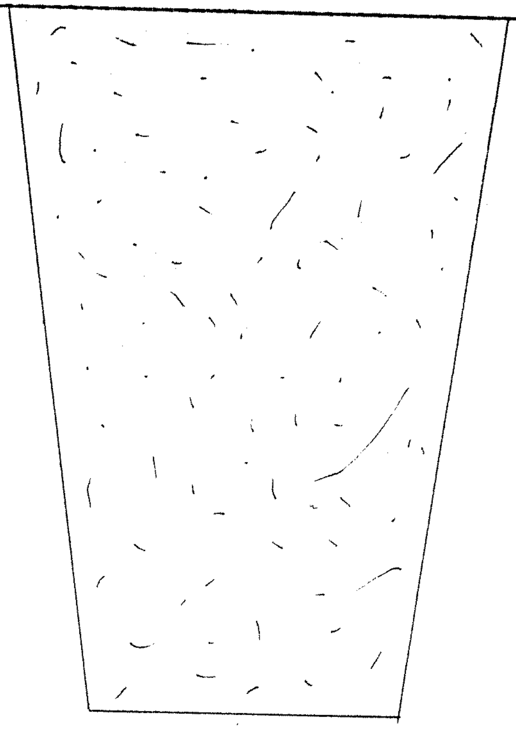
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(ML) SILT, very sandy, occasional seams of yellow SM		
2			
3			
4			
5	(SW-GW) SAND and GRAVEL, fine to coarse grained, some large well rounded cobbles		
6			
7			
8			
9			
10			
11			
12	End of Test Pit at 11.0' BGS Hole Backfilled		
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

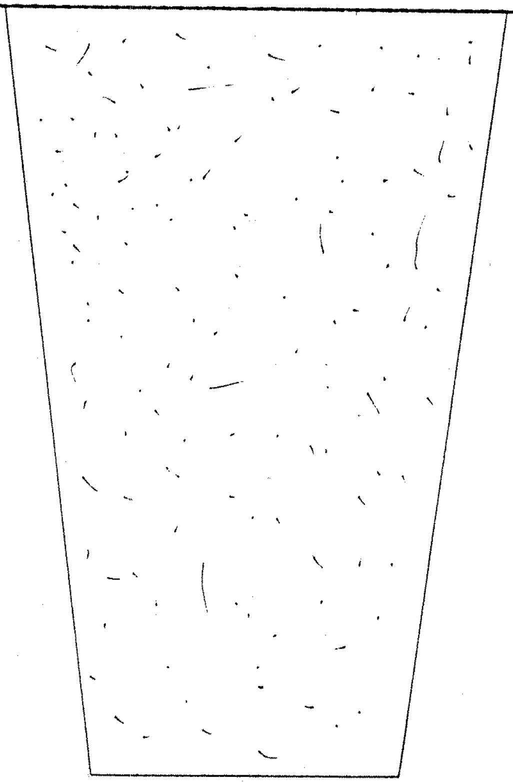
HOLE DESIGNATION: TP7-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	Building rubble, concrete, railroad ties, timbers		
2			
3			
4			
5			
6			
7			
8			
9			
10	(SP) SAND, very loose St. Peter sand, yellow to white yellow to white		
11			
12	End of Test Pit at 11.0' BGS Hole backfilled		
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

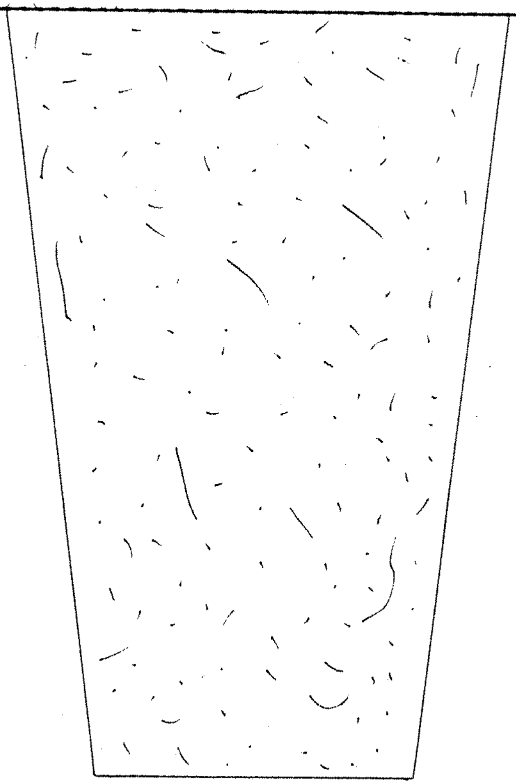
HOLE DESIGNATION: TP8-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(GW) GRAVEL and COBBLES, very coarse grained, trace sand.		
2			
3			
4			
5			
6			
7			
8			
9	Small piece of metal at 9.5'		
10			
11	(SP) SAND, very fine grained, color change to gray/black (sample taken)		
12	End of Test Pit at 12.0' BGS Hole backfilled		
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP9-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SP) SAND, very fine grained, yellow/orange, trace silt.		
2			
3			
4	Occasional seams of fine gravel and coarse sand.		
5			
6			
7			
8			
9			
10			
11			
12	(SM) SAND, silty, gray, wet to saturated		
13	End of Test Pit at 12.0' BGS Hole backfilled		

APPENDIX F

LABORATORY ANALYTICAL REPORTS

pace laboratories, inc.

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

REPORT OF LABORATORY ANALYSIS

#2191

March 22, 1988

Rec'd CRA
MAR 23 88

Mr. Steven Mockenhaupt
Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

Dear Mr. Mockenhaupt:

Enclosed is the report of laboratory analyses for samples received 01/22/88.

If you have any questions concerning this report, please feel free to contact Tom Halverson, Bill Scruton or me.

Sincerely,

Roger C. Splinter, Ph.D.
Director, Laboratory Services

Enclosures

1710 Douglas Drive North □ Minneapolis, MN 55422 □ Phone (612) 544-5543
an equal opportunity employer

pace
laboratories, inc.

REPORT OF LABORATORY ANALYSIS

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

March 22, 1988
PACE Project Number: 880122550

Attn: Mr. Steven Mockenhaupt

Project #2191

Date Sample(s) Collected: By Client
Date Sample(s) Received: 01/22/88

PACE Sample Number:

Parameter	Units	MDL	016700 TP-3 (1) Leachate	016710 TP-8 (2) Leachate
Arsenic	ug/L	2	10	ND
Barium	mg/L	0.2	1.5	0.2
Cadmium	mg/L	0.01	ND	ND
Chromium	mg/L	0.05	ND	ND
Copper	mg/L	0.01	0.02	ND
Lead	mg/L	0.1	0.3	ND
Mercury	ug/L	0.8	ND	ND
Selenium	ug/L	6	ND	ND
Silver	mg/L	0.04	ND	ND
Zinc	mg/L	0.01	0.92	0.03
Methanol	mg/L	5.0	ND	-
Ethanol	mg/L	5.0	ND	-
Iso-Propyl Alcohol	mg/L	5.0	ND	-
Ethyl Acetate	mg/L	5.0	ND	-
N-Butanol	mg/L	5.0	ND	-
Cyclohexane	mg/L	5.0	ND	-
Chloromethane	ug/L	1.0	ND(3)	-
Bromomethane	ug/L	1.5	ND(3)	-
Dichlorodifluoromethane	ug/L	1.5	ND(3)	-
Vinyl chloride	ug/L	1.5	ND(3)	-
Chloroethane	ug/L	1.0	ND(3)	-
Trichlorofluoromethane	ug/L	0.4	ND(3)	-
Allyl chloride	ug/L	4.0	ND(3)	-
1,1-Dichloroethylene	ug/L	0.3	ND(3)	-
Tetrahydrofuran	ug/L	15	ND(3)	-
1,1-Dichloroethane	ug/L	0.2	ND(3)	-

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Steven Mockenhaupt
Page 2

March 22, 1988
PACE Project Number: 880122550

PACE Sample Number:

Parameter	Units	MDL	016700 TP-3 (1) Leachate	016710 TP-8 Leachate
trans-1,2-Dichloroethylene	ug/L	0.3	ND(3)	-
cis-1,2-Dichloroethylene	ug/L	0.5	ND(3)	-
Ethyl ether	ug/L	0.3	ND(3)	-
Chloroform	ug/L	0.5	ND(3)	-
1,1,2-Trichlorotrifluoroethane	ug/L	0.7	ND(3)	-
Methyl ethyl ketone	ug/L	20	ND(3)	-
1,2-Dichloroethane	ug/L	0.2	ND(3)	-
Dibromomethane	ug/L	1.5	ND(3)	-
1,1,1-Trichloroethane	ug/L	0.5	ND(3)	-
Carbon tetrachloride	ug/L	0.3	ND(3)	-
Bromodichloromethane	ug/L	0.2	ND(3)	-
Dichloroacetonitrile	ug/L	1.0	ND(3)	-
2,3-Dichloro-1-propene	ug/L	0.5	ND(3)	-
1,2-Dichloropropane	ug/L	0.2	ND(3)	-
1,1-Dichloro-1-propene	ug/L	1.0	ND(3)	-
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND(3)	-
1,1,2-Trichloroethylene	ug/L	0.5	ND(3)	-
Benzene	ug/L	1.0	ND(3)	-
1,3-Dichloropropane	ug/L	0.6	ND(3)	-
Dibromochloromethane	ug/L	1.0	ND(3)	-
1,1,2-Trichloroethane	ug/L	1.0	ND(3)	-
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND(3)	-
1,2-Dibromoethane	ug/L	4.0	ND(3)	-
2-Chloroethylvinyl ether	ug/L	5.0	ND(3)	-
Bromoform	ug/L	1.0	ND(3)	-
1,1,1,2-Tetrachloroethane	ug/L	0.3	ND(3)	-
Methyl isobutyl ketone	ug/L	1.0	ND(3)	-
1,2,3-Trichloropropane	ug/L	4.0	ND(3)	-
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND(3)	-
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND(3)	-
Pentachloroethane	ug/L	2.0	ND (3)	-
Toluene	ug/L	1.0	180(3)	-
Chlorobenzene	ug/L	1.0	ND (3)	-
Ethyl benzene	ug/L	1.0	85 (3)	-

MDL Method Detection Limit

pace laboratories, inc.

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa

REPORT OF LABORATORY ANALYSIS

Mr. Steven Mockenhaupt
Page 3

March 22, 1988
PACE Project Number: 880122550

PACE Sample Number:			016700 TP-3 (1)	016710 TP-8
Parameter	Units	MDL	Leachate	Leachate
Cumene	ug/L	1.0	ND (3)	-
m-Xylene	ug/L	1.0	2600(4)	-
p-Xylene	ug/L	1.0	3700(4)(5)	-
o-Xylene	ug/L	1.0	3700(4)(5)	-
1,3-Dichlorobenzene	ug/L	4.0	ND (3)	-
1,2-Dichlorobenzene	ug/L	4.0	ND (3)	-
1,4-Dichlorobenzene	ug/L	4.0	ND (3)	-
Dichlorofluoromethane	ug/L	1.0	ND (3)	-

MDL Method Detection Limit

March 22, 1988
PACE Project Number: 880122550

PACE Sample Number: Parameter	Units	MDL	016680 TP-3	016690 TP-8
Cyanide, Reactive	mg/kg	1.0	ND	ND
Flash Point	Degrees F	1	140	GT200
Sulfide, Reactive	mg/kg	14	ND	61
pH		0.1	7.6	7.9
Chloromethane	ug/kg	120	-	ND
Bromomethane	ug/kg	190	-	ND
Dichlorodifluoromethane	ug/kg	190	-	ND
Vinyl Chloride	ug/kg	190	-	ND
Chloroethane	ug/kg	120	-	ND
Methylene Chloride	ug/kg	120	-	ND
Acetone	ug/kg	5000	-	ND
Trichlorofluoromethane	ug/kg	50	-	ND
Allyl chloride	ug/kg	500	-	ND
1,1-Dichloroethylene	ug/kg	38	-	ND
Tetrahydrofuran	ug/kg	1800	-	ND
1,1-Dichloroethane	ug/kg	25	-	ND
Trans-1,2-Dichloroethylene	ug/kg	38	-	ND
cis-1,2-Dichloroethylene	ug/kg	62	-	ND
Ethyl ether	ug/kg	380	-	ND
Chloroform	ug/kg	62	-	ND
1,1,2-Trichlorotrifluoroethane	ug/kg	88	-	ND
Methyl ethyl ketone	ug/kg	5000	-	ND
1,2-Dichloroethane	ug/kg	25	-	ND
Dibromomethane	ug/kg	180	-	ND
1,1,1-Trichloroethane	ug/kg	62	-	ND
Carbon Tetrachloride	ug/kg	38	-	ND
Bromodichloromethane	ug/kg	25	-	ND
Dichloroacetonitrile	ug/kg	10000	-	ND
2,3-Dichloro-1-propene	ug/kg	62	-	ND
1,2-Dichloropropane	ug/kg	25	-	ND
1,1-Dichloro-1-propene	ug/kg	120	-	ND
cis-1,3-Dichloro-1-propene	ug/kg	62	-	ND
1,1,2-Trichloroethylene	ug/kg	62	-	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

Mr. Steven Mockenhaupt
Page 5

March 22, 1988
PACE Project Number: 880122550

PACE Sample Number: Parameter	Units	MDL	016680 TP-3	016690 TP-8
Benzene	ug/kg	120	-	ND
1,3-Dichloropropane	ug/kg	75	-	ND
Dibromochloromethane	ug/kg	120	-	ND
1,1,2-Trichloroethane	ug/kg	120	-	ND
Trans-1,3-Dichloro-1-propene	ug/kg	38	-	ND
1,2-Dibromoethane	ug/kg	500	-	ND
2-Chloroethylvinyl Ether	ug/kg	620	-	ND
Bromoform	ug/kg	120	-	ND
1,1,1,2-Tetrachloroethane	ug/kg	38	-	ND
Methyl isobutyl ketone	ug/kg	120	-	ND
1,2,3-Trichloropropane	ug/kg	500	-	ND
1,1,2,2-Tetrachloroethane	ug/kg	120	-	ND
1,1,2,2-Tetrachloroethylene	ug/kg	120	-	ND
Pentachloroethane	ug/kg	250	-	ND
Toluene	ug/kg	120	-	ND
Chlorobenzene	ug/kg	120	-	ND
Ethylbenzene	ug/kg	120	-	ND
Cumene	ug/kg	120	-	ND
m-Xylene	ug/kg	120	-	ND
p-Xylene	ug/kg	120	-	ND
o-Xylene	ug/kg	120	-	ND
1,3-Dichlorobenzene	ug/kg	500	-	ND
1,2-Dichlorobenzene	ug/kg	500	-	ND
1,4-Dichlorobenzene	ug/kg	500	-	ND
Dichlorofluoromethane	ug/kg	120	-	ND
Methanol	mg/kg	5.0	-	ND
Ethanol	mg/kg	5.0	-	ND
Iso-Propyl Alcohol	mg/kg	5.0	-	ND
Ethyl Acetate	mg/kg	5.0	-	ND
N-Butanol	mg/kg	5.0	-	ND
Cyclohexane	mg/kg	5.0	-	ND

ND Not detected at or above the MDL.
MDL Method Detection Limit

(1) All analysis performed on extract from Toxicity Characteristic Leach Procedure.
(2) All analyses were performed on the EP Toxicity Leachate.
(3) Sample diluted 1 to 50; MDL's must be multiplied by dilution factor.
(4) Sample diluted 1 to 200, MDL's must be multplied by dilution factor.
(5) These compounds co-elute. Compound calculated as o-xylene.

The data contained in this report were obtained using EPA or other approved methodologies. All analysis were performed by me or under my direct supervision.

Thomas L. Halverson
Inorganic Chemistry Manager

William H. Scruton
Organic Chemistry Manager

Quality Control Data

Project # 2191
Project # 80122.550

Table 1

Summary of Accuracy Data (1)

Parameter	True Value	Observed Value	% Recovery	Mean % Recovery
Ethanol	8.8	8.8	100	NA(2)
Methylene Chloride	13.3	13.3	100	NA
Acetone	7.9	7.9	100	NA
Isopropyl Alcohol	8.0	8.0	100	NA
Methyl Ethyl Ketone	8.0	8.0	100	NA
Ethyl Acetate	9.0	9.0	100	NA
Cyclo hexane	9.5	9.5	100	NA
Methyl Isobutyl Ketone	8.0	8.0	100	NA
Toulene	8.7	8.7	100	NA
Xylenes	26.1	26.1	100	NA

(1) Data pertains to Continuing Calibration Check Standard.
(2) NA - Not available due to insufficient data.

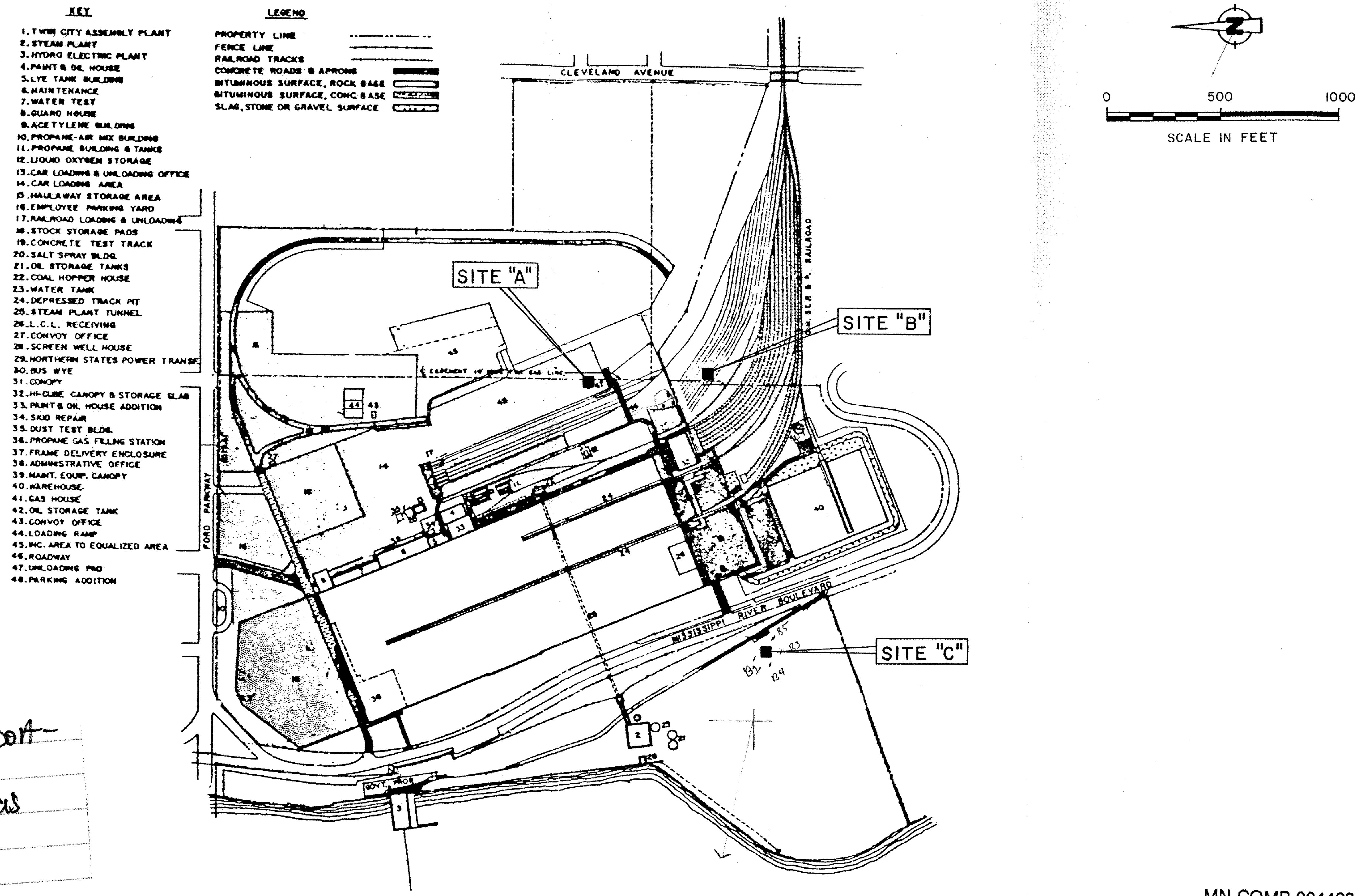
Quality Control Data

Project # 2191
PACE Project # 880122.550

Table 3

Summary of Precision Data

Parameter	Blank	Sample Result (D_1)	Duplicate Result (D_2)	Difference D_1-D_2	Date Analyzed
Flash Point		155	140	15	01/27/88
Barium	0.11	0.3	0.3	0	02/12/88



Part of previous report -
RI/FS
Assessment of fill areas
CRA Oct. 1988

figure 1.2
LOCATION OF FILL SITES
Ford Motor Company

CRA

2191-21/10/88-M

FC2
D4

GROUNDWATER MONITORING REPORT AND EVALUATION

SITE C

FORD MOTOR COMPANY

ST. PAUL, MINNESOTA

1a

DRAFT

PRINTED ON

JAN 11 1990

January 1990

2853

GROUNDWATER MONITORING REPORT AND EVALUATION

SITE C

FORD MOTOR COMPANY

ST. PAUL, MINNESOTA

DRAFT

PRINTED ON

JAN 11 1990

January 1990

2853

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

January 11, 1990

Reference No. 2853

Mr. Jerome Amber
FORD MOTOR COMPANY
15201 Century Drive, Suite 608
Dearborn, Michigan 48120

Dear Mr. Amber:

RE: Groundwater Monitoring Report and Evaluation - Site C

Please find enclosed the subject draft report. The groundwater data contained in this report is currently undergoing QA/QC review. This review is expected to be completed within 10 days pending receipt of all necessary data for the analytical laboratory.

If additional monitoring is undertaken during 1990 at Site C, consideration should be given to installation of a well west of abandoned well B2 to essentially replace well B2. This well would need to be installed at the west toe of the fill rather than through the rubble of the fill to accomplish installation. This well is necessary, given the information generated by this investigation, to provide meaningful data to any future monitoring. A proposed well location is presented on the attached figure.

If you should have any questions, please do not hesitate to contact us.

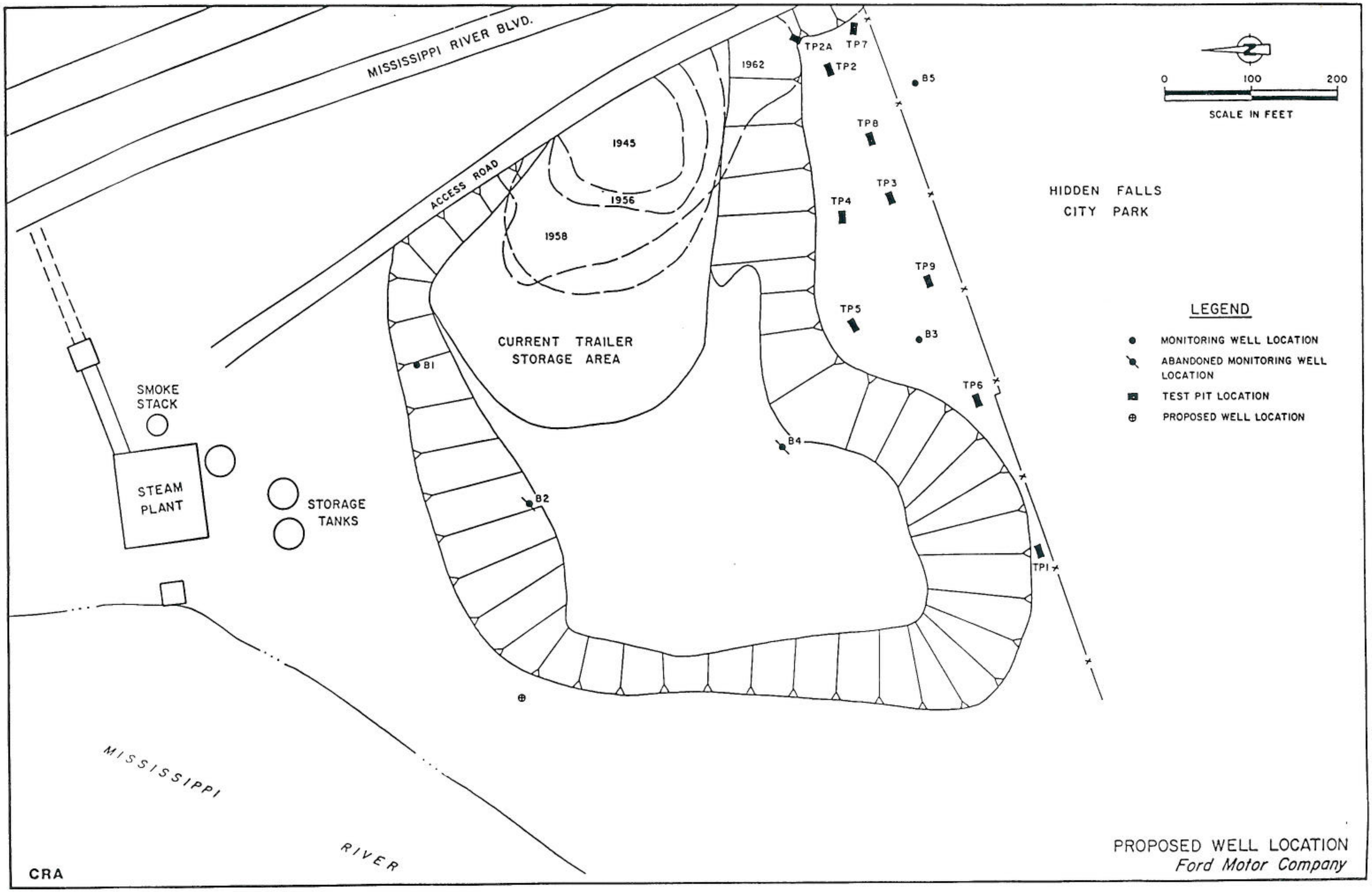
Yours Very Truly,

CONESTOGA-ROVERS AND ASSOCIATES

Jon L. Christoff

Jon L. Christofferson

JLC/kk
Enc.
cc: Jim Gibson, Ford
John Kallaus, Ford
Don Rueh, Ford



PROPOSED WELL LOCATION
Ford Motor Company

2853-11/27/89-M

LIST OF TABLES

LIST OF FIGURES

LIST OF PLANS

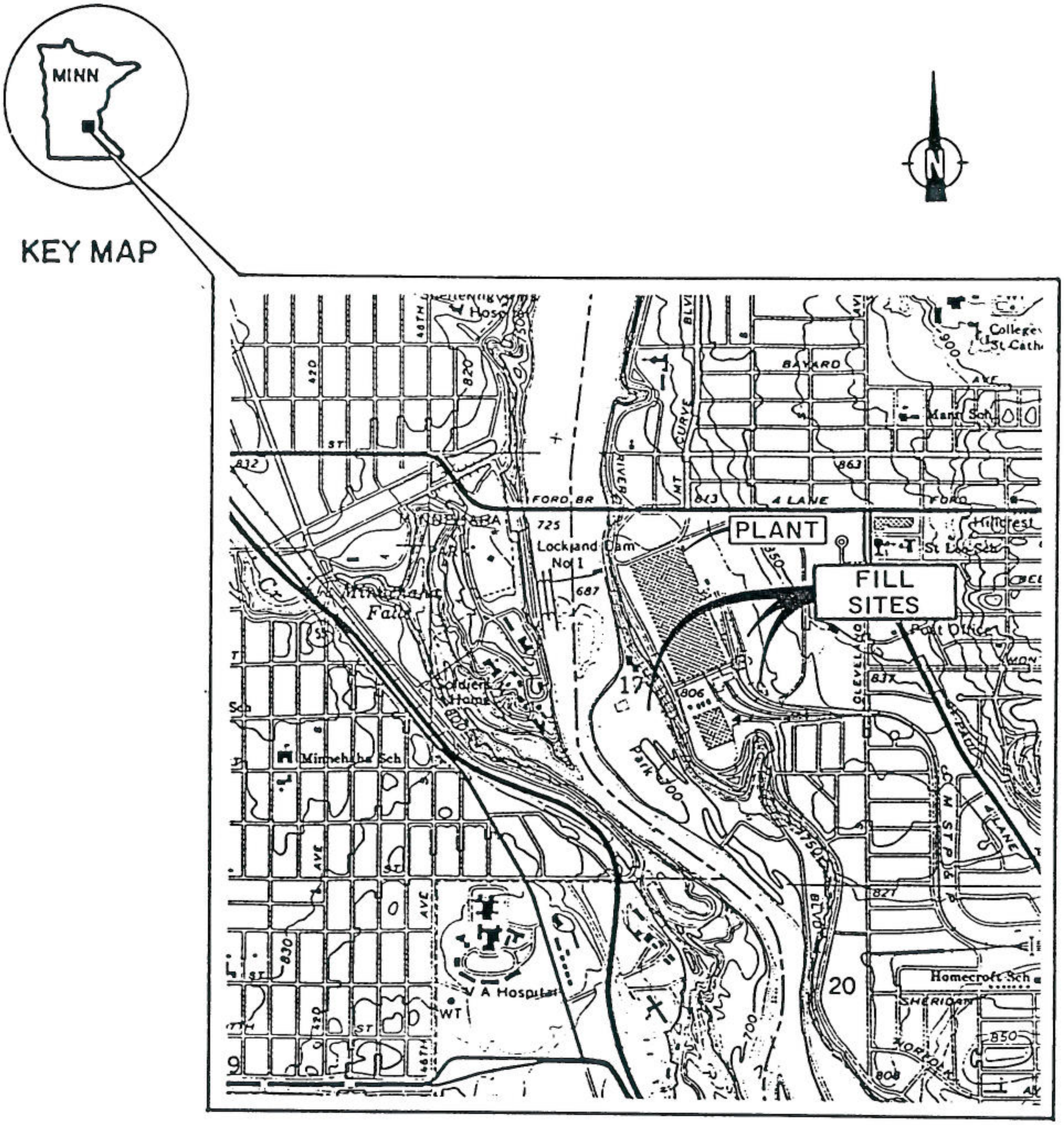
1.0 INTRODUCTION

The Ford Motor Company, Twin Cities Assembly Plant (Plant) is located in St. Paul, Minnesota, at 966 South Mississippi River Boulevard. The Plant complex includes buildings on both sides of Mississippi River Boulevard. Buildings west of Mississippi River Boulevard are located above the river bluff on the adjacent sand plains. The Plant location is presented on Figure 1.1.

The Plant was originally used to manufacture glass over 50 years ago. Since then the Plant has been expanded several times and is used to assemble pick-up trucks.

At different times during the Plant's history prior to 1970, paint sludges/wastes were deposited in a relatively small area on Plant property, west of Mississippi River Boulevard (Site C). This waste deposit was identified to U.S. EPA by Ford during the Superfund notification process. A hydrogeologic investigation was commissioned by Ford in 1981. Since that investigation was completed, additional earth fill has been placed over part of the waste fill. The area is now used as a parking lot for tractor trailer truck units. Excavated materials from two other sites (Sites A and B) were subsequently moved to Site C. The locations of the fill Sites are also presented on Figure 1.1 and presented in more detail on Figure 1.2.

In an effort to address environmental issues that may be associated with past waste handling and disposal practices, Ford Motor Company (Ford) hired Conestoga-Rovers and Associates (CRA) to conduct an



CITY OF ST.PAUL

FIGURE 1.1
LOCATION PLAN
Ford Motor Company

CRA

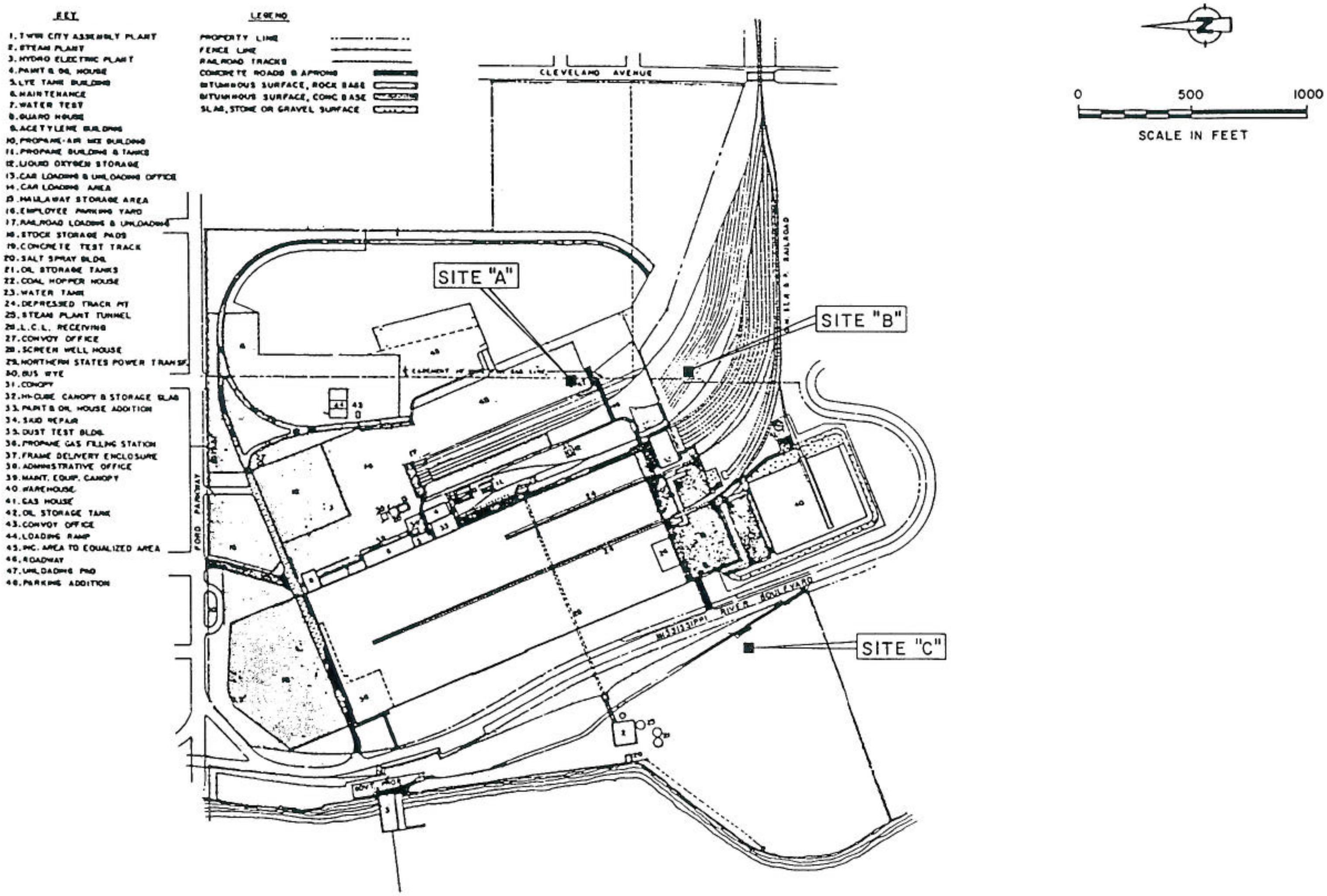


figure 1.2
LOCATION OF FILL SITES
Ford Motor Company

CRA

2191-21/10/88-M

assessment of the wastes deposited at these sites. This assessment consisted of a file review, hydrogeologic evaluation, test hole excavation (test pits), stadia survey and waste characterization sampling. From these tasks an assessment and evaluation of the site conditions was conducted. The results of these efforts are presented in a report titled "Assessment of Fill Areas, Ford Motor Company, Twin Cities Assembly Plant", dated October 25, 1988 by CRA.

The October 1988 report was reviewed and commented on by the MPCA in a letter dated February 7, 1989. The MPCA accepted the report and requested additional work. A work plan was submitted to MPCA to address their comments and requests on March 10, 1989, and was subsequently approved by MPCA on April 25, 1989. The scope of this additional investigation consisted primarily of three rounds of groundwater monitoring conducted over 1989. In addition, site wells were inspected, repaired and, if necessary, abandoned. Site area land features were also updated by survey.

This report represents a summary of the work completed as part of the Site C monitoring and environmental investigation.

2.0 BACKGROUND

At different times during the Plant's history, construction rubble and paint sludges/wastes were deposited in a relatively small area (Site C - approximately four acres in size) on Plant property west of Mississippi River Boulevard between the Boulevard and the Mississippi River. The majority of this material was deposited during the years 1950 through 1965. This practice was discontinued in 1965. During the years 1965 and 1966, construction debris was deposited in large quantities on top of this fill at Site C. The United States Corps of Engineers also deposited additional rubble between the Ford disposal Site and the river during reconstruction of the Lock and Dam No. 1 near the "Ford Bridge".

This Site C waste deposit was identified to the USEPA by Ford during the Superfund notification process. A hydrogeologic investigation was commissioned by Ford in 1981. Since the investigation was completed, additional clean fill has been placed over part of the Site C waste fill. Earth fill and construction rubble including broken concrete and road excavation rubble from the construction of Mississippi River Boulevard continue to be brought to Site C. A major potion of the top of the fill has been paved with 8 inches of concrete and is now used as a parking lot for tractor-trailer truck units. The remaining top area of Site C is used as a snow dump during winter months for snow removed from local public streets and parking lots.

3.0 FIELD ACTIVITIES

3.1 WELL REPAIR AND ABANDONMENT

On April 25, 1989, a well inspection was conducted of the existing monitoring wells at Site C. Upon completion of this inspection it was determined by CRA that wells B1, B3 and B5 could be made functional again. Wells B2 and B4 were damaged beyond repair by the continual dumping and regrading of rubble and fill in these areas.

In June of 1989, GME Consultants Inc., repaired wells B1, B3 and B5 by installing locking protective casings, bumper posts and additional riser pipes where necessary. Wells B2 and B4 were abandoned in accordance with the Minnesota Department of Health (MDH) water well code. The wells were grouted with a neat cement grout and all retrievable material was removed. Well abandonment records and logs are presented in Appendix A.

3.2 SITE C SURVEY

Following the repairs to wells B1, B3 and B5, a Site survey was completed to establish new top of casing elevations on these wells and to further define the top of fill area.

Table 3.1 presents the new well elevation data. Plan 1 (enclosed) shows the new top of fill area. It should be noted that filling and earth moving activities are still going on in this area and this plan represents the top of fill area as surveyed in September 1989.

3.3 GROUNDWATER SAMPLING

Three (3) rounds of groundwater and surface water sampling were completed according to the approved work plan. The samples were submitted to Pace Laboratories Inc. for chemical analysis under chain-of-custody procedures. The monitoring wells were purged and sampled using a precleaned* bottom filling stainless steel bailer. A minimum of three well volumes were purged prior to sampling. In the event that a well bailed dry prior to the removal of three well volumes, the well was allowed to recharge prior to sampling. The surface water samples were taken by the "Grab Sampling" method. The locations are close to, but may not be exactly the same as those previous sampled by Ford during earlier monitoring.

3.4 GROUNDWATER FLOW DIRECTION

Groundwater elevation data was obtained on June 2, 1989 and September 13, 1989. Groundwater elevations and groundwater flow directions are presented on Figures 3.1 and 3.2.

---

*Cleaning sequence consisted of: methanol-hexane-methanol rinse, air drying and distilled water rinse.

TABLE 3.1

FORD SITE C
REVISED* MONITORING WELL DATA

Well #	Top of Casing Elevation	Ground Elevation	Bottom of Screen Elevation	Groundwater Elevations 6/2/89	Groundwater Elevations 9/13/89
B1	738.06	735.9	681.62	689.35	686.91
B3	704.18	702.9	679.68	689.36	687.76
B5	703.90	703.2	678.50	690.45	689.19

Note:

All elevations are feet above mean sea level (AMSL).
*As revised due to well repairs and modifications.

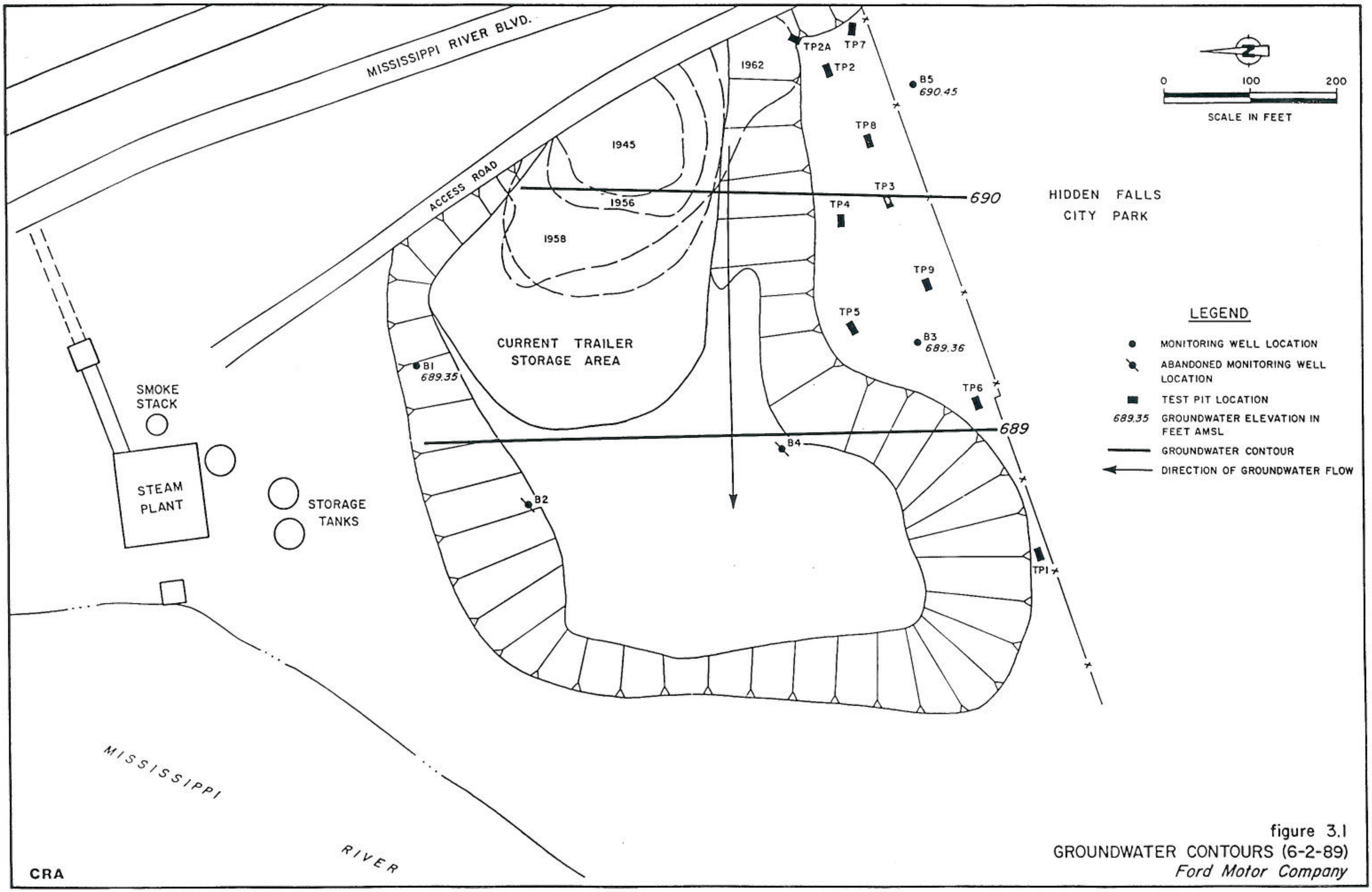


figure 3.1
GROUNDWATER CONTOURS (6-2-89)
Ford Motor Company

2853-11/27/89-M

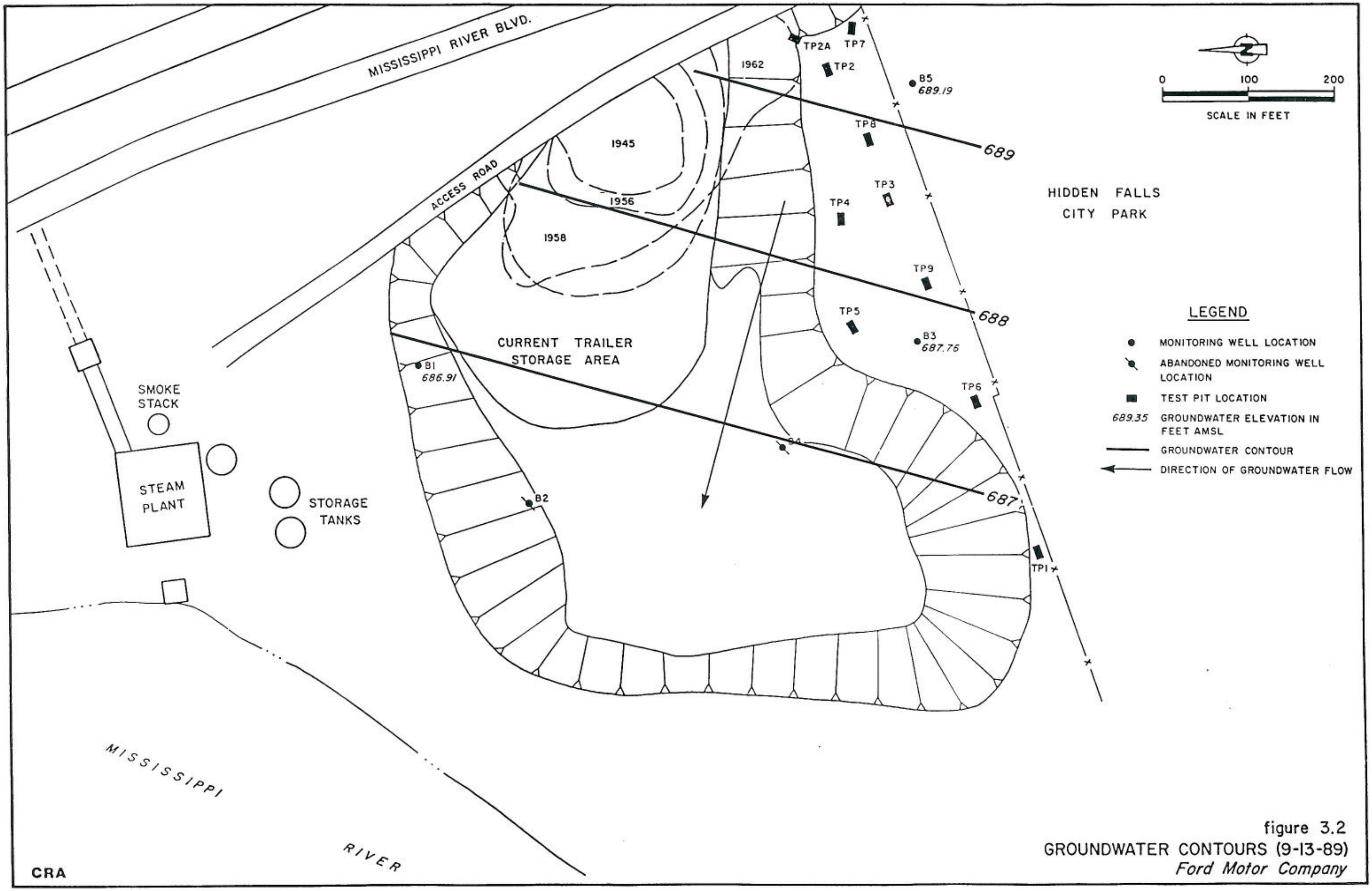


figure 3.2
GROUNDWATER CONTOURS (9-13-89)
Ford Motor Company

2853-11/27/89-M

Groundwater flow is predominantly to the west towards the Mississippi River. The river elevation may affect this flow direction to a minor degree. Water levels measured by CRA during 1988 had indicated a more northwesterly component of flow direction. Seasonal fluctuations in the river elevation also appear to change the gradients slightly as shown on Figures 3.1 and 3.2.

Groundwater elevations are measured in the existing monitoring wells which are screened in the fill and/or river deposits of sand and gravel. Thus, the groundwater flow directions represent a localized condition under the Site.

4.0 ANALYTICAL RESULTS

Results of the chemical analysis of groundwater and surface water are presented in Table 4.1. The analytical lab reports are presented in Appendix B. All water samples were analyzed for halocarbon and aromatic volatile organic compounds (VOC) by EPA methods 601 and 602. In addition to the 601/602 VOC parameters, the MPCA requested that cis-1,2-dichloroethylene and ethylacetate also be analyzed. This request was presented in their letter dated April 25, 1989. The following metals were also analyzed: Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver and Zinc.

TABLE 4.1

FORD SITE "C"
DETECTED COMPOUNDS

		B1			B3			B5			Mississippi River Up Stream			Mississippi River Down Stream		
Date:	MDL Range	6/89	8/89	9/89	6/89	8/89	9/89	6/89	8/89	9/89	6/89	8/89	9/89	6/89	8/89	9/89
Compound																
1,1-Dichloroethylene µg/L	0.3 µg/L	1.5	ND	ND	ND	0.5	ND	ND	0.8	ND	1.3	ND	ND	ND	1.1	ND
Methylene Chloride µg/L	1.0 µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND
Trichlorofluoromethane µg/L	0.4 µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND
Dichlorodifluoromethane µg/L	1.5 µg/L	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride µg/L	1.5 µg/L	ND	5.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene µg/L	0.5 µg/L	ND	ND	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium mg/L	0.0001 mg/L	ND	ND	ND	0.0002	ND	ND	0.0004	ND	0.0002	ND	0.0005	ND	ND	0.0008	ND
Lead mg/L	0.001 - 0.005 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	0.001
Zinc mg/L	0.01 mg/L	ND	ND	ND	0.03	ND	0.02	0.07	ND	0.26	ND	ND	ND	ND	ND	ND
Copper mg/L	0.01 mg/L	ND	0.01	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND
Nickel mg/L	0.05 mg/L	ND	ND	ND	ND	0.05	ND	0.08	0.05	ND	ND	ND	ND	ND	ND	ND
Chromium mg/L	0.001 mg/L	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND	ND	ND	ND	ND
Barium mg/L	0.2 mg/L	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

MDL - Method Detection Limit
ND - Not detected at or above method detection limit.

5.0 EVALUATION

Site C is comprised of fill and rubble material deposited over naturally occurring sands and gravels which were deposited by the Mississippi River. Groundwater under Site C flows towards the river and is influenced to some extent by the river. The data gathered from the existing monitoring wells represents site conditions in the immediate area under Site C. It is not known at this time whether or not the "perched" water under Site C is hydraulically connected to the underlying St. Peter Sandstone aquifer. On a regional scale, the St. Peter Sandstone and the Mississippi River are hydraulically connected.

The monitoring well network (wells B1, B3 and B5) at Site C is sufficient to determine general groundwater flow direction under Site C. However, given the groundwater flow directions calculated on June 6, 1989, and September 13, 1989, there is a gap in the monitoring network due to the loss of B2 and B4.

Evaluation of the groundwater quality data for 1989 (as presented on Table 4.1) indicates the following:

- measured concentrations for all metals tested (cadmium, lead, zinc, copper, nickel, chromium and barium) were all relatively low and typically acceptable for groundwater;

- low concentrations of four VOC were measured during the monitoring. The results are inconsistent from location to location and are not repeated in successive monitoring events at any one location. These inconsistent results indicate that VOC release from the Site is relatively small.

APPENDIX A
WELL ABANDONMENT LOGS

2853

GME CONSULTANTS, INC.
CONSULTING ENGINEERS
14000 21st Ave. No. / Minneapolis, MN 55447 / 612/559-1859

June 6, 1989

Mr. Steve Mockenhaupt
Conestoga-Rovers & Associates
382 West County Road D
St. Paul, Minnesota 55112

GME Project No. 2014

Re: Report for monitoring well abandonment and monitoring well surface protection at the Ford Plant in South St. Paul, Minnesota

Dear Mr. Mockenhaupt:

On March 3, 1989, we received authorization for the abandonment of existing monitoring wells, and the installation of surface protection at this site in Minneapolis, Minnesota. In accordance with your acceptance of our proposal, we have completed our services. This project was completed in compliance with our understanding of Minnesota Department of Health (MDH) regulations. Enclosed is our report including the MDH well abandonment logs, and a description of our services.

MONITORING WELL ABANDONMENT

Two existing monitoring wells (B-2 and B-4) were abandoned. Our drill crew retrieved as much down-hole 2 inch PVC riser pipe as possible by hand and with the Mobile B-24 rig. The wells were then grouted with neat cement to within two feet of the surface. Native soil was used to fill the remaining space in the boreholes.

You also requested that we upgrade the above ground protection for three existing monitoring wells at the site. Our drill crew installed three, 4 inch diameter by 8 foot long protective steel posts and one, 4 inch diameter by 5 foot long locking protective steel cap at B-1, B-3, and B-5. At B-5, the existing 2 inch PVC riser pipe was cut-off below grade and replaced with a new section. All the protective posts were cemented into place.

The monitoring well abandonment procedures and above ground protection installation were supervised by our Minnesota Licensed Water Well Driller in accordance with MDH regulations.

GENERAL QUALIFICATIONS

This report is a summary of the services performed at the Ford Plant site in South St. Paul, Minnesota. No warranty, either expressed or implied, is presented in this report with respect to the soil and groundwater conditions at this site.

We appreciate the opportunity to be of service to you for this project. If you have any questions regarding this report or if we may be of further assistance to you, please do not hesitate to contact us.

Sincerely,

GME CONSULTANTS, INC.

James A. Nordstog

James A. Nordstog
Director of Drilling Operations
Hydrogeologist

Thomas H Moore

Thomas H. Moore
Minnesota Licensed Water Well Driller

Enclosures: MDH Monitoring Well Abandonment Logs

JAN:WCK:jan

#2

STATE OF MINNESOTA DEPARTMENT OF HEALTH

ABANDONED WELL RECORD

MINNESOTA UNIQUE WELL NO. (leave blank if not known) ________

1. LOCATION OF WELL

County Name: Ramsey

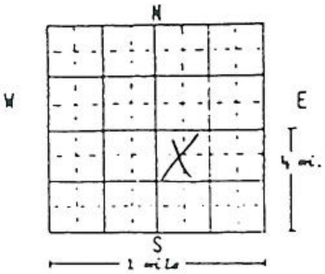
Township Name	Township Number	Range Number	Section No.	Fraction ¼ ¼ of ¼
	28 [✓ N] or S	23 E or [✓ W]	17	NW-SE

4. WELL DEPTH (completed) 44.5 ft. — Date sealed 5-31-89

Numerical Street Address and City of Well Location or Distance from Road Intersection

500' from Mississippi Blvd, St. Paul, Mn

Show exact location of well (in section grid with "X")



Sketch map of well location

Ford Plant

enclosed site map

5. DRILLING METHOD (if known)

1☐ Cable tool 4☐ Reverse 7☐ Driven 10☐ Dug
2☐ Hollow Rod 5☐ Air 8☐ Bored 11☐ ________
3☐ Rotary 6☐ Jetted 9☒ Power Auger

6. OBSTRUCTIONS

Well obstructed ☐ Yes ☒ No
Obstructions removed ☐ Yes ☐ No If obstructions cannot be removed, contact MDH before sealing.

7. USE

1☐ Domestic 4☒ Monitoring 8☐ Heat Loop
2☐ Irrigation 5☐ Public 9☐ Industry
3☐ Test Well 6☐ Municipal 10☐ Commercial
7☐ Air Conditioning 11☐ ________

2. PROPERTY OWNER'S NAME

Ford Motor Company
966 S. Mississippi Blvd.
St. Paul, Mn

Mailing Address if different than property address indicated above

8. CASING(S)

1☐ Black 4☐ Threaded 7☒ ________
2☐ Galv. 5☐ Welded
3☒ Plastic 6☐ Stainless Steel Not Known

________ in. to ________ ft.
________ in. to ________ ft.

3. FORMATION LOG

If not known, indicate formation log from new well or nearby well.

FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
cobbles, boulders			0	7
gravel, sand	brown		7	13
sand	brown		13	25
sand-gravel	brown		25	44

9. SCREEN

☒ Screened well from ____ ft. to Not Known ft. (If known)
☐ Open Hole from ____ ft. to ____ ft.

10. STATIC WATER LEVEL

29.5 ft. ☒ below ☐ above land surface Date Measured 11-18-81

11. WELLHEAD COMPLETION

1☐ Pitless Adapter 4☐ Found Buried N/A
2☐ Basement offset 5☐ ________
3☐ Well Pit

16. REMARKS, ELEVATION, SOURCE OF DATA - CASINGS REMOVED, CASINGS PERFORATED, ETC.

Enclosed site map.
Site mw #2

12. GROUTING INFORMATION

1☒ Neat Cement 2☐ Bentonite 3☒ cement

Grout material cement from 0 to 2 ft. cu. yds ____
neat cement 2 44.5

13. NEAREST SOURCES OF CONTAMINATION

____ feet ________ direction ________ type

Well disinfected before sealing? ☐ Yes

14. PUMP ☐ Removed ☐ Not Present N/A

Type: 1☐ Submersible 3☐ L.S. Turbine 5☐ Reciprocating
2☐ Jet 4☐ Centrifugal 6☐ ________

15. EXISTING WELLS (Please sketch locations of abandoned and active wells in remarks section or on back.)

Other unused well(s) on property? ☐ Yes ☐ No
Abandoned: ☒ Permanent ☐ Temporary ☐ Not sealed

17. WATER WELL CONTRACTORS CERTIFICATION

This well was sealed under my jurisdiction and this report is true to the best of my knowledge and belief.

GME Consultants, Inc
Licensee Business Name License No.

Address 14000 21st Ave N. Mpls, Mn

Signed ________ Date ________

Tom Moore Date 6-9-89
Name of Driller

OFFICIAL ABANDONED WELL RECORD (May be used for Property Transfer)

IMPORTANT: FILE WITH DEED

STATE OF MINNESOTA DEPARTMENT OF HEALTH

#4

ABANDONED WELL RECORD

MINNESOTA UNIQUE WELL NO. (leave blank if not known)

1. LOCATION OF WELL

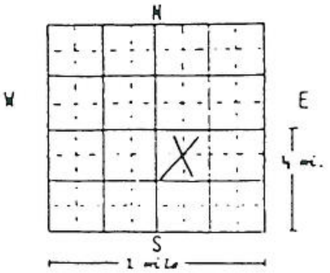
County Name Ramsey

Township Name	Township Number	Range Number	Section No.	Fraction ¼ ¼ of ¼
	28 [✓ N] or S	23 E or [✓ W]	17	NW - SE

Numerical Street Address and City of Well Location or Distance from Road Intersection

500' from Mississippi Blvd, St. Paul, Mn

Show exact location of well (in section grid with "X")



Sketch map of well location

Ford Plant Enclosed site map

4. WELL DEPTH (completed) 29.5 ft.

Date sealed 5-31-89

5. DRILLING METHOD (if known)

1☐ Cable tool 4☐ Reverse 7☐ Driven 10☐ Dug

2☐ Hollow Rod 5☐ Air 8☐ Bored 11☐ ____

3☐ Rotary 6☐ Jetted 9☒ Power Auger

6. OBSTRUCTIONS

Well obstructed ☐ Yes ☒ No

Obstructions removed ☐ Yes ☐ No If obstructions cannot be removed, contact MDH before sealing.

7. USE

1☐ Domestic 4☒ Monitoring 8☐ Heat Loop

2☐ Irrigation 5☐ Public 9☐ Industry

3☐ Test Well 6☐ Municipal 10☐ Commercial

7☐ Air Conditioning 11☐ ____

2. PROPERTY OWNER'S NAME

Ford Motor Company
966 S. Mississippi Blvd.
St. Paul, Mn

Mailing Address if different than property address indicated above

8. CASING(S)

1☐ Black 4☐ Threaded 7☐ ____

2☐ Galv. 5☐ Welded

3☒ Plastic 6☐ Stainless Steel Not Known

____ in. to ____ ft.

____ in. to ____ ft.

3. FORMATION LOG

If not known, indicate formation log from new well or nearby well.

FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
clay	brown		0	1
sand	brown		1	2
sand-fill	black		2	7
sand	brown		7	29

9. SCREEN

☐ Screened well from ____ ft. to Not Known (If known)

☐ Open Hole from ____ ft. to ____ ft.

10. STATIC WATER LEVEL

19.5 ft. ☒ below ☐ above land surface Date Measured 11-19-81

11. WELLHEAD COMPLETION

1☐ Pitless Adapter 4☐ Found Buried N/A

2☐ Basement offset 5☐ ____

3☐ Well Pit

16. REMARKS, ELEVATION, SOURCE OF DATA - CASINGS REMOVED, CASINGS PERFORATED, ETC.

Enclosed site map.

Site MW #4

12. GROUTING INFORMATION

1☒ Neat Cement 2☐ Bentonite 3☐ ____

Grout material ____ from ____ to ____ ft. cu. yds ____

EOB to surface

13. NEAREST SOURCES OF CONTAMINATION

____ feet ____ direction ____ type

Well disinfected before sealing? ☐ Yes

14. PUMP ☐ Removed ☐ Not Present N/A

Type: 1☐ Submersible 3☐ L.S. Turbine 5☐ Reciprocating

2☐ Jet 4☐ Centrifugal 6☐ ____

15. EXISTING WELLS (Please sketch locations of abandoned and active wells in remarks section or on back.)

Other unused well(s) on property? ☒ Yes ☐ No

Abandoned: ☐ Permanent ☒ Temporary ☐ Not sealed

17. WATER WELL CONTRACTORS CERTIFICATION

This well was sealed under my jurisdiction and this report is true to the best of my knowledge and belief.

GME Consultants, Inc

Licensee Business Name License No.

Address 14000 21st Ave N. Mpls, Mn

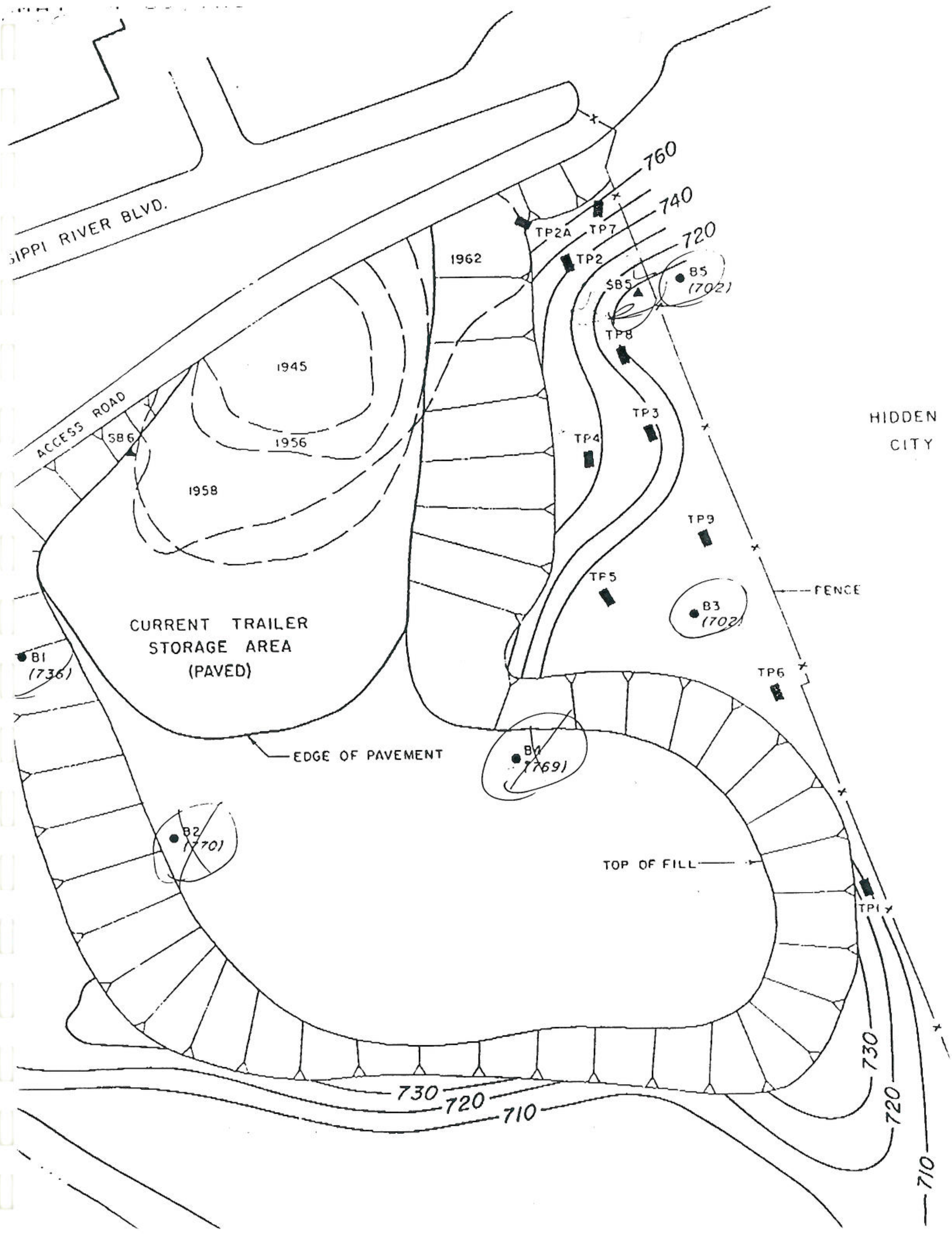
~~Signed~~ ____ Date

Tom Moore Date 6-9-89

Name of Driller

OFFICIAL ABANDONED WELL RECORD (May be used for Property Transfer)

IMPORTANT: FILE WITH DEED



SIPPI RIVER BLVD.
ACCESS ROAD
SB6
1945
1956
1958
1962
CURRENT TRAILER STORAGE AREA (PAVED)
EDGE OF PAVEMENT
TP2A
TP7
TP2
760
740
720
SB5
B5 (702)
TP8
TP3
TP4
TP9
TP5
B3 (702)
TP6
HIDDEN CITY
FENCE
B1 (736)
B4 (769)
B2 (770)
TOP OF FILL
TP1
730
720
710
730
720
710

APPENDIX B
LABORATORY REPORTS

pace®
laboratories, inc.

RE ORT OF LABORATORY ANALY

MN. FILE COPY

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas

#2853
Site C
June Water

August 09, 1989

CC: Shawn Horn
for D-Base

Mr. Steven Mockenhaupt
Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

Dear Mr. Mockenhaupt:

Enclosed is the report of laboratory analyses for samples received 06/05/89.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Susan D Max AFG

Susan D. Max
Director, Sampling and Analytical Services

Enclosures

pace laboratories, inc.

REPORT OF LABORATORY ANALYSIS

AU[illegible] 16. 89

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas

Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

August 09, 1989
PACE Project Number: 890605523

#2853
Site C
June - Water

Attn: Mr. Steven Mockenhaupt

2853

Date Sample(s) Collected: 06/02/89
Date Sample(s) Received: 06/05/89

			B-5	B-3	Dupl. B-3
PACE Sample Number:			184870 W-60289-JM-01	184880 W-60289-JM-02	184890 W-60289-JM-03
Parameter	Units	MDL			
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.2	ND	0.3	0.4
Cadmium	mg/L	0.0001	0.0004	0.0002	0.0001
Chromium	mg/L	0.001	0.002	ND	ND
Copper	mg/L	0.01	ND	ND	ND
Lead	mg/L	0.001	ND	ND	ND
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.05	0.08	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.04	ND	ND	ND
Zinc	mg/L	0.01	0.07	0.03	0.04
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.5	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.5	ND	ND	ND
Vinyl chloride	ug/L	1.5	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	ND
Trichlorofluoromethane	ug/L	0.4	ND	ND	ND
1,1-Dichloroethylene	ug/L	0.3	ND	ND	ND
1,1-Dichloroethane	ug/L	0.2	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND	ND	ND
Chloroform	ug/L	0.5	ND	ND	ND

ND Not detected at or above the MDL.
MDL Method Detection Limit

Mr. Steven Mockenhaupt
Page 2

August 09, 1989
PACE Project Number: 890605523

			B-5	B-3	B-3 (Dup)
PACE Sample Number:			184870 W-60289- JM-01	184880 W-60289- JM-02	184890 W-60289- JM-03
Parameter	Units	MDL			
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
1,2-Dichloroethane	ug/L	0.2	ND	ND	ND
1,1,1-Trichloroethane	ug/L	0.5	ND	ND	ND
Carbon tetrachloride	ug/L	0.3	ND	ND	ND
Bromodichloromethane	ug/L	0.2	ND	ND	ND
1,2-Dichloropropane	ug/L	0.2	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND	ND	ND
Benzene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	4.0	ND	ND	ND

ND	Not detected at or above the MDL.
MDL	Method Detection Limit

Mr. Steven Mockenhaupt
Page 3

August 09, 1989
PACE Project Number: 890605523

PACE Sample Number:			Rinsate Blank 184900 W-60289-JM-05	B-1 184910 W-60289-JM-06	Miss. River Upstream Surface Water 184920 W-60289-JM-07
Parameter	Units	MDL			
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.2	ND	ND	ND
Cadmium	mg/L	0.0001	ND	ND	ND
Chromium	mg/L	0.001	ND	ND	ND
Copper	mg/L	0.01	ND	ND	ND
Lead	mg/L	0.001	ND	ND	ND
Mercury	mg/L	0.0002	OD	ND	ND
Nickel	mg/L	0.05	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.04	ND	ND	ND
Zinc	mg/L	0.01	ND	ND	ND
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.5	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.5	ND	ND	ND
Vinyl chloride	ug/L	1.5	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	ND
Trichlorofluoromethane	ug/L	0.4	1.3	ND	ND
1,1-Dichloroethylene	ug/L	0.3	2.3	1.5	1.3
1,1-Dichloroethane	ug/L	0.2	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND	ND	ND
Chloroform	ug/L	0.5	ND	ND	ND
1,2-Dichloroethane	ug/L	0.2	ND	ND	ND
1,1,1-Trichloroethane	ug/L	0.5	2.7	ND	ND
Carbon tetrachloride	ug/L	0.3	ND	ND	ND
Bromodichloromethane	ug/L	0.2	ND	ND	ND
1,2-Dichloropropane	ug/L	0.2	ND	ND	ND

ND Not detected at or above the MDL.
MDL Method Detection Limit

pace laboratories, inc.

RE JRT OF LABORATORY ANALYS

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas

August 09, 1989
PACE Project Number: 890605523

			Blank	B-1	River up
PACE Sample Number:			184900	184910	184920
Parameter	Units	MDL	W-60289-JM-05	W-60289-JM-06	W-60289-JM-07
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND	ND	ND
Benzene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	1.4	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	4.0	ND	ND	ND

ND	Not detected at or above the MDL.
MDL	Method Detection Limit

Mr. Steven Mockenhaupt
Page 5

August 09, 1989
PACE Project Number: 890605523

Mississippi
River Downstream
Surface Water

PACE Sample Number: 184930

Parameter	Units	MDL	W-60289- JM-08
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Arsenic	mg/L	0.002	ND
Barium	mg/L	0.2	ND
Cadmium	mg/L	0.0001	ND
Chromium	mg/L	0.001	ND
Copper	mg/L	0.01	ND
Lead	mg/L	0.001	0.001
Mercury	mg/L	0.0002	ND
Nickel	mg/L	0.05	ND
Selenium	mg/L	0.005	ND
Silver	mg/L	0.04	ND
Zinc	mg/L	0.01	ND
ORGANIC ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
Chloromethane	ug/L	1.0	ND
Bromomethane	ug/L	1.5	ND
Dichlorodifluoromethane	ug/L	1.5	ND
Vinyl chloride	ug/L	1.5	ND
Chloroethane	ug/L	1.0	ND
Methylene chloride	ug/L	1.0	1.3
Trichlorofluoromethane	ug/L	0.4	2.1
1,1-Dichloroethylene	ug/L	0.3	ND
1,1-Dichloroethane	ug/L	0.2	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND
Chloroform	ug/L	0.5	ND
1,2-Dichloroethane	ug/L	0.2	ND
1,1,1-Trichloroethane	ug/L	0.5	ND
Carbon tetrachloride	ug/L	0.3	ND
Bromodichloromethane	ug/L	0.2	ND
1,2-Dichloropropane	ug/L	0.2	ND

ND	Not detected at or above the MDL.
MDL	Method Detection Limit

Mr. Steven Mockenhaupt
Page 6

August 09, 1989
PACE Project Number: 890605523

PACE Sample Number:

Parameter	Units	MDL	River Down 184930 W-60289- JM-08
ORGANIC ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND
Benzene	ug/L	1.0	ND
Dibromochloromethane	ug/L	1.0	ND
1,1,2-Trichloroethane	ug/L	1.0	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND
Bromoform	ug/L	1.0	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND
Toluene	ug/L	1.0	ND
Chlorobenzene	ug/L	1.0	ND
Ethyl benzene	ug/L	1.0	ND
1,3-Dichlorobenzene	ug/L	4.0	ND
1,2-Dichlorobenzene	ug/L	4.0	ND
1,4-Dichlorobenzene	ug/L	4.0	ND

ND	Not detected at or above the MDL.
MDL	Method Detection Limit

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my direct supervision.

Thomas L. Halverson
Inorganic Chemistry Manager

Dennis R Seeger

Dennis R. Seeger
Organic Chemistry Manager

QUALITY CONTROL DATA

Client Name Conestoga Rovers & Associates PACE Project Number 890605.523

Project Name 2853

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	True Value	Matrix Spike	% Rec	Rep. A	Rep. B	A-B	Mean % Rec
Arsenic	6-20-89	ND	115	10.59	9.74	92	10.2	10.2	0	109
Barium	6-15-89	ND	101	2.66	2.72	102	NA	NA	-	103
Cadmium	6-16-89	ND	103	1.142	1.098	96	1.087	1.087	0	98
Chromium	6-15-89	ND	103	5.25	5.31	101	5.51	5.51	0	104
Copper	6-6-89	0.08	102	0.80	0.80	100	1.02	1.00	0.02	100
Lead	6-9-89	ND	114	10	9.73	97	NA	NA	-	100
Mercury	6-9-89	ND	97	5.00	4.90	98	4.37	4.31	0.06	97
Nickel	6-6-89	ND	98	1.01	0.995	99	NA	NA	-	98
Selenium	6-39-89	ND	108	25.0	27.9	112	27.9	26.9	1.0	95
Silver	6-8-89	ND	95	2.0	1.66	83	NA	NA	-	101
Zinc	6-6-89	0.11	98	1.6	1.57	98	NA	NA	-	99

QUALITY CONTROL DATA

Client Name Conestoga Rovers & Associates PACE Project Number 890605.523

Project Name 2853 Sample Spiked 18605

Standard B

SUMMARY OF ORGANIC ACCURACY AND PRECISION DATA

Parameter EPA Methods 601, 602 MDH 465B Date of Analysis 6-8-89

Compound	MS % Rec	MSD % Rec	RPD	Accuracy Range	Precision Limit
Trichlorofluoromethane	89	88	0.60	83-120	30%
Dichlorofluoromethane	79	76	0.60	73-143	30%
trans-1,2-Dichloroethylene	93	88	5.52	72-139	30%
1,2-Dichloroethane	92	90	2.17	58-135	30%
1,1,1-Trichloroethane	100	91	9.42	87-132	30%
Bromodichloromethane	101	101	0	85-132	30%
2,3-Dichloropropene	98	90	8.51	70-123	30%
trans-1,3-Dichloropropene	105	100	4.82	54-145	30%
cis-1,3-Dichloropropene	78	76	2.56	64-138	30%
1,2-Dibromomethane	117	129	9.76	66-138	30%
Bromoform	88	87	0.60	62-136	30%
1,1,2,2-Tetrachloroethane	86	77	11.0	73-153	30%
Toluene	103	100	2.91	54-132	30%
Ethylbenzene	85	81	4.82	55-141	30%
m-Xylene	110	105	4.65	59-152	30%
o-Xylene	108	104	3.77	30-149	30%
1,2-Dichlorobenzene	106	104	1.90	40-142	30%

Comments: Method blank - no compounds of interest detected

NA Not Analyzed
ND Not Detected at or above the method detection limit

WPPLABFM191 pg1

QUALITY CONTROL DATA

Client Name Conestoga Rovers & Associates PACE Project Number 890605523

Project Name 2853 Sample Spiked

Standard A

SUMMARY OF ORGANIC ACCURACY AND PRECISION DATA

Parameter EPA Methods 601, 602 MDH 465B Date of Analysis 6-9-89

Compound	MS % Rec	MSD % Rec	RPD	Accuracy Range	Precision Limit
Methylene Chloride	90	94	4.26	49-119	30%
1,1-Dichloroethylene	140	137	2.17	78-123	30%
1,1-Dichloroethane	119	113	5.17	78-122	30%
Chloroform	144	132	8.69	74-123	30%
Carbon Tetrachloride	138	132	4.44	79-139	30%
1,2-Dichloropropane	112	104	7.40	73-126	30%
1,1,2-Trichloroethylene	97	92	5.29	75-126	30%
Benzene	112	104	7.41	59-126	30%
Dibromochloromethane	115	103	11.0	86-121	30%
1,1,2-Trichloroethane	115	103	110	86-121	30%
2-Chloroethylvinyl ether	NA	NA	-	82-145	30%
Tetrachloroethylene	100	92	8.33	68-119	30%
Chlorobenzene	95	88	7.65	68-112	30%
1,3-Dichlorobenzene	99	91	8.42	65-146	30%
1,4-Dichlorobenzene	98	90	8.60	46-141	30%

Comments: Method blank - no compounds of interest detected

NA Not Analyzed
ND Not Detected at or above the method detection limit

WPPLABFM191 pg2

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QUALITY CONTROL DATA

Client Name Conestoga Rovers & Associates PACE Project Number 890605.523

Project Name 2853 Sample Spiked 18845

Standard B

SUMMARY OF ORGANIC ACCURACY AND PRECISION DATA

Parameter EPA Methods 601, 602 MDH 465B Date of Analysis 6-12-89

Compound	MS % Rec	MSD % Rec	RPD	Accuracy Range	Precision Limit
Trichlorofluoromethane	75	91	19	83-120	30%
Dichlorofluoromethane	NA	NA	-	73-143	30%
trans-1,2-Dichloroethylene	102	119	15	72-139	30%
1,2-Dichloroethane	80	80	0	58-135	30%
1,1,1-Trichloroethane	117	122	4.2	87-132	30%
Bromodichloromethane	102	124	19	85-132	30%
2,3-Dichloropropene	NA	NA	-	70-123	30%
trans-1,3-Dichloropropene	139	164	17	54-145	30%
cis-1,3-Dichloropropene	79	105	28	64-138	30%
1,2-Dibromomethane	NA	NA	-	66-138	30%
Bromoform	89	108	19	62-136	30%
1,1,2,2-Tetrachloroethane	99	117	17	73-153	30%
Toluene	83	86	3.6	54-132	30%
Ethylbenzene	88	91	3.4	55-141	30%
m-Xylene	84	88	4.7	59-152	30%
o-Xylene	NA	NA	-	30-149	30%
1,2-Dichlorobenzene	85	96	12	40-142	30%

Comments: Method blank - no compounds of interest detected

NA Not Analyzed
ND Not Detected at or above the method detection limit WPPLABFM191 pg1

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REPORT OF LABORATORY ANALYSIS

QUALITY CONTROL DATA

Client Name Conestoga Rovers & Associates PACE Project Number 890605523

Project Name 2853 Sample Spiked 19062

Standard A

SUMMARY OF ORGANIC ACCURACY AND PRECISION DATA

Parameter EPA Methods 601, 602 MDH 465B Date of Analysis 6-12-89

Compound	MS % Rec	MSD % Rec	RPD	Accuracy Range	Precision Limit
Methylene Chloride	95	104	9.01	49-119	30%
1,1-Dichloroethylene	100	103	2.90	78-123	30%
1,1-Dichloroethane	84	85	0.06	78-122	30%
Chloroform	88	91	3.35	74-123	30%
Carbon Tetrachloride	84	85	0.06	79-139	30%
1,2-Dichloropropane	86	87	0.60	73-126	30%
1,1,2-Trichloroethylene	90	89	0.60	75-126	30%
Benzene	103	101	0.20	59-126	30%
Dibromochloromethane	86	82	0.60	86-121	30%
1,1,2-Trichloroethane	86	87	0.60	86-121	30%
2-Chloroethylvinyl ether	203	210	3.38	82-145	30%
Tetrachloroethylene	90	89	0.10	68-119	30%
Chlorobenzene	87	90	3.38	68-112	30%
1,3-Dichlorobenzene	89	89	0	65-146	30%
1,4-Dichlorobenzene	85	83	2.38	46-141	30%

Comments: 1,1-Dichloroethylene detected at 1.2 ug/L - no other compounds detected

NA Not Analyzed
ND Not Detected at or above the method detection limit WPPLABFM191 pg2

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RE ORT OF LABORATORY ANALY

QUALITY CONTROL DATA

Client Name Conestoga Rovers & Associates PACE Project Number 890605.523

Project Name 2853 Sample Spiked

Standard B

SUMMARY OF ORGANIC ACCURACY AND PRECISION DATA

Parameter EPA Methods 601, 602 MDH 465B Date of Analysis 6-14-89

Compound	MS % Rec	MSD % Rec	RPD	Accuracy Range	Precision Limit
Trichlorofluoromethane	81	83	2.44	83-120	30%
Dichlorofluoromethane	73	75	2.70	73-143	30%
trans-1,2-Dichloroethylene	83	82	1.21	72-139	30%
1,2-Dichloroethane	80	81	1.24	58-135	30%
1,1,1-Trichloroethane	86	85	1.17	87-132	30%
Bromodichloromethane	89	89	0	85-132	30%
2,3-Dichloropropene	86	85	1.17	70-123	30%
trans-1,3-Dichloropropene	84	85	1.18	54-145	30%
cis-1,3-Dichloropropene	75	73	2.68	64-138	30%
1,2-Dibromomethane	99	100	1.00	66-138	30%
Bromoform	93	96	3.17	62-136	30%
1,1,2,2-Tetrachloroethane	77	76	1.31	73-153	30%
Toluene	99	87	12.9	54-132	30%
Ethylbenzene	82	71	14.4	55-141	30%
m-Xylene	105	92	13.2	59-152	30%
o-Xylene	104	94	10.1	30-149	30%
1,2-Dichlorobenzene	103	91	12.4	40-142	30%

Comments: Method blank - no compounds of interest detected

NA Not Analyzed
ND Not Detected at or above the method detection limit WPPLABFM191 pg1

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): Pac Labs

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2853

PROJECT NAME: Ford

SAMPLER'S SIGNATURE (SIGN)

SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
	W-60289-JM-01	6-2-89	1848	Ford	Water	5	Analyze for:
	" -02		88	Site		5	Halocarbon &
	" -03		89			5	Aromatic Organic
	" -05		90			5	compound:
	" -06		91			5	using EPA
	" -07		92			5	methods 601
	" -08		93			5	& 602.
							Analyze For:
							Following Metals:
							As, Ba, Cd,
							Cr, Cu, Pb,
							Hg, Se, Ag,
							Zn, Ni.
				TOTAL NUMBER OF CONTAINERS			

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY: ① (SIGN)	DATE/TIME 6-5-89 1500	RECEIVED BY: ② MJC (SIGN)
RELINQUISHED BY: ② (SIGN)	DATE/TIME	RECEIVED BY: ③ (SIGN)
RELINQUISHED BY: ③ (SIGN)	DATE/TIME	RECEIVED BY: ④ (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN)	DATE/TIME 6/5/89 1630
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME

WHITE - CRA OFFICE COPY
YELLOW - RECEIVING LABORATORY COPY
PINK - CRA LABORATORY COPY
GOLDEN ROD - SHIPPERS

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PORT OF LABORATORY ANALY

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#2853

October 05, 1989 **MN. FILE COPY**

Rec'd

OCT 30 89

Site C
Water
August 1989

Mr. Jon Michaels
Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

RE: PACE Project No. 890808.516

Dear Mr. Michaels:

Enclosed is the report of laboratory analyses for samples received August 08, 1989.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

S D Max

Susan D. Max
Director, Sampling and Analytical Services

Enclosures

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PORT OF LABORATORY ANALYS

Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

October 05, 1989
PACE Project Number: 890808516

Attn: Mr. Jon Michaels

2853

B 1

PACE Sample Number: 279190
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-06	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Arsenic	mg/L	0.002	ND	08/25/89
Barium	mg/L	0.2	ND	08/09/89
Cadmium	mg/L	0.0001	ND	09/05/89
Chromium	mg/L	0.001	ND	08/22/89
Copper	mg/L	0.01	0.01	08/09/89
Lead	mg/L	0.005	ND	08/24/89
Mercury	mg/L	0.0002	ND	08/24/89
Nickel	mg/L	0.05	ND	08/14/89
Selenium	mg/L	0.010	ND	08/24/89
Silver	mg/L	0.04	ND	08/17/89
Zinc	mg/L	0.01	ND	08/24/89
ORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Ethyl acetate	ug/L	20	ND	09/01/89
PURGEABLE HALOCARBONS AND AROMATICS				
Chloromethane	ug/L	1.0	ND	09/01/89
Bromomethane	ug/L	1.5	ND	09/01/89
Dichlorodifluoromethane	ug/L	1.5	14 (1)	09/01/89
Vinyl chloride	ug/L	1.5	5.2 (1)	09/01/89
Chloroethane	ug/L	1.0	ND	09/01/89
Methylene chloride	ug/L	1.0	ND	09/01/89
Trichlorofluoromethane	ug/L	0.4	ND	09/01/89
1,1-Dichloroethylene	ug/L	0.3	ND	09/01/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
(1)	These compounds co-elute

Mr. Jon Michaels
Page 2

October 05, 1989
PACE Project Number: 890808516

			B-1	
PACE Sample Number:			279190	
Date Collected:			08/04/89	
Date Received:			08/08/89	
Parameter	Units	MDL	W-080489-JM-06	DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE HALOCARBONS AND AROMATICS				
1,1-Dichloroethane	ug/L	0.2	ND	09/01/89
trans-1,2-Dichloroethylene	ug/L	0.3	ND	09/01/89
Chloroform	ug/L	0.5	ND	09/01/89
1,2-Dichloroethane	ug/L	0.2	ND	09/01/89
1,1,1-Trichloroethane	ug/L	0.5	ND	09/01/89
Carbon tetrachloride	ug/L	0.3	ND	09/01/89
Bromodichloromethane	ug/L	0.2	ND	09/01/89
1,2-Dichloropropane	ug/L	0.2	ND	09/01/89
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	09/01/89
1,1,2-Trichloroethylene	ug/L	0.5	ND	09/01/89
Benzene	ug/L	1.0	ND	09/01/89
Dibromochloromethane	ug/L	1.0	ND	09/01/89
1,1,2-Trichloroethane	ug/L	1.0	ND	09/01/89
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	09/01/89
2-Chloroethylvinyl ether	ug/L	5.0	ND	09/01/89
Bromoform	ug/L	1.0	ND	09/01/89
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	09/01/89
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	09/01/89
Toluene	ug/L	1.0	ND	09/01/89
Chlorobenzene	ug/L	1.0	ND	09/01/89
Ethyl benzene	ug/L	1.0	ND	09/01/89
1,3-Dichlorobenzene	ug/L	4.0	ND	09/01/89
1,2-Dichlorobenzene	ug/L	4.0	ND	09/01/89
1,4-Dichlorobenzene	ug/L	4.0	ND	09/01/89
cis-1,2-Dichloroethylene	ug/L	0.5	ND	09/01/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

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PORT OF LABORATORY ANALYS

Mr. Jon Michaels
Page 3

October 05, 1989
PACE Project Number: 890808516

B-3

PACE Sample Number: 279200
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-07	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Arsenic	mg/L	0.002	ND	08/25/89
Barium	mg/L	0.2	ND	08/09/89
Cadmium	mg/L	0.0001	ND	09/05/89
Chromium	mg/L	0.001	ND	08/22/89
Copper	mg/L	0.01	0.02	08/09/89
Lead	mg/L	0.005	ND	08/24/89
Mercury	mg/L	0.0002	ND	08/24/89
Nickel	mg/L	0.05	0.05	08/14/89
Selenium	mg/L	0.010	ND	08/24/89
Silver	mg/L	0.04	ND	08/17/89
Zinc	mg/L	0.01	ND	08/24/89
ORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Ethyl acetate	ug/L	120	ND	08/18/89
PURGEABLE HALOCARBONS AND AROMATICS				
Chloromethane	ug/L	1.0	ND	08/18/89
Bromomethane	ug/L	1.5	ND	08/18/89
Dichlorodifluoromethane	ug/L	1.5	ND	08/18/89
Vinyl chloride	ug/L	1.5	ND	08/18/89
Chloroethane	ug/L	1.0	ND	08/18/89
Methylene chloride	ug/L	1.0	ND	08/18/89
Trichlorofluoromethane	ug/L	0.4	ND	08/18/89
1,1-Dichloroethylene	ug/L	0.3	0.5	08/18/89
1,1-Dichloroethane	ug/L	0.2	ND	08/18/89
trans-1,2-Dichloroethylene	ug/L	0.3	ND	08/18/89
Chloroform	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
Page 4

October 05, 1989
PACE Project Number: 890808516

B-3

PACE Sample Number: 279200
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-07	DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE HALOCARBONS AND AROMATICS				
1,2-Dichloroethane	ug/L	0.2	ND	08/18/89
1,1,1-Trichloroethane	ug/L	0.5	ND	08/18/89
Carbon tetrachloride	ug/L	0.3	ND	08/18/89
Bromodichloromethane	ug/L	0.2	ND	08/18/89
1,2-Dichloropropane	ug/L	0.2	ND	08/18/89
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	08/18/89
1,1,2-Trichloroethylene	ug/L	0.5	ND	08/18/89
Benzene	ug/L	1.0	ND	08/18/89
Dibromochloromethane	ug/L	1.0	ND	08/18/89
1,1,2-Trichloroethane	ug/L	1.0	ND	08/18/89
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	08/18/89
2-Chloroethylvinyl ether	ug/L	5.0	ND	08/18/89
Bromoform	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	08/18/89
Toluene	ug/L	1.0	ND	08/18/89
Chlorobenzene	ug/L	1.0	ND	08/18/89
Ethyl benzene	ug/L	1.0	ND	08/18/89
1,3-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,2-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,4-Dichlorobenzene	ug/L	4.0	ND	08/18/89
cis-1,2-Dichloroethylene	ug/L	0.5	ND	08/18/89

MDL Method Detection Limit
ND Not detected at or above the MDL.

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October 05, 1989
PACE Project Number: 890808516

			Miss. River upstream	
PACE Sample Number:			279210	
Date Collected:			08/04/89	
Date Received:			08/08/89	
Parameter	Units	MDL	W-080489-JM-08	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Arsenic	mg/L	0.002	ND	08/25/89
Barium	mg/L	0.2	ND	08/09/89
Cadmium	mg/L	0.0001	0.0005	09/05/89
Chromium	mg/L	0.001	ND	08/22/89
Copper	mg/L	0.01	ND	08/09/89
Lead	mg/L	0.005	ND	08/24/89
Mercury	mg/L	0.0002	ND	08/24/89
Nickel	mg/L	0.05	ND	08/14/89
Selenium	mg/L	0.010	ND	08/24/89
Silver	mg/L	0.04	ND	08/17/89
Zinc	mg/L	0.01	ND	08/24/89
ORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Ethyl acetate	ug/L	120	ND	08/18/89
PURGEABLE HALOCARBONS AND AROMATICS				
Chloromethane	ug/L	1.0	ND	08/18/89
Bromomethane	ug/L	1.5	ND	08/18/89
Dichlorodifluoromethane	ug/L	1.5	ND	08/18/89
Vinyl chloride	ug/L	1.5	ND	08/18/89
Chloroethane	ug/L	1.0	ND	08/18/89
Methylene chloride	ug/L	1.0	ND	08/18/89
Trichlorofluoromethane	ug/L	0.4	ND	08/18/89
1,1-Dichloroethylene	ug/L	0.3	ND	08/18/89
1,1-Dichloroethane	ug/L	0.2	ND	08/18/89
trans-1,2-Dichloroethylene	ug/L	0.3	ND	08/18/89
Chloroform	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

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October 05, 1989
PACE Project Number: 890808516

Miss. River upstream

PACE Sample Number: 279210
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-08	DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE HALOCARBONS AND AROMATICS				
1,2-Dichloroethane	ug/L	0.2	ND	08/18/89
1,1,1-Trichloroethane	ug/L	0.5	ND	08/18/89
Carbon tetrachloride	ug/L	0.3	ND	08/18/89
Bromodichloromethane	ug/L	0.2	ND	08/18/89
1,2-Dichloropropane	ug/L	0.2	ND	08/18/89
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	08/18/89
1,1,2-Trichloroethylene	ug/L	0.5	ND	08/18/89
Benzene	ug/L	1.0	ND	08/18/89
Dibromochloromethane	ug/L	1.0	ND	08/18/89
1,1,2-Trichloroethane	ug/L	1.0	ND	08/18/89
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	08/18/89
2-Chloroethylvinyl ether	ug/L	5.0	ND	08/18/89
Bromoform	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	08/18/89
Toluene	ug/L	1.0	ND	08/18/89
Chlorobenzene	ug/L	1.0	ND	08/18/89
Ethyl benzene	ug/L	1.0	ND	08/18/89
1,3-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,2-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,4-Dichlorobenzene	ug/L	4.0	ND	08/18/89
cis-1,2-Dichloroethylene	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

October 05, 1989
PACE Project Number: 890808516

Miss River
Downstream

PACE Sample Number: 279220
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-09	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Arsenic	mg/L	0.002	ND	08/25/89
Barium	mg/L	0.2	ND	08/09/89
Cadmium	mg/L	0.0001	0.0008	09/05/89
Chromium	mg/L	0.001	ND	08/22/89
Copper	mg/L	0.01	ND	08/09/89
Lead	mg/L	0.005	ND	08/24/89
Mercury	mg/L	0.0002	ND	08/24/89
Nickel	mg/L	0.05	ND	08/14/89
Selenium	mg/L	0.010	ND	08/24/89
Silver	mg/L	0.04	ND	08/17/89
Zinc	mg/L	0.01	ND	08/24/89
ORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Ethyl acetate	ug/L	120	ND	08/18/89
PURGEABLE HALOCARBONS AND AROMATICS				
Chloromethane	ug/L	1.0	ND	08/18/89
Bromomethane	ug/L	1.5	ND	08/18/89
Dichlorodifluoromethane	ug/L	1.5	ND	08/18/89
Vinyl chloride	ug/L	1.5	ND	08/18/89
Chloroethane	ug/L	1.0	ND	08/18/89
Methylene chloride	ug/L	1.0	ND	08/18/89
Trichlorofluoromethane	ug/L	0.4	ND	08/18/89
1,1-Dichloroethylene	ug/L	0.3	1.1	08/18/89
1,1-Dichloroethane	ug/L	0.2	ND	08/18/89
trans-1,2-Dichloroethylene	ug/L	0.3	ND	08/18/89
Chloroform	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

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PACE Project Number: 890808516

Miss River Down stream

PACE Sample Number: 279220
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-09	DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE HALOCARBONS AND AROMATICS				
1,2-Dichloroethane	ug/L	0.2	ND	08/18/89
1,1,1-Trichloroethane	ug/L	0.5	ND	08/18/89
Carbon tetrachloride	ug/L	0.3	ND	08/18/89
Bromodichloromethane	ug/L	0.2	ND	08/18/89
1,2-Dichloropropane	ug/L	0.2	ND	08/18/89
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	08/18/89
1,1,2-Trichloroethylene	ug/L	0.5	ND	08/18/89
Benzene	ug/L	1.0	ND	08/18/89
Dibromochloromethane	ug/L	1.0	ND	08/18/89
1,1,2-Trichloroethane	ug/L	1.0	ND	08/18/89
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	08/18/89
2-Chloroethylvinyl ether	ug/L	5.0	ND	08/18/89
Bromoform	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	08/18/89
Toluene	ug/L	1.0	ND	08/18/89
Chlorobenzene	ug/L	1.0	ND	08/18/89
Ethyl benzene	ug/L	1.0	ND	08/18/89
1,3-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,2-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,4-Dichlorobenzene	ug/L	4.0	ND	08/18/89
cis-1,2-Dichloroethylene	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels

October 05, 1989
PACE Project Number: 890808516

Parameter	Units	MDL	B-5	DATE ANALYZED
PACE Sample Number:			279230	
Date Collected:			08/04/89	
Date Received:			08/08/89	
Parameter	Units	MDL	W-080489-JM-10	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Arsenic	mg/L	0.002	ND	08/25/89
Barium	mg/L	0.2	ND	08/09/89
Cadmium	mg/L	0.0001	ND	09/05/89
Chromium	mg/L	0.001	ND	08/22/89
Copper	mg/L	0.01	ND	08/09/89
Lead	mg/L	0.005	ND	08/24/89
Mercury	mg/L	0.0002	ND	08/24/89
Nickel	mg/L	0.05	0.05	08/14/89
Selenium	mg/L	0.010	ND	08/24/89
Silver	mg/L	0.04	ND	08/17/89
Zinc	mg/L	0.01	ND	08/24/89
ORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Ethyl acetate	ug/L	120	ND	08/18/89
PURGEABLE HALOCARBONS AND AROMATICS				
Chloromethane	ug/L	1.0	ND	08/18/89
Bromomethane	ug/L	1.5	ND	08/18/89
Dichlorodifluoromethane	ug/L	1.5	ND	08/18/89
Vinyl chloride	ug/L	1.5	ND	08/18/89
Chloroethane	ug/L	1.0	ND	08/18/89
Methylene chloride	ug/L	1.0	ND	08/18/89
Trichlorofluoromethane	ug/L	0.4	ND	08/18/89
1,1-Dichloroethylene	ug/L	0.3	0.8	08/18/89
1,1-Dichloroethane	ug/L	0.2	ND	08/18/89
trans-1,2-Dichloroethylene	ug/L	0.3	ND	08/18/89
Chloroform	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

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October 05, 1989
PACE Project Number: 890808516

B-5

PACE Sample Number: 279230
Date Collected: 08/04/89
Date Received: 08/08/89

Parameter	Units	MDL	W-080489-JM-10	DATE ANALYZED
ORGANIC ANALYSIS				
PURGEABLE HALOCARBONS AND AROMATICS				
1,2-Dichloroethane	ug/L	0.2	ND	08/18/89
1,1,1-Trichloroethane	ug/L	0.5	ND	08/18/89
Carbon tetrachloride	ug/L	0.3	ND	08/18/89
Bromodichloromethane	ug/L	0.2	ND	08/18/89
1,2-Dichloropropane	ug/L	0.2	ND	08/18/89
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	08/18/89
1,1,2-Trichloroethylene	ug/L	0.5	ND	08/18/89
Benzene	ug/L	1.0	ND	08/18/89
Dibromochloromethane	ug/L	1.0	ND	08/18/89
1,1,2-Trichloroethane	ug/L	1.0	ND	08/18/89
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	08/18/89
2-Chloroethylvinyl ether	ug/L	5.0	ND	08/18/89
Bromoform	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	08/18/89
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	08/18/89
Toluene	ug/L	1.0	ND	08/18/89
Chlorobenzene	ug/L	1.0	ND	08/18/89
Ethyl benzene	ug/L	1.0	ND	08/18/89
1,3-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,2-Dichlorobenzene	ug/L	4.0	ND	08/18/89
1,4-Dichlorobenzene	ug/L	4.0	ND	08/18/89
cis-1,2-Dichloroethylene	ug/L	0.5	ND	08/18/89

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
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October 05, 1989
PACE Project Number: 890808516

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my direct supervision.

Scott Engelman for

Michael A. Radle
Inorganic Chemistry Manager

Susan D Max TLH

Susan D. Max
Organic Chemistry Manager

07 127

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): Pace Labs

CHAIN OF CUSTODY RECORD

PROJECT №: 2853

PROJECT NAME: Ford, Site C

SAMPLER'S SIGNATURE (SIGN)

SEQ. №.	SAMPLE №.	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
W-	080489-JM	-06		27919	Water	5	Analyze For:
"	"	-07		20	↓	5	① Organics
"	"	-08		21		5	using EPA
"	"	-09		22		5	Methods
"	"	-10		23		5	601; 602
							② 'Cis-1,2-
							dichloroethylene
							③ ethylacetate
							④ TCL Metals
							Following:
							As, Ba, Cd,
							Cr, Cu, Pb,
							Hg, Se, Ag,
							Zn, Ni.
				TOTAL NUMBER OF CONTAINERS			

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY: [1] (SIGN)	DATE/TIME 8-8-89 13:45	RECEIVED BY: Pace Labs ② Elbert E. Brown (SIGN)
RELINQUISHED BY: [2] (SIGN)	DATE/TIME /	RECEIVED BY: ③ (SIGN)
RELINQUISHED BY: [3] (SIGN)	DATE/TIME /	RECEIVED BY: ④ (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN) W Satriale	DATE/TIME 8/8/89 15:02
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME /

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 005134

#2853

CONESTOGA-ROVERS & ASSOCIATES
382 West County Road D
St. Paul, Minnesota 55416

Rec'd CRA
NOV 10 89

ANALYTICAL REPORT SUBMISSION CHECK LIST

Date Samples Received 8-8-89

Date Report Sent to CRA ______

Method
☐ Overnight
☐ Regular Mail
☐ Fax
☐ Other ______

Items Included

1. ✓ Summary List of Samples Analyzed
2. ✓ Date of Sample Receipt
3. ✓ Date of Sample Extraction
4. ✓ Date of Sample Analysis
5. ✓ Method Blank Data for all Parameters
6. ✓ Matrix Spike Recoveries
7. ✓ Matrix Spike Duplicate Recoveries
8. ✓ QC Check Sample Data
9. NA Surrogate Spike Recoveries

All samples extracted and analyzed within specified holding times:

☐ Yes ☐ No

If no is checked please list CRA sample IDs of any samples that exceeded their holding times.

______

______

______

______

Lab ______

Check List Completed by ______

CRA USE ONLY

Date Received ______

Received by ______

Complete: ☐ Yes ☐ No

Copies to ______

pace laboratories, inc.

ient CRA — By ________ Date ________

Project 2853 — Sheet No. 1 of 3

Subject Summary of Samples Analyzed — Project No. 890808.576

ACE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
7919	W-080489-JM-06	8-4-89	8-8-89	NA	Arsenic	8-25-89
				NA	Barium	8-9-89
				NA	Cadmium	9-5-89
				NA	Chromium	8-22-89
				NA	Copper	8-9-89
				NA	Lead	8-24-89
				NA	Mercury	8-24-89
				NA	Nickel	8-14-89
				NA	Selenium	8-24-89
				NA	Silver	8-17-89
				NA	Zinc	8-24-89
				NA	Ethyl Acetate	9-1-89
				NA	601/602	9-1-89
27920	W-080489-JM-07	8-4-89	8-8-89	NA	Arsenic	8-25-89
				NA	Barium	8-9-89
				NA	Cadmium	9-5-89
				NA	Chromium	8-22-89
				NA	Copper	8-9-89
				NA	Lead	8-24-89
				NA	Mercury	8-24-89
				NA	Nickel	8-14-89
				NA	Selenium	8-24-89
				NA	Silver	8-17-89
				NA	Zinc	8-24-89

pace laboratories, inc.

Client CRA By Date
Project 2853 Sheet No. 2 of 3
Subject Summary of Samples Analyzed Project No. 890808.516

PACE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
27920	W-080489-JM-07	8-4-89	8-8-89	NA	Ethyl Acetate	8-18-89
				NA	601/602	8-18-89
27921	W-080489-JM-08	8-4-89	8-8-89	NA	Arsenic	8-25-89
				NA	Barium	8-9-89
				NA	Cadmium	9-5-89
				NA	Chromium	8-22-89
				NA	Copper	8-9-89
				NA	Lead	8-24-89
				NA	Mercury	8-24-89
				NA	Nickel	8-14-89
				NA	Selenium	8-24-89
				NA	Silver	8-17-89
				NA	Zinc	8-24-89
				NA	Ethyl Acetate	8-18-89
				NA	601/602	8-18-89
27922	W-080489-JM-09	8-4-89	8-8-89	NA	Arsenic	8-25-89
				NA	Barium	8-9-89
				NA	Cadmium	9-5-89
				NA	Chromium	8-22-89
				NA	Copper	8-9-89
				NA	Lead	8-24-89
				NA	Mercury	8-24-89
				NA	Nickel	8-14-89
				NA	Selenium	8-24-89

pace laboratories, inc.

ient CRA By Date

Project 2853 Sheet No. 3 of 3

Subject Summary of Samples Analyzed Project No. 890808.516

ACE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
27922	W-080489-JM-09	8-4-89	8-8-89	NA	Silver	8-17-89
				NA	Zinc	8-24-89
				NA	Ethyl Acetate	8-18-89
				NA	601/602	8-18-89
27923	W-080489-JM-10	8-4-89	8-8-89	NA	Arsenic	8-25-89
				NA	Barium	8-9-89
				NA	Cadmium	9-5-89
				NA	Chromium	8-22-89
				NA	Copper	8-9-89
				NA	Lead	8-24-89
				NA	Mercury	8-24-89
				NA	Nickel	8-14-89
				NA	Selenium	8-24-89
				NA	Silver	8-17-89
				NA	Zinc	8-24-89
				NA	Ethyl Acetate	8-18-89
				NA	601/602	8-18-89

Project Name CRA

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	Spiked Value	% Rec	Acc. Range	Sample A	Sample A Dup	RPD	RPD Range
Arsenic	8-25-89	<0.002	97	10.0	100	85-115	13.2	14.6	10	±30
PACE Sample#				30030			27392			
Barium	8-9-89	<0.2	92	5.45	100	85-115	4.3	4.6	7	30
PACE Sample#				27443			27391			
Cadmium	9-5-89	<0.0001	101	1.43	95	85-115	1.23	1.26	2	30
PACE Sample#				27922			28096			
Chromium	8-22-89	<0.001	106	5.1	85	85-115	5.3	5.2	2	30
PACE Sample#				28234			26032			
Copper	8-9-89	<0.01	92	1.014	97	85-115	0.97	0.98	1	30
PACE Sample#				27465			27334			
Lead	8-28-89	<0.005	97	NA	—	85-115	1.0	1.0	0	30
PACE Sample#							27923			
Mercury	8-27-89	<0.0002	100	2.0	99	85-115	ND	ND	—	
PACE Sample#				28836						
Nickel	8-14-89	<0.05	91	1.05	99	85-115	0.99	0.99	0	30
PACE Sample#				26964			27923			

NA Not Analyzed
ND Not Detected at or above the method detection limit

Project Name CRA

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	Spiked Value	% Rec	Acc. Range	Sample A	Sample A Dup	RPD	RPD Range
Selenium	8-25-89	<0.010	100	16	93	85-115	1	1	0	30
PACE Sample#				27920			27919			
Silver	8-17-89	<0.04	101	0.500	106	85-115	0.54	0.54	0	30
PACE Sample#				27446			26554			
Zinc	8-24-89	0.103	96	1.600	96	85-115	0.30	0.30	0	30
PACE Sample#				28075			27574			
PACE Sample#										
PACE Sample#										
PACE Sample#										
PACE Sample#										
PACE Sample#										

NA Not Analyzed
ND Not Detected at or above the method detection limit

JWN

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601, 602, 465B
INSTRUMENT: C
STANDARD: A
SAMPLE SPIKED: 30189
SAMPLE MATRIX: WATER

FILE NUMBER:
PREPED BY:
DATE PREPED:
ANALYZED BY:
DATE ANALYZED 9-1-85

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Chloromethane	20.0	ND	26.5	132	26.7	134 ~~132~~	.75		30%	30189
Bromomethane			24.5	123	25.3	127	1.6		30%	30191
Vinyl Chloride			25.2	126	26.9	135	3.4		30%	27919
Chloroethane			21.3	107	24.0	120	5.7		30%	30198
Methylene Chloride			20.9	105	23.3	117	5.4	152 - 31	30%	30199
1,1-Dichloroethylene			22.1	111	24.0	120	3.9	132 - 40	30%	30188
1,1-Dichloroethane			21.6	108	23.7	119	4.8	126 - 61	30%	30200
Chloroform			22.8	114	25.5	128	5.8	122 - 67	30%	29484
Carbon Tetrachloride			21.5	108	23.2	116	3.6	136 - 59	30%	28171
1,2-Dichloropropane			21.0	106	22.5	113	3.2	127 - 63	30%	28172
1,1,2-Trichloroethylene			21.7	109	24.7	124*	6.4	117 - 72	30%	28173
Benzene			19.2	96	20.5	103	3.5	120 - 79	30%	
Dibromochloro Methane	40.0		40.5	101	48.7	122	9.4	151 - 55	30%	

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601, 602, 465B
INSTRUMENT: C
STANDARD: A
SAMPLE SPIKED:
SAMPLE MATRIX:

FILE NUMBER:
PREPED BY:
DATE PREPED:
ANALYZED BY:
DATE ANALYZED

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
1,1,2-Trichloroethane	40.0	ND	40.5	101	48.7	122	9.4	151 - 55	30%	
2-Chloroethylvinyl Ether	|	|	13.1	33*	16.2	81 *	42*	145 - 82	30%	
Tetrachloroethylene	20.0	|	20.2	101	22.7	114	6.0	122 - 60	30%	
Chlorobenzene	|	|	19.1	96	20.7	104	4.0	141 - 32	30%	
1,3-Dichlorobenzene	|	|	15.3	77	17.7	89	2.2	150 - 46	30%	
1,4-Dichlorobenzene	|	|	13.9	[illegible] 70 *	13.7	[illegible] 6.9 *	.72	111 - 70	30%	
	|	|								

* Asterisked Value are outside QC limits.
RPD: VOAs ______ out of ____ outside of QC limits.
Recovery: VOAS ______ out of ____ outside of QC limits.
Blank:
Comments: * No Limits for This cmpd

QC Reviewed by:
DATE:

74HPPLAS

Page 2 of 2

SUBSET ABBREVIATION: 601&602

FOR CLP USE ONLY? ☐

DATE COLLECTED: ______
DATE RECEIVED: ______
DATE ANALYZED: ______
ANALYST: ______
DATE EXTRACTED: ______
DATA REVIEWED BY: ______
ENTERED BY: ______

PROJECT NAME: ______
CLIENT NAME: ______
PROJECT NUMBER: ______
FILE NUMBER: ______
INSTR. ID: ______
MATRIX: ______

SAMPLE NAME: Method Blank
SAMPLE NO.: ______

Ⓒ

PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date 9/1 011.5 ml	Date 011:	Results (Report)
CHLOROMETHANE	CHLOROMETH	1.0			ND
BROMOMETHANE	BROMOMETH	1.5			
DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5			
VINYL CHLORIDE (1)	VINYLCHLOR	1.5			
CHLOROETHANE	CHLOROETH	1.0	1.20		1.2
METHYLENE CHLORIDE	MECL	1.0			ND
TRICHLOROFLUOROMETHANE	FREON11	0.4			
1,1-DICHLOROETHYLENE	11DCEENE	0.3			
1,1-DICHLOROETHANE	11DCEANE	0.2			
TRANS-1,2-DICHLOROETHYLENE	TRANS12DCE	0.3			
CHLOROFORM	CHLOROFORM	0.5			
,2-DICHLOROETHANE	12DCEANE	0.2			
1,1,1-TRICHLOROETHANE	111TCEANE	0.5			
CARBON TETRACHLORIDE	CARBONTET	0.3			
BROMODICHLOROMETHANE	BDCMETHANE	0.2			
1,2-DICHLOROPROPANE	12DCPANE	0.2			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5			
1,1,2-TRICHLOROETHYLENE	TCE	0.5			
BENZENE	BENZENE	1.0			
DIBROMOCHLOROMETHANE(2)	DBCMETHANE	1.0			
1,1,2-TRICHLOROETHANE(2)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3			

Form 0023W

SUBSET ABBREVIATION: 601&602

SAMPLE NAME: ____________________

SAMPLE NO.: ____________________

PARAMETER NAME	ABBREV.	Other ______ ug/l MDL	Date Dil.	Date Dil.	Results (Report)
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			ND
BROMOFORM	BROMOFORM	1.0			
1,1,2,2-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0			
TOLUENE	TOLUENE	1.0			
CHLOROBENZENE	CHLOROBENZ	1.0			
ETHYLBENZENE	ETHYLBENZ	1.0			
1,3-DICHLOROBENZENE	13DCBENZ	4.0			
1,2-DICHLOROBENZENE	12DCBENZ	4.0			
1,4-DICHLOROBENZENE	14DCBENZ	4.0			

Footnote: 1 - These compounds co-elute
2 - These compounds co-elute

Form 0223W

SUBSET ABBREVIATION: 4658

FOR CLP USE ONLY? ☐

DATE COLLECTED:
DATE RECEIVED:
DATE ANALYZED: 9-1-89
ANALYST: ~~AHD~~ JH/SPS/WB
DATE EXTRACTED:
DATA REVIEWED BY:
ENTERED BY:

PROJECT NAME:
CLIENT NAME:
PROJECT NUMBER:
FILE NUMBER:
INSTR. ID: C
MATRIX: WATER

SAMPLE NAME: CHECK STD A
SAMPLE NO.:

	PARAMETER NAME	ABBREV.	Other ug/l MDL	Date Dil. 9-1-89	Date Dil.	Results (Report) % REC
X	CHLOROMETHANE	CHLOROMETH	1.0			126
X	BROMOMETHANE	BROMOMETH	1.5			117
	DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5			
X	VINYL CHLORIDE (1)	VINYLCHLOR	1.5			127
X	CHLOROETHANE	CHLOROETH	1.0			90
X	METHYLENE CHLORIDE	MECL	1.0			110
	ACETONE	ACETONE	40			
	TRICHLOROFLUOROMETHANE	FREON11	0.4			
	ALLYL CHLORIDE	ALLYL CHL	4.0			
X	1,1-DICHLOROETHYLENE	11DCEENE	0.3			106
	TETRAHYDROFURAN	THF	15			
X	1,1-DICHLOROETHANE	11DCEANE	0.2			102
	TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3			
	CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			
	ETHYL ETHER	ETHYLETHER	0.3			
X	CHLOROFORM	CHLOROFORM	0.5			112
	1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
	METHYL ETHYL KETONE	MEK	20			
	1,2-DICHLOROETHANE	12DCEANE	0.2			
	DIBROMOMETHANE	DIBROMOMETH	1.5			
	1,1,1-TRICHLOROETHANE	111TCEANE	0.5			
X	CARBON TETRACHLORIDE	CARBONTET	0.3			97

Form 0211W

SUBSET ABBREVIATION: 4658

SAMPLE NAME: CHECK STD A

SAMPLE NO.:

	PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date Dil. 9-1-89	Date Dil.	Results (Report) % REC
	BROMODICHLOROMETHANE	BDCMETHANE	0.2			
	DICHLOROACETONITRILE	DCACETONIT	1.0			
	2,3-DICHLORO-1-PROPENE	23DCPENE	0.5			
X	1,2-DICHLOROPROPANE	12DCPANE	0.2			98
	1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
	CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5			
X	1,1,2-TRICHLOROETHYLENE	TCE	0.5			94
X	BENZENE	BENZENE	1.0			95
	1,3-DICHLOROPROPANE	13DCPANE	0.5			
X	DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0			97
X	1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			97
	TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3			
	1,2-DIBROMOETHANE	EDB	4.0			
X	2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			69
	BROMOFORM	BROMOFORM	1.0			
	1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			
	METHYL ISOBUTYL KETONE	MIBK	1.0			
	1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
	1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
X	1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0			89
	PENTACHLOROETHANE	PENTACEANE	2.0			
	TOLUENE	TOLUENE	1.0			
X	CHLOROBENZENE	CHLOROBENZ	1.0			86
	ETHYLBENZENE	ETHYLBENZ	1.0			
	CUMENE	CUMENE	1.0			
	M-XYLENE	M-XYLENE	1.0			
	P-XYLENE (4)	P-XYLENE	1.0			
	O-XYLENE (4)	O-XYLENE	1.0			
X	1,3-DICHLOROBENZENE	13DCBENZ	4.0			74.5
	1,2-DICHLOROBENZENE	12DCBENZ	4.0			
X	1,4-DICHLOROBENZENE	14DCBENZ	4.0			66
	DICHLOROFLUOROMETHANE	FREON21	1.0			

Footnote:
1 - These compounds co-elute
2 - These compounds co-elute
3 - These compounds co-elute
4 - These compounds co-elute

DAILY MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS : 601,602,465B
INSTRUMENT: D
STANDARD: A
SAMPLE SPIKED: 29532
SAMPLE MATRIX: Water

FILE NUMBER:
PREPPED BY: KF
DATE PREPPED: 9/1/89
ANALYZED BY: KF
DATE ANALYZED: 9/1/89

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Method Blank	Check Std.	Sample Result	MS	% Rec.	Conc. MSD	% Rec.	RPD	QC LIMITS* UCL	LCL	Assoc. Samples
Chloromethane	20.0	ND		ND	3.50	17.5	2.45	12.3	35.3			30140
Bromomethane					25.3	127	24.6	123	2.81			27733
Vinyl Chloride					22.9	115	20.5	103	11.1			27570
Chloroethane					23.6	118	22.4	112	5.22			27572
Methylene Chloride				↓	18.2	91.0	19.0	95.4	4.30			27574
1,1-Dichloroethylene				3.50	18.5	92.5	14.3	71.5	25.6			29383
1,1-Dichloroethane				ND	19.8	99.0	18.8	94.0	5.18			30330
Chloroform				0.712	18.0	90.0	19.1	95.5	5.93			29532
Carbon Tetrachloride				ND	19.7	98.5	18.5	92.5	6.28			30583
1,2-Dichloropropane				↓	17.3	86.5	17.8	89.0	2.84			30645
1,1,2-Trichloroethylene				4.71	20.0	100	16.2	81.0	21.0			30646
Benzene	[illegible]			ND	29.9	149	29.7	148	0.671			30647
Dibromochloro Methane	20 ~~20.0~~				16.6	83	16.2	81.0	2.44			
1,1,2-Trichloroethane	20 ↓				17.6	88.0	17.1	85.5	2.88			
2-Chloroethylvinyl Ether	20.0			↓	—	—	13.9	69.5	—			
Tetrachloroethylene				55.3*	9.33	46.7	16.4	82.0	54.9			
Chlorobenzene				ND	17.8	89.0	17.0	85.0	4.60			
1,3-Dichlorobenzene					19.2	96.0	17.7	88.5	8.13			
1,4-Dichlorobenzene	↓	↓		↓	19.3	96.5	18.2	91.0	5.87			

CONFIRM

Form 0161X, page 1

* Asterisked Values are outside QC limits.

RPD: VOAs ____ out of ____ outside of QC limits.

Recovery: VOAs ____ out of ____ outside of QC limits.

QC Reviewed by:
DATE:

Comments: * tetrachlorethylene was out because of high amount in sample

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601 - 602, 465B
INSTRUMENT: C
STANDARD: A
SAMPLE SPIKED: 27957
SAMPLE MATRIX: [illegible]

FILE NUMBER:
PREPED BY: [illegible]
DATE PREPED: 5/11/89
ANALYZED BY: [illegible]
DATE ANALYZED 5/11/89

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Chloromethane	20	NA	22.8	114	23.1	116	1.7		30%	27987
Bromomethane			24.0	120	24.4	122	1.7		30%	27986
Vinyl Chloride			22.2	111	22.4	112	0.9		30%	27988
Chloroethane			22.6	113	22.6	113	0		30%	27989
Methylene Chloride		2.66	20.8	104	20.5	103	1.0	152 - 31	30%	27990
1,1-Dichloroethylene		NA	22.2	111	22.8	114	2.7	132 - 40	30%	27558
1,1-Dichloroethane			21.5	108	22.1	111	2.7	126 - 61	30%	27559
Chloroform			20.6	103	21.2	106	2.9	122 - 67	30%	27560
Carbon Tetrachloride			21.0	105	22.0	110	4.4	136 - 59	30%	27561
1,2-Dichloropropane	20		20.6	103	20.9	105	1.9	127 - 63	30%	27563
1,1,2-Trichloroethylene	20		20.9	105	21.8	109	3.7	117 - 72	30%	
Benzene	20		19.8	99	21.8	109	9.6	120 - 79	30%	
Dibromochloro Methane	40		39.0	98	39.7	99	1.0	151 - 55	30%	

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601, 602, 465B
INSTRUMENT: C
STANDARD: A
SAMPLE SPIKED:
SAMPLE MATRIX:

FILE NUMBER:
PREPED BY:
DATE PREPED:
ANALYZED BY:
DATE ANALYZED

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
1,1,2-Trichloroethane	40	nd	39.0	98	39.9	99	1.0	151 - 55	30%	
2-Chloroethylvinyl Ether	20	41.44	11.0	55	13.2	66	18	145 - 82	30%	
Tetrachloroethylene		nd	21.9	110	21.1	106	3.7	122 - 60	30%	
Chlorobenzene			17.4	87	18.2	91	4.5	141 - 32	30%	
1,3-Dichlorobenzene			17.8	89	16.2	81	9.4	150 - 46	30%	
1,4-Dichlorobenzene			16.1	81	14.9	75	7.7	111 - 70	30%	

* Asterisked Value are outside QC limits.

RPD: VOAs ________ out of ____ outside of QC limits.

Recovery: VOAS ________ out of ____ outside of QC limits.

Blank:

Comments:

QC Reviewed by:

DATE:

74HPPLAS

SUBSET ABBREVIATION: 4658

FOR CLP USE ONLY? ☐

DATE COLLECTED:
DATE RECEIVED:
DATE ANALYZED: 10-18-89
ANALYST: SPS/PNW
DATE EXTRACTED:
DATA REVIEWED BY:
ENTERED BY:

PROJECT NAME:
CLIENT NAME:
PROJECT NUMBER:
FILE NUMBER:
INSTR. ID: C
* MATRIX: ~~WATER~~ METHANOL

SAMPLE NAME: METHOD BLANK
SAMPLE NO.:

PARAMETER NAME	ABBREV.	Other ______ ug/l MDL	Date Dil.	Date Dil.	Results (Report)
CHLOROMETHANE	CHLOROMETH	1.0	<MDL		
BROMOMETHANE	BROMOMETH	1.5			
DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5			
VINYL CHLORIDE (1)	VINYLCHLOR	1.5			
CHLOROETHANE	CHLOROETH	1.0			
METHYLENE CHLORIDE	MECL	1.0			
ACETONE	ACETONE	40			
TRICHLOROFLUOROMETHANE	FREON11	0.4			
ALLYL CHLORIDE	ALLYL CHL	4.0			
1,1-DICHLOROETHYLENE	11DCEENE	0.3			
TETRAHYDROFURAN	THF	15			
1,1-DICHLOROETHANE	11DCEANE	0.2			
TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3			
CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			
ETHYL ETHER	ETHYLETHER	0.3			
CHLOROFORM	CHLOROFORM	0.5			
1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
METHYL ETHYL KETONE	MEK	20			
1,2-DICHLOROETHANE	12DCEANE	0.2			
DIBROMOMETHANE	DIBROMOMETH	1.5			
1,1,1-TRICHLOROETHANE	111TCEANE	0.5			
CARBON TETRACHLORIDE	CARBONTET	0.3			

SUBSET ABBREVIATION: 4658

SAMPLE NAME: METHOD BLANK
SAMPLE NO.: ____________

PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date Coll.	Date Coll.	Results (Report)
BROMODICHLOROMETHANE	BDCMETHANE	0.2	< MDL		
DICHLOROACETONITRILE	DCACETONIT	1.0			
2,3-DICHLORO-1-PROPENE	23DCPENE	0.5			
1,2-DICHLOROPROPANE	12DCPANE	0.2			
1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5			
1,1,2-TRICHLOROETHYLENE	TCE	0.5			
BENZENE	BENZENE	1.0			
1,3-DICHLOROPROPANE	13DCPANE	0.5			
DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0			
1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3			
1,2-DIBROMOETHANE	EDB	4.0			
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			
BROMOFORM	BROMOFORM	1.0			
1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			
METHYL ISOBUTYL KETONE	MIBK	1.0			
1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0			
PENTACHLOROETHANE	PENTACEANE	2.0			
TOLUENE	TOLUENE	1.0			
CHLOROBENZENE	CHLOROBENZ	1.0			
ETHYLBENZENE	ETHYLBENZ	1.0			
CUMENE	CUMENE	1.0			
M-XYLENE	M-XYLENE	1.0			
P-XYLENE (4)	P-XYLENE	1.0			
O-XYLENE (4)	O-XYLENE	1.0			
1,3-DICHLOROBENZENE	13DCBENZ	4.0			
1,2-DICHLOROBENZENE	12DCBENZ	4.0			
1,4-DICHLOROBENZENE	14DCBENZ	4.0			
DICHLOROFLUOROMETHANE	FREON21	1.0			

Footnote: 1 - These compounds co-elute
2 - These compounds co-elute
3 - These compounds co-elute
4 - These compounds co-elute

SUBSET ABBREVIATION: 4658

FOR CLP USE ONLY? ☐

DATE COLLECTED:
DATE RECEIVED:
DATE ANALYZED: 8-18-89
ANALYST: SBS/PNW
DATE EXTRACTED:
DATA REVIEWED BY:
ENTERED BY:

PROJECT NAME:
CLIENT NAME:
PROJECT NUMBER:
FILE NUMBER:
INSTR. ID: C
MATRIX: WATER

SAMPLE NAME: CHECK STD A
SAMPLE NO.:

Other ____ %REC

	PARAMETER NAME	ABBREV.	ug/l MDL	Date Dil.	Date Dil.	Results (Report)
X	CHLOROMETHANE	CHLOROMETH	1.0	105		
X	BROMOMETHANE	BROMOMETH	1.5	103		
	DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5	~~102~~ BS		
X	VINYL CHLORIDE (1)	VINYLCHLOR	1.5	102		
X	CHLOROETHANE	CHLOROETH	1.0	102		
X	METHYLENE CHLORIDE	MECL	1.0	101		
	ACETONE	ACETONE	40			
	TRICHLOROFLUOROMETHANE	FREON11	0.4			
	ALLYL CHLORIDE	ALLYL CHL	4.0			
X	1,1-DICHLOROETHYLENE	11DCEENE	0.3	108		
	TETRAHYDROFURAN	THF	15			
X	1,1-DICHLOROETHANE	11DCEANE	0.2	106		
	TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3			
	CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			
	ETHYL ETHER	ETHYLETHER	0.3			
X	CHLOROFORM	CHLOROFORM	0.5	103		
	1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
	METHYL ETHYL KETONE	MEK	20			
	1,2-DICHLOROETHANE	12DCEANE	0.2			
	DIBROMOMETHANE	DIBROMOMETH	1.5			
	1,1,1-TRICHLOROETHANE	111TCEANE	0.5			
X	CARBON TETRACHLORIDE	CARBONTET	0.3	107		

Form 0211W

SUBSET ABBREVIATION: 4658

SAMPLE NAME: CHECK STD A

SAMPLE NO.: ______

PARAMETER NAME	ABBREV.	Other ______ ug/l MDL	Date Anl. % REC	Date Anl.	Results (Report)
BROMODICHLOROMETHANE	BDCMETHANE	0.2			
DICHLOROACETONITRILE	DCACETONIT	1.0			
2,3-DICHLORO-1-PROPENE	23DCPENE	0.5			
X 1,2-DICHLOROPROPANE	12DCPANE	0.2	99		
1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5			
x 1,1,2-TRICHLOROETHYLENE	TCE	0.5	100		
BENZENE	BENZENE	1.0	99		
1,3-DICHLOROPROPANE	13DCPANE	0.5			
DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0	96		
1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3			
1,2-DIBROMOETHANE	EDB	4.0			
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			
BROMOFORM	BROMOFORM	1.0			
1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			
METHYL ISOBUTYL KETONE	MIBK	1.0			
1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0			
PENTACHLOROETHANE	PENTACEANE	2.0			
TOLUENE	TOLUENE	1.0			
CHLOROBENZENE	CHLOROBENZ	1.0			
ETHYLBENZENE	ETHYLBENZ	1.0			
CUMENE	CUMENE	1.0			
M-XYLENE	M-XYLENE	1.0			
P-XYLENE (4)	P-XYLENE	1.0			
O-XYLENE (4)	O-XYLENE	1.0			
1,3-DICHLOROBENZENE	13DCBENZ	4.0			
1,2-DICHLOROBENZENE	12DCBENZ	4.0			
1,4-DICHLOROBENZENE	14DCBENZ	4.0			
DICHLOROFLUOROMETHANE	FREON21	1.0			

Footnote: 1 - These compounds co-elute   2 - These compounds co-elute

DAILY MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601/602/465B
INSTRUMENT:
STANDARD: B
SAMPLE SPIKED: 27591
SAMPLE MATRIX: WATER

FILE NUMBER:
PREPPED BY:
DATE PREPPED:
ANALYZED BY: AAR
DATE ANALYZED: 8-18-89

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Method Blank	%Rec Check Std.	Sample Result	MS	% Rec.	Conc. MSD	% Rec.	RPD	QC LIMITS* UCL	LCL	Assoc. Samples
Dichlorodifluoromethane	20	ND	51	ND	15.3	77	15.1	76	1.3			27448
Trichlorofluoromethane	20		NP		NP	—	NP	—				27547
Dichlorofluoromethane	20		138		23.9	120	22.9	115 ~~[illegible]~~	4.3			27367
Trans-1,2-Dichloroethylene	20		107		23.0	115	22.3	112	2.6			27449
1,2-Dichloroethane	20		83		18.4	92	18.3	92	0			27451
1,1,1-Trichloroethane	20		104		22.6	113	22.0	110	2.7			27453
Bromodichloromethane	20		100		21.5	108	21.4	107	0.9			27455
2,3-Dichloro-1-propene	20		98		21.3	107	21.0	105	1.9			27457
Trans-1,3-Dichloro-1-propene	14		RP ~~68~~ 96		14.5	104	14.8	106	1.9			27459
cis-1,3-Dichloro-1-propene	26		85		24.0	92	24.0	92	0			27591
1,2-Dibromomethane	20		NP		NP	—	NP	—				27532
Bromoform	20		107		22.1	111	22.1	111	0			27536
1,1,2,2-Tetrachloroethane	20		55		23.5	118	23.1	116	1.7			27538
Toluene	20		108		22.8	114	22.8	114	0			27541
Ethyl Benzene	20		109		23.3	117	23.2	116	0.9			27548
m-Xylene	20		118		25.1	126	25.0	125	0.8			27550
o-Xylene	20		124		19.1	96	26.6	133	32			27554
1,2-Dichlorobenzene	20		102		20.1	101	21.7	109	7.6			26429

* Asterisked Values are outside QC limits.

RPD: VOAs ____ out of ____ outside of QC limits.
Recovery: VOAs ____ out of ____ outside of QC limits.
Comments: NP - NOT PRESENT

Form 0161X, page 2

QC Reviewed by:
DATE:

pace laboratories, inc.

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas
Irvine, California
Asheboro, North Carolina

REPORT OF LABORATORY ANALYSIS

Rec'd CRA
NOV 22 89

November 16, 1989

Site C
Water
September

Mr. Jon Michaels
Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

RE: PACE Project No. 890914.537
2853

Dear Mr. Michaels:

Enclosed is the report of laboratory analyses for samples received September 14, 1989.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Susan D Max TS

Susan D. Max
Director, Sampling and Analytical Services

Enclosures

1710 Douglas Drive North □ Minneapolis, MN 55422 □ Phone (612) 544-5543
an equal opportunity employer

pace®
laboratories, inc.

REPORT OF LABORATORY ANALYSIS

Offices:
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Coralville, Iowa
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Leawood, Kansas
Irvine, California
Asheboro, North Carolina

Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

November 16, 1989
PACE Project
Number: 890914537

Attn: Mr. Jon Michaels

2853

			B-1	B-3	Rinsate Blank
PACE Sample Number:			331220	331230	331240
Date Collected:			09/13/89	09/13/89	09/13/89
Date Received:			09/14/89	09/14/89	09/14/89
Parameter	Units	MDL	W-091389-JM-01	W-091389-JM-02	W-091389-JM-03
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.2	ND	ND	ND
Cadmium	mg/L	0.0001	ND	ND	ND
Chromium	mg/L	0.001	ND	ND	ND
Copper	mg/L	0.01	ND	ND	ND
Lead	mg/L	0.001	ND	ND	ND
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.05	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.04	ND	ND	ND
Zinc	mg/L	0.01	ND	0.02	ND
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Ethyl acetate	ug/L	250	ND	ND	ND
PURGEABLE HALOCARBONS AND AROMATICS					
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.5	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.5	ND	ND	ND
Vinyl chloride	ug/L	1.5	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	ND
Trichlorofluoromethane	ug/L	0.4	ND	ND	ND
1,1-Dichloroethylene	ug/L	0.3	ND	ND	ND
1,1-Dichloroethane	ug/L	0.2	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
Page 2

November 16, 1989
PACE Project
Number: 890914537

2853

PACE Sample Number:			331220	331230	331240
Date Collected:			09/13/89	09/13/89	09/13/89
Date Received:			09/14/89	09/14/89	09/14/89
Parameter	Units	MDL	W-091389-JM-01	W-091389-JM-02	W-091389-JM-03
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
trans-1,2-Dichloroethylene	ug/L	0.3	ND	ND	ND
Chloroform	ug/L	0.5	ND	ND	ND
1,2-Dichloroethane	ug/L	0.2	ND	ND	ND
1,1,1-Trichloroethane	ug/L	0.5	ND	ND	0.8
Carbon tetrachloride	ug/L	0.3	ND	ND	ND
Bromodichloromethane	ug/L	0.2	ND	ND	ND
1,2-Dichloropropane	ug/L	0.2	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	0.5	2.1	ND	ND
Benzene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	4.0	ND	ND	ND
cis-1,2-Dichloroethylene	ug/L	0.5	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
Page 3

November 16, 1989
PACE Project
Number: 890914537

2853

			B-5	Duplicate B-3	Miss. River upstream
PACE Sample Number:			331250	331260	331270
Date Collected:			09/13/89	09/13/89	09/13/89
Date Received:			09/14/89	09/14/89	09/14/89
Parameter	Units	MDL	W-091389-JM-04	W-091389-JM-05	W-091389-JM-06
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.2	ND	ND	ND
Cadmium	mg/L	0.0001	0.0002	ND	ND
Chromium	mg/L	0.001	ND	ND	ND
Copper	mg/L	0.01	ND	ND	ND
Lead	mg/L	0.001	ND	ND	0.001
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.05	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.04	ND	ND	ND
Zinc	mg/L	0.01	0.26	0.02	ND
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Ethyl acetate	ug/L	250	ND	ND	ND
PURGEABLE HALOCARBONS AND AROMATICS					
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.5	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.5	ND	ND	ND
Vinyl chloride	ug/L	1.5	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	ND
Trichlorofluoromethane	ug/L	0.4	ND	ND	ND
1,1-Dichloroethylene	ug/L	0.3	ND	ND	ND
1,1-Dichloroethane	ug/L	0.2	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND	ND	ND
Chloroform	ug/L	0.5	ND	ND	ND
1,2-Dichloroethane	ug/L	0.2	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
Page 4

November 16, 1989
PACE Project
Number: 890914537

2853

PACE Sample Number:			331250	331260	331270
Date Collected:			09/13/89	09/13/89	09/13/89
Date Received:			09/14/89	09/14/89	09/14/89
Parameter	Units	MDL	W-091389-JM-04	W-091389-JM-05	W-091389-JM-06
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
1,1,1-Trichloroethane	ug/L	0.5	ND	ND	ND
Carbon tetrachloride	ug/L	0.3	ND	ND	ND
Bromodichloromethane	ug/L	0.2	ND	ND	ND
1,2-Dichloropropane	ug/L	0.2	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND	ND	ND
Benzene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	4.0	ND	ND	ND
cis-1,2-Dichloroethylene	ug/L	0.5	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
Page 5

November 16, 1989
PACE Project
Number: 890914537

2853

Miss. River
Downstream

PACE Sample Number: 331280
Date Collected: 09/13/89
Date Received: 09/14/89

Parameter	Units	MDL	W-091389-JM-07
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Arsenic	mg/L	0.002	ND
Barium	mg/L	0.2	ND
Cadmium	mg/L	0.0001	ND
Chromium	mg/L	0.001	ND
Copper	mg/L	0.01	ND
Lead	mg/L	0.001	0.001
Mercury	mg/L	0.0002	ND
Nickel	mg/L	0.05	ND
Selenium	mg/L	0.005	ND
Silver	mg/L	0.04	ND
Zinc	mg/L	0.01	ND
ORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Ethyl acetate	ug/L	250	ND
PURGEABLE HALOCARBONS AND AROMATICS			
Chloromethane	ug/L	1.0	ND
Bromomethane	ug/L	1.5	ND
Dichlorodifluoromethane	ug/L	1.5	ND
Vinyl chloride	ug/L	1.5	ND
Chloroethane	ug/L	1.0	ND
Methylene chloride	ug/L	1.0	ND
Trichlorofluoromethane	ug/L	0.4	ND
1,1-Dichloroethylene	ug/L	0.3	ND
1,1-Dichloroethane	ug/L	0.2	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND
Chloroform	ug/L	0.5	ND
1,2-Dichloroethane	ug/L	0.2	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

November 16, 1989
PACE Project Number: 890914537

2853

PACE Sample Number: 331280
Date Collected: 09/13/89
Date Received: 09/14/89

Parameter	Units	MDL	W-091389-JM-07
ORGANIC ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
1,1,1-Trichloroethane	ug/L	0.5	ND
Carbon tetrachloride	ug/L	0.3	ND
Bromodichloromethane	ug/L	0.2	ND
1,2-Dichloropropane	ug/L	0.2	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND
Benzene	ug/L	1.0	ND
Dibromochloromethane	ug/L	1.0	ND
1,1,2-Trichloroethane	ug/L	1.0	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND
Bromoform	ug/L	1.0	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND
Toluene	ug/L	1.0	ND
Chlorobenzene	ug/L	1.0	ND
Ethyl benzene	ug/L	1.0	ND
1,3-Dichlorobenzene	ug/L	4.0	ND
1,2-Dichlorobenzene	ug/L	4.0	ND
1,4-Dichlorobenzene	ug/L	4.0	ND
cis-1,2-Dichloroethylene	ug/L	0.5	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

November 16, 1989
PACE Project
Number: 890914537

2853

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my direct supervision.

Michael A. Radle
Inorganic Chemistry Manager

Dennis R Seeger for

Susan D. Max
Organic Chemistry Manager

CONESTOGA-ROVERS & ASSOCIATES
382 West County Road D
St. Paul, Minnesota 55416

ANALYTICAL REPORT SUBMISSION CHECK LIST

Date Samples Received 9-14-89

Date Report Sent to CRA ____________

Method
☐ Overnight
☐ Regular Mail
☐ Fax
☐ Other ____________

Items Included

1. ✓ Summary List of Samples Analyzed
2. ✓ Date of Sample Receipt
3. ✓ Date of Sample Extraction
4. ✓ Date of Sample Analysis
5. ✓ Method Blank Data for all Parameters
6. ✓ Matrix Spike Recoveries
7. ✓ Matrix Spike Duplicate Recoveries
8. ✓ QC Check Sample Data
9. NA Surrogate Spike Recoveries

All samples extracted and analyzed within specified holding times:

☐ Yes ☐ No

If no is checked please list CRA sample IDs of any samples that exceeded their holding times.

____

____

____

____

Lab ____________ Check List Completed by ____________

CRA USE ONLY

Date Received ____________ Complete: ☐ Yes ☐ No

Received by ____________ Copies to ____________

pace laboratories, inc.

Client CRA By ______ Date ______

Project 2853 Sheet No. 1 of 4

Subject Summary of Samples Analyzed Project No. 890914.53r

ACE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
33122	W-091389-JM-01	9-13-89	9-14-89	NA	Arsenic	10-4-89
				NA	Barium	9-22-89
				NA	Cadmium	9-20-89
				NA	Chromium	10-9-89
				NA	Copper	9-21-89
				NA	Lead	10-4-89
				NA	mercury	9-28-89
				NA	Nickel	10-2-89
				NA	Selenium	10-2-89
				NA	Silver	10-5-89
				NA	Zinc	9-26-89
				NA	Ethyl acetate	9-27-89
				NA	601/602	9-27-89
33123	W-091389-JM-02	9-13-89	9-14-89	NA	Arsenic	10-4-89
				NA	Barium	9-22-89
				NA	Cadmium	9-20-89
				NA	Chromium	10-9-89
				NA	Copper	9-21-89
				NA	Lead	10-4-89
				NA	Mercury	9-28-89
				NA	Nickel	10-2-89
				NA	Selenium	10-2-89
				NA	Silver	10-5-89
				NA	Zinc	9-26-89

pace
laboratories, inc.

Client CRA By ____ Date ____

Project 2853 Sheet No. 2 of 4

Subject Summary of Samples Analyzed Project No. 890914.537

CE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
				NA	Ethyl acetate	9-26-89
					601/602	9-26-89
33124	W-091389-JM-03	9-13-89	9-14-89		Arsenic	10-4-89
					Barium	9-22-89
					Cadmium	9-20-89
					Chromium	10-9-89
					Copper	9-29-89
					Lead	10-4-89
					Mercury	9-28-89
					Nickel	10-2-89
					Selenium	10-2-89
					Silver	10-5-89
					Zinc	9-26-89
					Ethyl acetate	9-26-89
					601/602	9-26-89
33125	W-091389-JM-04	9-13-89	9-14-89		Arsenic	10-4-89
					Barium	9-22-89
					Cadmium	9-20-89
					Chromium	10-9-89
					Copper	9-21-89
					Lead	10-4-89
					Mercury	9-28-89
					Nickel	10-2-89
					Selenium	10-2-89

pace laboratories, inc.

Client CRA By______ Date______

Project 2853 Sheet No. 3 of 4

Subject Summary of Samples Analyzed Project No. 890914.537

ACE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
				NA	Silver	10-5-89
					Zinc	9-26-89
					Ethyl acetate	9-26-89
					601/602	9-26-89
33126	W-091389-JM-05	9-13-89	9-14-89		Arsenic	10-4-89
					Barium	9-22-89
					Cadmium	9-20-89
					Chromium	10-9-89
					Copper	9-21-89
					Lead	10-4-89
					Mercury	9-28-89
					Nickel	10-2-89
					Selenium	10-2-89
					Silver	10-5-89
					Zinc	9-26-89
					Ethyl acetate	9-26-89
					601/602	9-26-89
33127	W-091389-JM-06	9-13-89	9-14-89		Arsenic	10-4-89
					Barium	9-22-89
					Cadmium	9-20-89
					Chromium	10-9-89
					Copper	9-21-89
					Lead	10-4-89
					Mercury	9-28-89

pace laboratories, inc.

Client______ By______ Date______

Project______ Sheet No. 4 of 4

Subject______ Project No.______

ACE Sample Number	CRA Sample Number	Date of Collection	Date of Receipt	Date of Extraction	Analysis	Date of Analysis
				NA	Nickel	10-2-89
					Selenium	10-2-89
					Silver	10-5-89
					Zinc	9-26-89
					Ethyl acetate	9-26-89
					601/602	9-26-89
33128	W-091389-JM-07	9-13-89	9-14-89		Arsenic	10-4-89
					Barium	9-22-89
					Cadmium	9-20-89
					Chromium	10-9-89
					Copper	9-21-89
					Lead	10-4-89
					Mercury	9-28-89
					Nickel	10-2-89
					Selenium	10-2-89
					Silver	10-5-89
					Zinc	9-26-89
					Ethyl acetate	9-27-89
					601/602	9-27-89

Project Name CRA

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	Spiked Value	% Rec	Acc. Range	Sample A	Sample A Dup	RPD	RPD Range
Arsenic	10-4-89	<0.002	107	10.2	103	85-115	10.2	10.7	5	±30
PACE Sample#				36642			33126			
Barium	9-22-89	<0.2	96	5.06	92	85-115	4.7	4.8	2	30
PACE Sample#				33123			31986			
Cadmium	9-20-89	<0.0001	90	1.0	96	85-115	1.42	1.48	4	30
PACE Sample#				32849			33229			
Chromium	10-9-89	<0.001	112	5.0	98	85-115	8.3	8.0	4	30
PACE Sample#				36644			33126			
Copper	9-21-89	0.025	98	1.00	101	85-115	1.22	1.20	2	30
PACE Sample#				32991			32633			
	9-29-89	<0.01	97	1.00	97	85-115	1.6	1.6	0	30
PACE Sample#				35416			34279			
Lead	10-4-89	<0.001	99	10.8	106	85-115	8.6	8.5	1	30
PACE Sample#				33489			33229			
Mercury	9-28-89	<0.0002	99	5.00	112	85-115	4.03	4.80	17	30
PACE Sample#				35180			34253			

NA Not Analyzed
ND Not Detected at or above the method detection limit

Project Name CRA

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	Spiked Value	% Rec	Acc. Range	Sample A	Sample A Dup	RPD	RPD Range
Nickel	10-2-89	<0.05	100	1.60	94	85-115	0.97	0.97	0	.30
PACE Sample#				35356			33494			
Selenium	10-2-89	<0.005	111	25.0	125	85-115	20.2	21.5	6	30
PACE Sample#				31937			36169			
Silver	10-5-89	<0.04	96	0.50	101	85-115	0.51	0.50	2	30
PACE Sample#				33229			33127			
Zinc	9-26-89	0.10	100	0.334	100	85-115	0.25	0.25	0	30
PACE Sample#				32991			33042			
PACE Sample#										
PACE Sample#										
PACE Sample#										
PACE Sample#										

NA Not Analyzed
ND Not Detected at or above the method detection limit

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601/602/465B
INSTRUMENT: C
STANDARD: B
SAMPLE SPIKED: 32786
SAMPLE MATRIX: Water

FILE NUMBER:
PREPED BY: pnn
DATE PREPED: 9/26/09
ANALYZED BY: PNN
DATE ANALYZED 9/26/09

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Dichlorodifluoromethane	20	ND	23.8	119	23.3	117			30%	32786
Trichlorofluoromethane			NA - in Std A					124 - 46	30%	35171
Dichlorofluoromethane			23.3	117*	23.1	116*		* 102 - 48	30%	35172
Trans-1,2 Dichloroethylene			20.4	102	20.3	102		*Jrr 121 - 59	30%	32967
1,2-Dichloroethane			19.0	95	18.6	93		131 - 47	30%	33123
1,1,1-Trichloroethane		1.03	20.0	100	19.0	95		119 - 63	30%	33124
Bromodichloromethane		ND	20.1	101	18.6	93		116 - 73	30%	33125
2,3-Dichloro-1-propene	20		20.9	105	20.6	103		118 - 61	30%	33126
Trans-1,3-Dichloro-1-propene	14.4		14.6	101	12.6	88		114 - 65	30%	33127
cis-1,3-Dichloro-1-propene	25.6		29.6	116	28.8	113		124 - 46	30%	
1,2-Dibromomethane	20		22.8	114	21.8	109		135 - 75	30%	
Bromoform			20.4	102	20.3	102		127 - 64	30%	
1,1,2,2-Tetrachloroethane			20.0	100	19.4	97		124 - 42	30%	

Page 1 of 2

Sdr 10/4/89

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601/602/465B
INSTRUMENT: C
STANDARD: B
SAMPLE SPIKED: ________
SAMPLE MATRIX: ________

FILE NUMBER: ________
PREPED BY: ________
DATE PREPED: ________
ANALYZED BY: ________
DATE ANALYZED ________

CLIENT NAME: ________
PROJECT NAME: ________
PROJECT NUMBER: ________

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Toluene	20	ND	18.5	93	18.9	95		123 - 68	30%	
Ethyl Benzene			18.9	95	18.2	91		117 - 49	30%	
m-Xylene			19.4	97	18.5	93		126 - 69	30%	
o-Xylene			19.1	96	18.1	91		124 - 73	30%	
1,2-Dichlorobenzene			17.9	90	16.9	85		126 - 78	30%	

* Asterisked Value are outside QC limits.

RPD: VOAs ________ out of ____ outside of QC limits.
Recovery: VOAS ________ out of ____ outside of QC limits.
Blank: ________
* Comments: Dichlorofluoromethane is high in the spike due to new spike mix. JWN
Limits for Dichlorofluoromethane are based on old mix.

QC Reviewed by: JWN/Sdn
DATE: 10-4-89

74HPPLAS

Page 2 of 2

SUBSET ABBREVIATION: 4658

FOR CLP USE ONLY? ☐

DATE COLLECTED:

DATE RECEIVED:

DATE ANALYZED: 9/26/89

ANALYST: PNN

DATE EXTRACTED:

DATA REVIEWED BY:

ENTERED BY:

PROJECT NAME:

CLIENT NAME:

PROJECT NUMBER:

FILE NUMBER:

INSTR. ID: C

MATRIX: Water

SAMPLE NAME:

SAMPLE NO.: Method Blank

PARAMETER NAME	ABBREV.	Other ___ ug/l MDL	Date C 9/26/89 Dil. Sml	Date Dil.	Results (Report)
CHLOROMETHANE	CHLOROMETH	1.0	ND		ND
BROMOMETHANE	BROMOMETH	1.5			
DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5			
VINYL CHLORIDE (1)	VINYLCHLOR	1.5			
CHLOROETHANE	CHLOROETH	1.0			
METHYLENE CHLORIDE	MECL	1.0			
ACETONE	ACETONE	40			
TRICHLOROFLUOROMETHANE	FREON11	0.4			
ALLYL CHLORIDE	ALLYL CHL	4.0			
1,1-DICHLOROETHYLENE	11DCEENE	0.3			
TETRAHYDROFURAN	THF	15			
1,1-DICHLOROETHANE	11DCEANE	0.2			
TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3			
CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			
ETHYL ETHER	ETHYLETHER	0.3			
CHLOROFORM	CHLOROFORM	0.5			
1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
METHYL ETHYL KETONE	MEK	20			
1,2-DICHLOROETHANE	12DCEANE	0.2			
DIBROMOMETHANE	DIBROMOMETH	1.5			
1,1,1-TRICHLOROETHANE	111TCEANE	0.5			
CARBON TETRACHLORIDE	CARBONTET	0.3			

Form 0211W

UBSET ABBREVIATION: 4658

SAMPLE NAME: ______________

SAMPLE NO.: ______________

PARAMETER NAME	ABBREV.	Other ______ ug/l MDL	Date Anal.	Date Anal.	Results (Report)
BROMODICHLOROMETHANE	BDCMETHANE	0.2	ND		ND
DICHLOROACETONITRILE	DCACETONIT	1.0			
2,3-DICHLORO-1-PROPENE	23DCPENE	0.5			
1,2-DICHLOROPROPANE	12DCPANE	0.2			
1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5			
1,1,2-TRICHLOROETHYLENE	TCE	0.5			
BENZENE	BENZENE	1.0			
1,3-DICHLOROPROPANE	13DCPANE	0.5			
DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0			
1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3			
1,2-DIBROMOETHANE	EDB	4.0			
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			
BROMOFORM	BROMOFORM	1.0			
1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			
METHYL ISOBUTYL KETONE	MIBK	1.0			
1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0			
PENTACHLOROETHANE	PENTACEANE	2.0			
TOLUENE	TOLUENE	1.0			
CHLOROBENZENE	CHLOROBENZ	1.0			
ETHYLBENZENE	ETHYLBENZ	1.0			
CUMENE	CUMENE	1.0			
M-XYLENE	M-XYLENE	1.0			
P-XYLENE (4)	P-XYLENE	1.0			
O-XYLENE (4)	O-XYLENE	1.0			
1,3-DICHLOROBENZENE	13DCBENZ	4.0			
1,2-DICHLOROBENZENE	12DCBENZ	4.0			
1,4-DICHLOROBENZENE	14DCBENZ	4.0			
DICHLOROFLUOROMETHANE	FREON21	1.0			

Footnote: 1 - These compounds co-elute
2 - These compounds co-elute
3 - These compounds co-elute
4 - These compounds co-elute

UBSET ABBREVIATION: 465B

FOR CLP USE ONLY? ☐

ATE COLLECTED:

ATE RECEIVED:

DATE ANALYZED: 9/26/09

NALYST: PWN

ATE EXTRACTED:

ATA REVIEWED BY:

NTERED BY:

PROJECT NAME:

CLIENT NAME:

PROJECT NUMBER:

FILE NUMBER:

INSTR. ID: (C)

MATRIX: water

SAMPLE NAME:

SAMPLE NO.: Check stand

PARAMETER NAME	ABBREV.	Other ug/l MDL	Date (C) 9/24/09 Dil. RC ppb	Date Dil.	Results (Report)
CHLOROMETHANE	CHLOROMETH	1.0			ND
BROMOMETHANE	BROMOMETH	1.5			
DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5	25.1		25
VINYL CHLORIDE (1)	VINYLCHLOR	1.5			ND
CHLOROETHANE	CHLOROETH	1.0			
METHYLENE CHLORIDE	MECL	1.0			
ACETONE	ACETONE	40			
TRICHLOROFLUOROMETHANE	FREON11	0.4			
ALLYL CHLORIDE	ALLYL CHL	4.0			
1,1-DICHLOROETHYLENE	11DCEENE	0.3			
TETRAHYDROFURAN	THF	15			
1,1-DICHLOROETHANE	11DCEANE	0.2			
TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3	21.6		22
CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			ND
ETHYL ETHER	ETHYLETHER	0.3			
CHLOROFORM	CHLOROFORM	0.5			
1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
METHYL ETHYL KETONE	MEK	20			
1,2-DICHLOROETHANE	12DCEANE	0.2	20.1		20
DIBROMOMETHANE	DIBROMOMETH	1.5			ND
1,1,1-TRICHLOROETHANE	111TCEANE	0.5	20.9		21
CARBON TETRACHLORIDE	CARBONTET	0.3			ND

Form 0211W

SUBSET ABBREVIATION: 4658

SAMPLE NAME: ____________

SAMPLE NO.: ____________

PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date Dil.	Date Dil.	Results (Report)
BROMODICHLOROMETHANE	BDCMETHANE	0.2	20.0		20
DICHLOROACETONITRILE	DCACETONIT	1.0			ND
2,3-DICHLORO-1-PROPENE	23DCPENE	0.5	20.5		21
1,2-DICHLOROPROPANE	12DCPANE	0.2			ND
1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5	28.1		28
1,1,2-TRICHLOROETHYLENE	TCE	0.5			ND
BENZENE	BENZENE	1.0			
1,3-DICHLOROPROPANE	13DCPANE	0.5			
DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0			
1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3	13.2		13
1,2-DIBROMOETHANE	EDB	4.0	21.8		22
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			ND
BROMOFORM	BROMOFORM	1.0	20.5		21
1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			ND
METHYL ISOBUTYL KETONE	MIBK	1.0			
1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0	18.6		19
PENTACHLOROETHANE	PENTACEANE	2.0			ND
TOLUENE	TOLUENE	1.0	18.0		18
CHLOROBENZENE	CHLOROBENZ	1.0			ND
ETHYLBENZENE	ETHYLBENZ	1.0	18.5		19
CUMENE	CUMENE	1.0			ND
M-XYLENE	M-XYLENE	1.0	17.3		17
P-XYLENE (4)	P-XYLENE	1.0 1mw	NP ~~16.4~~		ND
O-XYLENE (4)	O-XYLENE	1.0	16.4		16
1,3-DICHLOROBENZENE	13DCBENZ	4.0			ND
1,2-DICHLOROBENZENE	12DCBENZ	4.0	15.4		15
1,4-DICHLOROBENZENE	14DCBENZ	4.0			ND
DICHLOROFLUOROMETHANE	FREON21	1.0	25.1		25

Footnote: 1 - These compounds co-elute 2 - These compounds co-elute

3 - These compounds co-elute 4 - These compounds co-elute

SUBSET ABBREVIATION: 4658

FOR CLP USE ONLY? ☐

DATE COLLECTED:

DATE RECEIVED:

DATE ANALYZED: 9/27/89

ANALYST: Phn

DATE EXTRACTED:

DATA REVIEWED BY:

ENTERED BY:

PROJECT NAME:

CLIENT NAME:

PROJECT NUMBER:

FILE NUMBER:

INSTR. ID: (C)

MATRIX: Water

SAMPLE NAME:

SAMPLE NO.: Method Blank

PARAMETER NAME	ABBREV.	Other ug/l MDL	(C) Date 9/27/89 Dil 5ml	Date Dil.	Results (Report)
CHLOROMETHANE	CHLOROMETH	1.0	N/D		N/D
BROMOMETHANE	BROMOMETH	1.5			
DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5			
VINYL CHLORIDE (1)	VINYLCHLOR	1.5			
CHLOROETHANE	CHLOROETH	1.0			
METHYLENE CHLORIDE	MECL	1.0			
ACETONE	ACETONE	40			
TRICHLOROFLUOROMETHANE	FREON11	0.4			
ALLYL CHLORIDE	ALLYL CHL	4.0			
1,1-DICHLOROETHYLENE	11DCEENE	0.3			
TETRAHYDROFURAN	THF	15			
1,1-DICHLOROETHANE	11DCEANE	0.2			
TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3			
CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			
ETHYL ETHER	ETHYLETHER	0.3			
CHLOROFORM	CHLOROFORM	0.5			
1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
METHYL ETHYL KETONE	MEK	20			
1,2-DICHLOROETHANE	12DCEANE	0.2			
DIBROMOMETHANE	DIBROMOMETH	1.5			
1,1,1-TRICHLOROETHANE	111TCEANE	0.5			
CARBON TETRACHLORIDE	CARBONTET	0.3			

Form 0211W

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601/602/465B
INSTRUMENT: C
STANDARD: B
SAMPLE SPIKED:
SAMPLE MATRIX:

FILE NUMBER:
PREPED BY:
DATE PREPED:
ANALYZED BY:
DATE ANALYZED

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Toluene	20	ND	16,6	83	16,9	85	2,30	123 - 68	30%	
Ethyl Benzene			16,5	83	18,0	91	9,2	117 - 49	30%	
m-Xylene			16,5	83	17,1	86	3,55	126 - 69	30%	
o-Xylene			16,3	82	16,9	85	3,59	124 - 73	30%	
1,2-Dichlorobenzene			20,7	104	17,3	87	17,8	126 - 78	30%	

* Asterisked Value are outside QC limits.
RPD: VOAs ______ out of ____ outside of QC limits.
Recovery: VOAS ______ out of ____ outside of QC limits.
Blank:
Comments:

QC Reviewed by: JWN/
DATE: 10-4-89

74HPPLAS

SUBSET ABBREVIATION: 4658

FOR CLP USE ONLY? ☐

DATE COLLECTED: ____________________
DATE RECEIVED: ____________________
DATE ANALYZED: ____________________
ANALYST: ____________________
DATE EXTRACTED: ____________________
DATA REVIEWED BY: ____________________
ENTERED BY: ____________________

PROJECT NAME: ____________________
CLIENT NAME: ____________________
PROJECT NUMBER: ____________________
FILE NUMBER: ____________________
INSTR. ID: ____________________
MATRIX: ____________________

SAMPLE NAME: ____________________
SAMPLE NO.: Check standard

(C)

PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date Dil. 9/27/99 20ppb	Date Dil.	Results (Report)
CHLOROMETHANE	CHLOROMETH	1.0			
BROMOMETHANE	BROMOMETH	1.5			
DICHLORODIFLUOROMETHANE (1)	FREON 12	1.5	24,1		24
VINYL CHLORIDE (1)	VINYLCHLOR	1.5			
CHLOROETHANE	CHLOROETH	1.0			
METHYLENE CHLORIDE	MECL	1.0			
ACETONE	ACETONE	40			
TRICHLOROFLUOROMETHANE	FREON11	0.4			
ALLYL CHLORIDE	ALLYL CHL	4.0			
1,1-DICHLOROETHYLENE	11DCEENE	0.3			
TETRAHYDROFURAN	THF	15			
1,1-DICHLOROETHANE	11DCEANE	0.2			
TRANS-1,2-DICHLOROETHYLENE (2)	TRANS12DCE	0.3	19,4		19
CIS-1,2-DICHLOROETHYLENE (2)	CIS12DCE	0.5			
ETHYL ETHER	ETHYLETHER	0.3			
CHLOROFORM	CHLOROFORM	0.5			
1,1,2-TRICHLOROTRIFLUOROETHANE	FREON113	0.7			
METHYL ETHYL KETONE	MEK	20			
1,2-DICHLOROETHANE	12DCEANE	0.2	17,2		17
DIBROMOMETHANE	DIBROMOMETH	1.5			
1,1,1-TRICHLOROETHANE	111TCEANE	0.5	19,3		19
CARBON TETRACHLORIDE	CARBONTET	0.3			

Form 0211W

SUBSET ABBREVIATION: 4658

SAMPLE NAME: ______________

SAMPLE NO.: ______________

PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date Oil.	Date Oil.	Results (Report)
BROMODICHLOROMETHANE	BDCMETHANE	0.2	19.0		19
DICHLOROACETONITRILE	DCACETONIT	1.0			
2,3-DICHLORO-1-PROPENE	23DCPENE	0.5	20.1		20
1,2-DICHLOROPROPANE	12DCPANE	0.2			
1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5	27.6		28
1,1,2-TRICHLOROETHYLENE	TCE	0.5			
BENZENE	BENZENE	1.0			
1,3-DICHLOROPROPANE	13DCPANE	0.5			
DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0			
1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3	13.6		14
1,2-DIBROMOETHANE	EDB	4.0	22.6		23
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			
BROMOFORM	BROMOFORM	1.0	19.6		20
1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			
METHYL ISOBUTYL KETONE	MIBK	1.0			
1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0	15.9		16
PENTACHLOROETHANE	PENTACEANE	2.0			
TOLUENE	TOLUENE	1.0	16.85		17
CHLOROBENZENE	CHLORCBENZ	1.0			
ETHYLBENZENE	ETHYLBENZ	1.0	18.2		18
CUMENE	CUMENE	1.0			
M-XYLENE	M-XYLENE	1.0	17.1		17
P-XYLENE (4)	P-XYLENE	1.0			
O-XYLENE (4)	O-XYLENE	1.0	16.85		17
1,3-DICHLOROBENZENE	13DCBENZ	4.0			
1,2-DICHLOROBENZENE	12DCBENZ	4.0	17.3		17
1,4-DICHLOROBENZENE	14DCBENZ	4.0			
DICHLOROFLUOROMETHANE	FREON21	1.0	24.9		25

Footnote: [illegible] - These compounds co-elute
[illegible] - These compounds co-elute
3 - These compounds co-elute
4 - These compounds co-elute

DAILY MATRIX SPKIE/MATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601/602/465B
INSTRUMENT: C
STANDARD: B
SAMPLE SPIKED:
SAMPLE MATRIX:

FILE NUMBER:
PREPED BY: pnw
DATE PREPED: 9/27/19
ANALYZED BY: pnw
DATE ANALYZED 9/27/19

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Dichlorodifluoromethane	20	ND	20.4	102	534	27	146		30%	34034
Trichlorofluoromethane								124 - 46	30%	32969
Dichlorofluoromethane			21.6	* 108	22.0	* 113	4.52	102 - 48	30%	33122
Trans-1,2-Dichloroethylene			17.7	89	17.8	89	0	121 - 59	30%	33128
1,2-Dichloroethane			16.1	81	16.1	81	0	131 - 47	30%	33044
1,1,1-Trichloroethane			16.3	82	16.4	82	0	119 - 63	30%	34033
Bromodichloromethane			16.4	82	16.1	81	1.22	116 - 73	30%	34035
2,3-Dichloro-1-propene	20		16.8	84	16.8	84	0	118 - 61	30%	34036
Trans-1,3-Dichloro-1-propene	14.4		11.4	79	11.0	76	3.87	114 - 65	30%	32968
cis-1,3-Dichloro-1-propene	25.6		26.1	102	25.9	102	0	124 - 46	30%	
1,2-Dibromomethane	20		19.6	98	19.3	97	1.02	135 - 75	30%	
Bromoform			16.0	80	16.2	81	1.24	127 - 64	30%	
1,1,2,2-Tetrachloroethane			13.0	65	13.1	66	1.52	124 - 42	30%	

* On the specific cmpd the accuracy limits are from [illegible] the DCF was not made by Supelco mixtures and therefore the ~~limit~~ % recovery were low. Now with the Supelco mixtures combined [illegible] % recovery [illegible] 100%.

UBSET ABBREVIATION: 4658

SAMPLE NAME: ____________________

SAMPLE NO.: ____________________

PARAMETER NAME	ABBREV.	Other ____ ug/l MDL	Date Anl.	Date Anl.	Results (Report)
BROMODICHLOROMETHANE	BDCMETHANE	0.2	N/D		N/D
DICHLOROACETONITRILE	DCACETONIT	1.0			
2,3-DICHLORO-1-PROPENE	23DCPENE	0.5			
1,2-DICHLOROPROPANE	12DCPANE	0.2			
1,1-DICHLORO-1-PROPENE	11DCPENE	1.0			
CIS-1,3-DICHLORO-1-PROPENE	CIS13DCP	0.5			
1,1,2-TRICHLOROETHYLENE	TCE	0.5			
BENZENE	BENZENE	1.0			
1,3-DICHLOROPROPANE	13DCPANE	0.5			
DIBROMOCHLOROMETHANE (3)	DBCMETHANE	1.0			
1,1,2-TRICHLOROETHANE (3)	112TCEANE	1.0			
TRANS-1,3-DICHLORO-1-PROPENE	TRANS13DCP	0.3			
1,2-DIBROMOETHANE	EDB	4.0			
2-CHLOROETHYLVINYL ETHER	2CEVETHER	5.0			
BROMOFORM	BRMOFORM	1.0			
1,1,1,2-TETRACHLOROETHANE	1112TTEANE	0.3			
METHYL ISOBUTYL KETONE	MIBK	1.0			
1,2,3-TRICHLOROPROPANE	123TCPANE	4.0			
1,1,2,2,-TETRACHLOROETHANE	1122TTEANE	1.0			
1,1,2,2-TETRACHLOROETHYLENE	1122TTEENE	1.0			
PENTACHLOROETHANE	PENTACEANE	2.0			
TOLUENE	TOLUENE	1.0			
CHLOROBENZENE	CHLOROBENZ	1.0			
ETHYLBENZENE	ETHYLBENZ	1.0			
CUMENE	CUMENE	1.0			
M-XYLENE	M-XYLENE	1.0			
P-XYLENE (4)	P-XYLENE	1.0			
O-XYLENE (4)	O-XYLENE	1.0			
1,3-DICHLOROBENZENE	13DCBENZ	4.0			
1,2-DICHLOROBENZENE	12DCBENZ	4.0			
1,4-DICHLOROBENZENE	14DCBENZ	4.0			
DICHLOROFLUOROMETHANE	FREON21	1.0			

Footnote: 1 - These compounds co-elute
2 - These compounds co-elute
3 - These compounds co-elute
4 - These compounds co-elute

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LIST OF FIGURES

1.0 INTRODUCTION

The Ford Motor Company, Twin Cities Assembly Plant (Plant) is located in St. Paul, Minnesota, at 966 South Mississippi River Boulevard. The Plant complex includes buildings on both sides of Mississippi River Boulevard. The Plant location is presented on Figure 1.1.

A more detailed chronology of the Plant's history is outlined in a report entitled "Groundwater Monitoring Report and Evaluation - Site C" dated January 24, 1990.

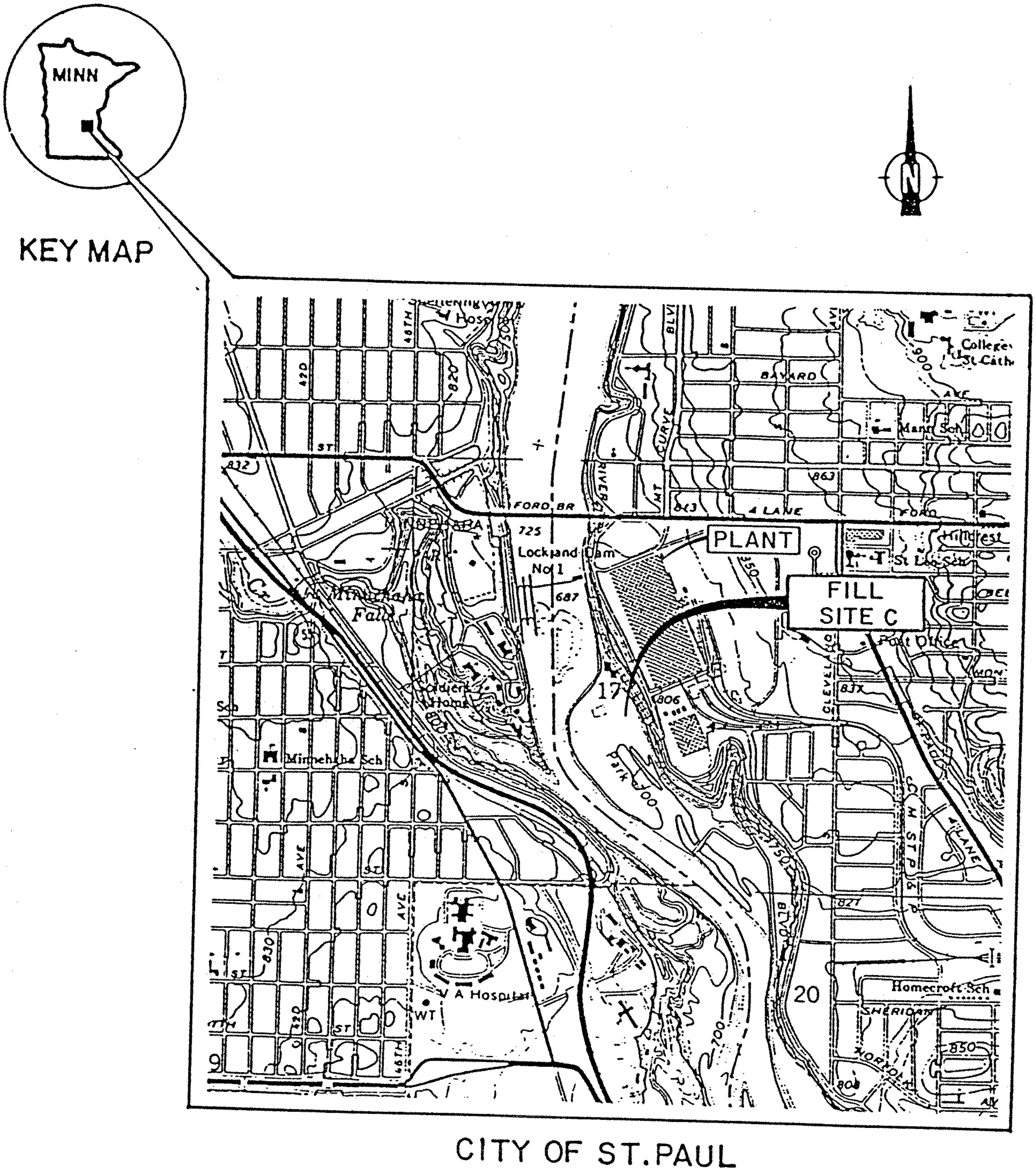


FIGURE 1.1
LOCATION PLAN
Ford Motor Company

CRA

2191 –22/09/87–1–D–0

2.0 BACKGROUND

The Site C waste disposal area was reported to the USEPA by Ford during the Superfund notification process. The location of Site C is provided on Figure 1.1. Several hydrogeologic investigations were completed. The most recent investigation was presented in the report titled "Groundwater Monitoring Report and Evaluation - Site C". This report was submitted to the Minnesota Pollution Control Agency (MPCA) on January 24, 1990.

On January 31, 1990, a meeting was held with the MPCA to discuss the results of this report. The MPCA requested additional field work to be completed at Site C. On March 2, 1990, a work plan for supplemental groundwater monitoring was submitted to the MPCA. This work plan included the installation of an additional monitoring well and two rounds of groundwater and surface water sampling.

This monitoring report summarizes the data and evaluation results from these field activities.

3.0 FIELD ACTIVITIES

3.1 MONITORING WELL INSTALLATION

CRA contracted GME Consultants Inc. to install the new monitoring well (MW-6). Work commenced on April 9, 1990, and was completed on April 10, 1990. The location of the new monitoring well (MW6) is shown on Figures 3.1, 3.2 and 3.3.

A CME 55 drill rig, using 4-1/4-inch inside diameter, hollow stem augers advanced the well boring. Split spoon samples were collected continuously to the bottom of the boring.

The monitoring well was completed using the following materials:

- 10-foot, 2.0-inch diameter, .10 slot stainless steel screen;
- 40-foot, 2.0-inch, low carbon steel riser;
- #10 silica sand pack;
- Bentonite slurry seal;
- Bentonite (approximately 3 percent) cement grout;
- 4.0-inch diameter locking protective casing;
- three 4.0-inch steel protective posts.

The monitoring well was installed inside the auger annulus by backing the augers form the boring while simultaneously installing the sand pack. The sand pack was installed from the bottom to approximately 8 feet

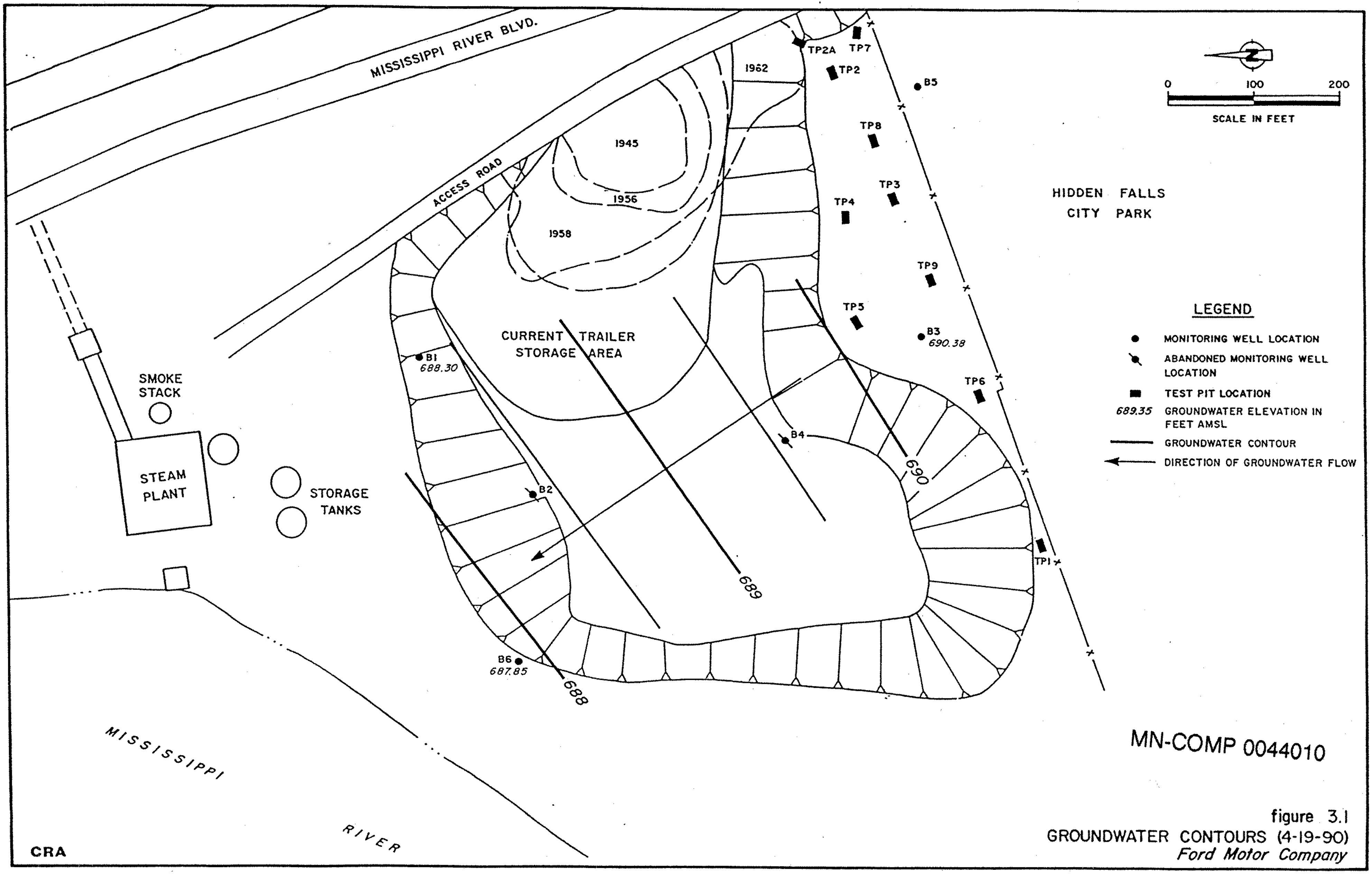


figure 3.1
GROUNDWATER CONTOURS (4-19-90)
Ford Motor Company

2853-11/27/89-M

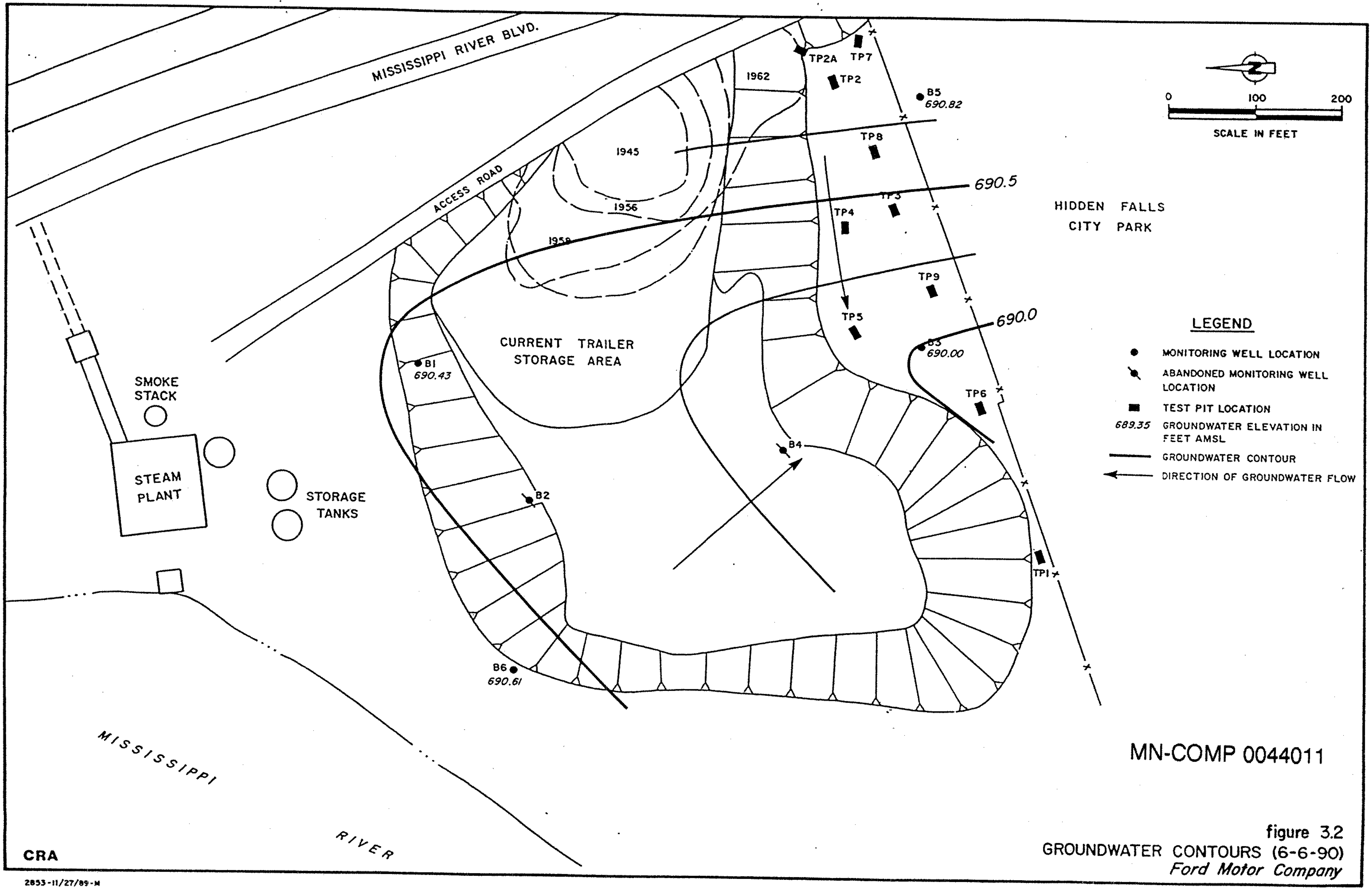


figure 3.2
GROUNDWATER CONTOURS (6-6-90)
Ford Motor Company

2853-11/27/89-M

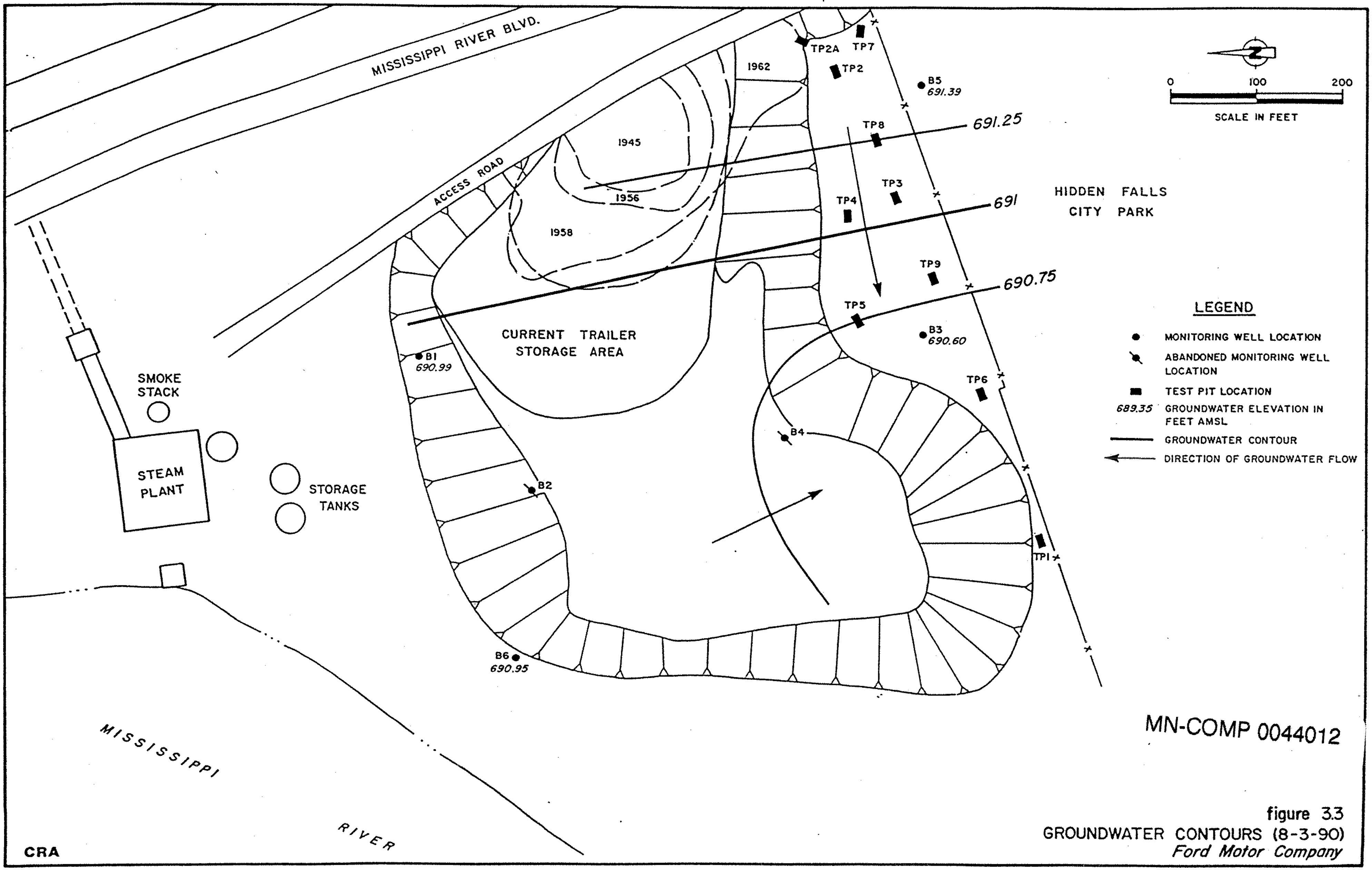


figure 3.3
GROUNDWATER CONTOURS (8-3-90)
Ford Motor Company

above the top of the screen. Natural sand and gravel filled the annulus to approximately 26 feet BGS. A bentonite slurry seal approximately 3 feet thick was emplaced above the sand pack. The remaining auger annulus was backfilled by the tremie grout method using a mixture of bentonite and cement. Surface protection consisted of a 4.0-inch diameter locking protective casing and three steel bumper posts. The well completion log is presented in Appendix A.

The drill rig, augers, well materials and additional associated equipment were decontaminated using a high temperature, hot water steam rinse.

Well MW-6 was developed and stabilized following installation using a 2-inch stainless steel and teflon, bottom filling bailer. A minimum of five standing well volumes was purged. Field parameters of pH, conductivity and temperature were noted after each well volume. The well was considered stabilized after three consecutive volumes with readings of less than 5 percent variability were purged. In total, 44 well volumes were removed during development.

Table 3.1 presents the new well elevation data.

3.2 GROUNDWATER AND SURFACE WATER SAMPLING

Two (2) rounds of groundwater and surface water sampling were completed according to the approved work plan and the MPCA guidance manual "Procedures for Groundwater Monitoring; MPCA Guidelines"

TABLE 3.1

FORD SITE C
REVISED* MONITORING WELL ELEVATION DATA

Well #	Top of Casing Elevation	Ground Elevation	Bottom of Screen Elevation	Groundwater Elevations								
				8/3/90	6/6/90	4/19/90	9/13/89	6/2/89	3/24/88(1)	12/1/82(2)	3/3/82(3)	1/5/82(3)
B1	738.06	735.9	681.62	690.99	690.43	688.30	686.91	689.35	688.24	691.85	688.35	688.62
B3	704.18	702.9	679.68	690.66	690.00	690.38	687.76	689.36	688.50	691.42	688.27	688.65
B5	703.90	703.2	678.50	691.39	690.82	-(4)	689.19	690.45	689.61	691.96	NI	NI
B6	730.85	728.4	681.90	690.95	690.61	687.85	NI	NI	NI	NI	NI	NI
Staff Gauge Lock & Dam #1	-	-	-	691.4	691.5	688.2						

Note:

All elevations are feet above mean sea level (AMSL).

*As revised due to well repairs and modifications.

(1) From report "Assessment of Fill Areas, Ford Motor Company, Twin Cities Assembly Plant," CRA, October 1988.

(2) From report "Twin Cities Assembly Facility, Groundwater Monitoring Wells Survey," Ford Motor Company, December 1, 1982.

(3) From report "Twin Cities Assembly Facility, Groundwater Monitoring Wells Survey," Ford Motor Company, March 3, 1982.

(4) This water level omitted by error on this date, therefore, an additional water level round taken 8/3/90.

NI Not Installed

December 1986. The samples were submitted to Pace Laboratories Inc. for chemical analysis under chain-of-custody procedures. The monitoring wells were purged and sampled using a precleaned* bottom filling stainless steel bailer. A minimum of three well volumes were purged prior to each sampling.

The surface water samples were taken by the "Grab Sampling" method. On the two sampling events, samples were obtained from both an upstream and downstream locations. These surface water locations are the same as the 1989 surface water sampling locations.

3.3 GROUNDWATER FLOW DIRECTION

Groundwater elevation data was obtained on April 19, 1990, June 6, 1990, and August 3, 1990. Groundwater elevations and groundwater flow directions are presented on Figures 3.1, 3.2 and 3.3.

Groundwater flow is predominantly to the west towards the Mississippi River. Seasonal control of the river elevation may affect this flow direction to some degree. Water levels measured by CRA during 1988, also presented on Table 3.1, had indicated a more northwesterly component of flow direction. A similar westerly flow pattern was also provided by data presented by Ford in December 1982 as also indicated on Table 3.1. Early groundwater elevations by Ford do not include well B5, as it was not installed until later in

---

*Cleaning sequence consisted of: methanol-hexane-methanol rinse, air drying and distilled water rinse.

1982. Only the 1990 data includes the new well B6. Seasonal fluctuations in the river elevation also appear to change the gradients as shown on Figures 3.1, 3.2 and 3.3.

Figures 3.2 and 3.3 show a flow direction to the south for the western edge of Site C. These flow directions indicated that the river was recharging this portion of Site C. The Army Corp of Engineers maintain a staff gauge in the lower pool of Lock and Dam #1. The elevations of the river were approximately 3 feet higher during the June and August water level rounds when compared to the river elevation in April. The change in river elevation explains why groundwater flow for June and August are different than the flow direction for April.

Groundwater elevations are measured in the existing monitoring wells which are screened in the fill and/or river deposits of sand and gravel. Thus, the groundwater flow directions represent a localized condition under Site C.

4.0 ANALYTICAL RESULTS

Results of the chemical analysis of groundwater and surface water are presented in Table 4.1. The analytical lab reports and the data validation memorandums are presented in Appendix B. All water samples were analyzed for halocarbon and aromatic volatile organic compounds (VOC) by EPA methods 601 and 602. In addition to the 601/602 VOC parameters, the MPCA requested that *cis*-1,2-dichloroethylene and ethylacetate also be analyzed. This request was presented in MPCA's letter dated April 25, 1989. The following metals were also analyzed: arsenic, selenium and mercury by Atomic Absorption Method and barium, cadmium, chromium, copper, lead, silver, zinc and nickel by inductively coupled plasma analysis (EPA Method 6010).

TABLE 4.1

FORD SITE "C"
DETECTED COMPOUNDS

	B1					B3					B5			B6	
	6/89	8/89	9/89	4/90	6/90	6/89	8/89	9/89	4/90	6/90	6/89	8/89	9/89	4/90	6/90
cis-1,2-Dichloroethylene µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.5
1,1-Dichloroethylene µg/L	1.5	ND$^{(R)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8$^{(J)}$	ND	ND	ND
Methylene Chloride µg/L	ND	ND$^{(R)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4$^{(U)}$	ND
Trichlorofluoromethane µg/L	ND	ND$^{(R)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane µg/L	ND	14$^{(J)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride µg/L	ND	5.2$^{(J)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene µg/L	ND	ND$^{(R)}$	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5
Chloroform µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.9	ND
Cadmium mg/L	ND	ND	ND	ND	ND	0.0002	ND	ND	ND	ND	0.0004	ND	0.0002	ND	ND
Lead mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc mg/L	ND	ND	ND	ND	ND	0.03	ND	0.02	ND	ND	0.07	ND	0.26	ND	0.007$^{(U)}$
Copper mg/L	ND	0.01	ND	ND	ND	ND	0.02	ND	0.01$^{(U)}$	ND	ND	ND	ND	ND	ND
Nickel mg/L	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	0.08	0.05	ND	ND	ND
Chromium mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND
Barium mg/L	ND	ND	ND	ND	0.06	0.3	ND	ND	0.2	0.18	ND	ND	ND	ND	0.073

TABLE 4.1 (CONT'D)

FORD SITE "C"
DETECTED COMPOUNDS

	Mississippi River Up Stream					Mississippi River Down Stream				
	6/89	8/89	9/89	4/90	6/90	6/89	8/89	9/89	4/90	6/90
cis-1,2-Dichloroethylene µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene µg/L	1.3	ND	ND	ND	ND	ND	$1.1^{(J)}$	ND	ND	ND
Methylene Chloride µg/L	ND	ND	ND	$1.3^{(U)}$	1.0	1.3	ND	ND	ND	ND
Trichlorofluoromethane µg/L	ND	ND	ND	ND	ND	$2.1^{(J)}$	ND	ND	ND	ND
Dichlorodifluoromethane µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium mg/L	ND	0.0005	ND	ND	ND	ND	0.0008	ND	ND	ND
Lead mg/L	ND	ND	0.001	ND	ND	ND	ND	0.001	ND	ND
Zinc mg/L	ND	ND	ND	ND	$0.009^{(U)}$	ND	ND	ND	ND	ND
Copper mg/L	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND
Nickel mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium mg/L	ND	ND	ND	ND	0.058	ND	ND	ND	ND	0.055

MDL - Method Detection Limit
ND - Not detected at or above method detection limit.
(J) - Value estimated based on holding time exceedence.
(R) - Value unusable based on holding time exceedence.
(U) - Value qualified as non-detect based on method blank.

5.0 EVALUATION

The data gathered for the report on the existing monitoring well network at Site C indicate the following:

- A data quality assessment was conducted of the samples collected during the two sampling rounds. With minor exceptions, the data was found to be acceptable to assess analyte concentrations within groundwater and surface water at the Site (see footnotes to Table 4.1 and lab report validation, Appendix B).

- Groundwater flow direction under Site C flows predominantly west towards the Mississippi River.

- Groundwater chemical data gathered from this monitoring represents Site conditions in the immediate area under Site C.

- Chemical data from samples taken at the river indicate that Site C has had no impact on the river.

- Barium was the only analyte found above method detection limits in the river samples taken and was found at equal concentrations upstream and downstream of the Site.

- Results for June sampling for zinc and April sampling for copper were qualified as non-detect due to the presence of the analyte in the method blank.

- Chemical data from the two rounds of sampling on wells B1, B3 and B6 indicate that wells B1 and B3 had no VOCs present during either sampling event.

- Well B6 had methylene chloride detected at 1.4 µg/*l* during the April sampling. This value was qualified as non-detect due to the presence of this analyte in the method blank.

- Chloroform was detected at well B6 during the April sampling event at a concentration of 3.9 µg/*l* but was not detected during the June event. Well B6 was downgradient of the Site during the April sampling event. Well B6 was not downgradient during the June sampling event, however, well B3 was. No VOCs were present in well B3 in either sampling event.

- During the June sampling, two analytes, *cis*-1,2-dichloroethylene and trichloroethylene, were detected at well B6 at concentrations of 5.5 and 0.5 µg/*l*, respectively. However, neither compound was detected during the earlier April event when B6 was more downgradient of the Site.

- The metals concentrations at all sampling locations are either not detected or at levels well below any concentrations of concern.

- The groundwater results from both 1989 and 1990 are inconsistent from location to location and are not repeated in successive monitoring events at any one location. These inconsistent results indicate that any VOC release associated with the Site is insignificant. These results are similar in terms of their low levels to those found by Ford during 1982 monitoring at these wells.

- Review of all 1990 sampling data from both rounds indicates no analyte concentration at or near any applicable standards often used for comparison of water quality and purity (e.g. MCLs and RALs). All results for this supplemental 1990 monitoring were found well below RALs and MCLs.

- Based on site history and the prior results obtained, no further Site C monitoring is warranted.

All of Which is Respectfully Submitted,

CONESTOGA-ROVERS & ASSOCIATES

A Van Norman

Alan W. Van Norman, P. Eng.

Jon L. Christoff

Jon Christofferson

APPENDIX A

WELL INSTRUMENTATION LOGS

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

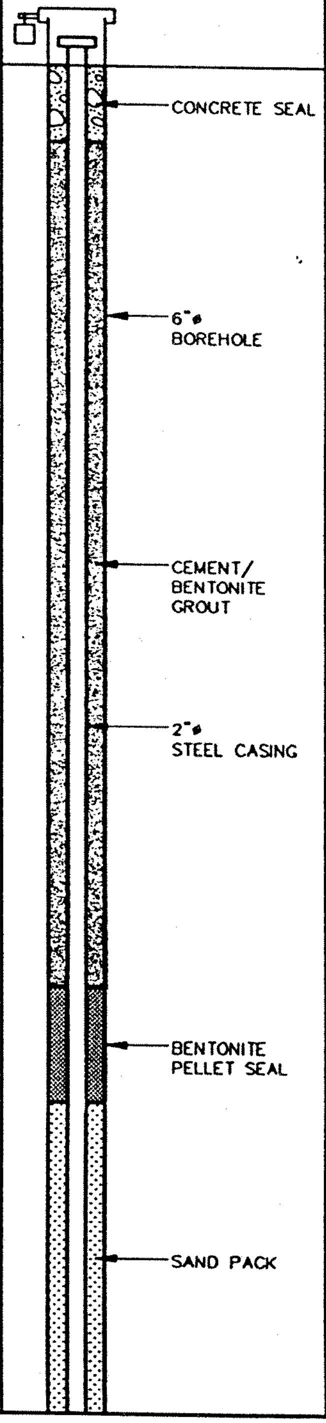
(L-06)

PROJECT NAME: FORD SITE C
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: MW-6 (Page 1 of 2)
DATE COMPLETED: APRIL 10, 1990
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL
	ML(SILT)FILL, 10-40% clay, green, dry	
2.5		
	ML(SILT)FILL, brick, red-brown, dry	
5.0		
7.5		
	GC(GRAVEL)FILL, coarse, dry	-8.0
10.0	CL(CLAY)FILL, 10-30% silt, 10-30% sand and coarse gravel, well graded No recovery	-10.0
12.5		
15.0		
17.5		
20.0		
22.5		
25.0		
	SW(SAND), 20-50% gravel, brown, dry, ALLUVIUM and GC(GRAVEL), 20-50% sand	-26.0
27.5		
30.0		
32.5		

MONITOR INSTALLATION



SAMPLE

NUMBER	STATE	'N' VALUE
1SS	☒	28
2SS	☒	25
3SS	☒	22
4SS	☒	40
5SS	/	100
6SS	☒	40
7SS	☒	17
8SS	☒	23
9SS	☒	41
10SS	☒	8
11SS	☒	19
12SS	☒	15
13SS	☒	18

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

APPENDIX B

ANALYTICAL REPORTS AND VALIDATION

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

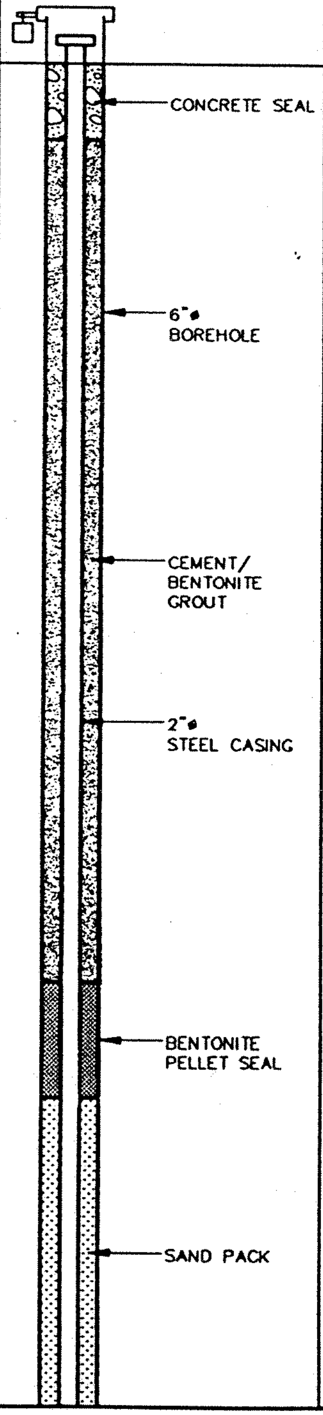
(L-06)

PROJECT NAME: FORD SITE C
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: MW-6 (Page 1 of 2)
DATE COMPLETED: APRIL 10, 1990
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL
	ML(SILT)FILL, 10–40% clay, green, dry	
2.5		
	ML(SILT)FILL, brick, red-brown, dry	
5.0		
7.5		
	GC(GRAVEL)FILL, coarse, dry	*-8.0*
10.0	CL(CLAY)FILL, 10–30% silt, 10–30% sand and coarse gravel, well graded No recovery	*-10.0*
12.5		
15.0		
17.5		
20.0		
22.5		
25.0		
	SW(SAND), 20–50% gravel, brown, dry, ALLUVIUM and GC(GRAVEL), 20–50% sand	*-26.0*
27.5		
30.0		
32.5		

MONITOR INSTALLATION



SAMPLE

NUMBER	STATE	'N' VALUE
1SS		28
2SS		25
3SS		22
4SS		40
5SS		100
6SS		40
7SS		17
8SS		23
9SS		41
10SS		8
11SS		19
12SS		15
13SS		18

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

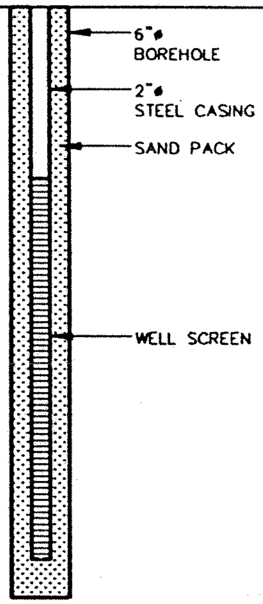
(L-06)

PROJECT NAME: FORD SITE C
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: MW-6 (Page 2 of 2)
DATE COMPLETED: APRIL 10, 1990
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
35.0			14SS	☒	14
37.5					
			15SS	☒	18
40.0					
42.5	No recovery		16SS	╱	25
45.0			AC	☒	
47.5					
	END OF HOLE @ 48.0 FT. BGS	-48.0			
50.0					
52.5					
55.0					
57.5					
60.0					
62.5					
65.0					

MONITOR INSTALLATION



SCREEN DETAILS:
Screened Interval:
37.0 to 47.0' BGS
Length -10.0'
Diameter -2.0"
Slot # 10
Material -Stainless Steel
Sand pack interval:
27.0 to 48.0' BGS
Material -Natural

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

pace
INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

MN. FILE COPY

May 14, 1990

MAY 17. 90

Mr. Jon Michaels
Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

RE: PACE Project No. 900419.524
2853 Ford Site C

Dear Mr. Michaels:

Enclosed is the report of laboratory analyses for samples received April 19, 1990.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Helen L Addie

Helen L.S. Addie
Project Manager

Enclosures

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

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pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

May 14, 1990
PACE Project
Number: 900419524

Attn: Mr. Jon Michaels

2853 Ford Site C			B-6	Miss. R. UpStr.	Rinsate Blank
PACE Sample Number:			146860	146870	146880
Date Collected:			04/19/90	04/19/90	04/19/90
Date Received:			04/19/90	04/19/90	04/19/90
Parameter	Units	MDL	W-011990-JM-01	W-011990-JM-02	W-011990-JM-03
SUBCONTRACT ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.0	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.0	ND	ND	ND
Vinyl chloride	ug/L	1.0	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	1.4	1.3	1.1
Trichlorofluoromethane	ug/L	1.0	ND	ND	ND
1,1-Dichloroethylene	ug/L	1.0	ND	ND	ND
1,1-Dichloroethane	ug/L	1.0	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	1.0	ND	ND	ND
Chloroform	ug/L	1.0	3.9	ND	ND
1,2-Dichloroethane	ug/L	1.0	ND	ND	ND
1,1,1-Trichloroethane	ug/L	1.0	ND	ND	ND
Carbon tetrachloride	ug/L	1.0	ND	ND	ND
Bromodichloromethane	ug/L	1.0	ND	ND	ND
1,2-Dichloropropane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	1.0	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	1.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
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May 14, 1990
PACE Project
Number: 900419524

2853 Ford Site C

			B-6	Miss. R. Up Str.	Rinsate Blank
PACE Sample Number:			146860	146870	146880
Date Collected:			04/19/90	04/19/90	04/19/90
Date Received:			04/19/90	04/19/90	04/19/90
Parameter	Units	MDL	W-011990-JM-01	W-011990-JM-02	W-011990-JM-03
SUBCONTRACT ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Benzene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
Xylenes	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	1.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	1.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	1.0	ND	ND	ND
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.20	ND	ND	ND
Cadmium	mg/L	0.010	ND	ND	ND
Chromium	mg/L	0.1	ND	ND	ND
Copper	mg/L	0.010	ND	ND	ND
Lead	mg/L	0.10	ND	ND	ND
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.05	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.04	ND	ND	ND
Zinc	mg/L	0.01	ND	ND	ND
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Ethyl acetate	ug/L	1	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

Mr. Jon Michaels
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2853 Ford Site C

May 14, 1990
PACE Project
Number: 900419524

			B-1	B-1 Dupl.	B-3
PACE Sample Number:			146890	146900	146910
Date Collected:			04/19/90	04/19/90	04/19/90
Date Received:			04/19/90	04/19/90	04/19/90
Parameter	Units	MDL	W-011990-JM-04	W-011990-JM-05	W-011990-JM-06
SUBCONTRACT ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.0	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.0	ND	ND	ND
Vinyl chloride	ug/L	1.0	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	ND
Trichlorofluoromethane	ug/L	1.0	ND	ND	ND
1,1-Dichloroethylene	ug/L	1.0	ND	ND	ND
1,1-Dichloroethane	ug/L	1.0	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	1.0	ND	ND	ND
Chloroform	ug/L	1.0	ND	ND	ND
1,2-Dichloroethane	ug/L	1.0	ND	ND	ND
1,1,1-Trichloroethane	ug/L	1.0	ND	ND	ND
Carbon tetrachloride	ug/L	1.0	ND	ND	ND
Bromodichloromethane	ug/L	1.0	ND	ND	ND
1,2-Dichloropropane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	1.0	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	1.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND
Benzene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

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REPORT OF LABORATORY ANALYSIS

Mr. Jon Michaels
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May 14, 1990
PACE Project Number: 900419524

2853 Ford Site C

			B-1	B-1 Dup'l.	B-3
PACE Sample Number:			146890	146900	146910
Date Collected:			04/19/90	04/19/90	04/19/90
Date Received:			04/19/90	04/19/90	04/19/90
Parameter	Units	MDL	W-011990-JM-04	W-011990-JM-05	W-011990-JM-06
SUBCONTRACT ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Ethyl benzene	ug/L	1.0	ND	ND	ND
Xylenes	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	1.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	1.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	1.0	ND	ND	ND
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.20	ND	ND	0.2
Cadmium	mg/L	0.010	ND	ND	ND
Chromium	mg/L	0.1	ND	ND	ND
Copper	mg/L	0.010	ND	ND	0.01
Lead	mg/L	0.10	ND	ND	ND
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.05	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.04	ND	ND	ND
Zinc	mg/L	0.01	ND	ND	ND
ORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Ethyl acetate	ug/L	1	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
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May 14, 1990
PACE Project
Number: 900419524

Miss.R.
DN.STR.

PACE Sample Number: 146920
Date Collected: 04/19/90
Date Received: 04/19/90

Parameter	Units	MDL	W-011990-JM-07
SUBCONTRACT ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
Chloromethane	ug/L	1.0	ND
Bromomethane	ug/L	1.0	ND
Dichlorodifluoromethane	ug/L	1.0	ND
Vinyl chloride	ug/L	1.0	ND
Chloroethane	ug/L	1.0	ND
Methylene chloride	ug/L	1.0	ND
Trichlorofluoromethane	ug/L	1.0	ND
1,1-Dichloroethylene	ug/L	1.0	ND
1,1-Dichloroethane	ug/L	1.0	ND
trans-1,2-Dichloroethylene	ug/L	1.0	ND
Chloroform	ug/L	1.0	ND
1,2-Dichloroethane	ug/L	1.0	ND
1,1,1-Trichloroethane	ug/L	1.0	ND
Carbon tetrachloride	ug/L	1.0	ND
Bromodichloromethane	ug/L	1.0	ND
1,2-Dichloropropane	ug/L	1.0	ND
trans-1,3-Dichloro-1-propene	ug/L	1.0	ND
1,1,2-Trichloroethylene	ug/L	1.0	ND
Dibromochloromethane	ug/L	1.0	ND
1,1,2-Trichloroethane	ug/L	1.0	ND
cis-1,3-Dichloro-1-propene	ug/L	1.0	ND
2-Chloroethylvinyl ether	ug/L	1.0	ND
Bromoform	ug/L	1.0	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND
Benzene	ug/L	1.0	ND
Toluene	ug/L	1.0	ND
Chlorobenzene	ug/L	1.0	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels
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May 14, 1990
PACE Project
Number: 900419524

2853 Ford Site C

Miss. R.
DN. STR.

PACE Sample Number: 146920
Date Collected: 04/19/90
Date Received: 04/19/90

Parameter	Units	MDL	W-011990-JM-07
SUBCONTRACT ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
Ethyl benzene	ug/L	1.0	ND
Xylenes	ug/L	1.0	ND
1,3-Dichlorobenzene	ug/L	1.0	ND
1,4-Dichlorobenzene	ug/L	1.0	ND
1,2-Dichlorobenzene	ug/L	1.0	ND
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Arsenic	mg/L	0.002	ND
Barium	mg/L	0.20	ND
Cadmium	mg/L	0.010	ND
Chromium	mg/L	0.1	ND
Copper	mg/L	0.010	ND
Lead	mg/L	0.10	ND
Mercury	mg/L	0.0002	ND
Nickel	mg/L	0.05	ND
Selenium	mg/L	0.005	ND
Silver	mg/L	0.04	ND
Zinc	mg/L	0.01	ND
ORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Ethyl acetate	ug/L	1	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Michaels

May 14, 1990
PACE Project
Number: 900419524

2853 Ford Site C

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger

Starla Enger
Inorganic Chemistry Manager

Lisa Shanahan for

Susan D. Max
Organic Chemistry Manager

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(LDA)

REPORT OF LABORATORY ANALYSIS

Project # 900419.524
CRA
(QC is attached) !

April 30, 1990

PACE INCORPORATED
1710 Douglas Drive North
Minneapolis, MN 55422

Re: Your samples received on 04/24/90

Enclosed are results of analysis performed upon your samples referenced above. If you have any questions or comments pertaining to this data package, please refer to Invoice #30487.

Yours truly,

Rodney T. Miller

Rodney T. Miller
Regional Director

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PACE LABS, INC.

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QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0498 Customer Sample ID : 14686

		RESULTS		Q.C. BLANK & SPIKED BLANK			Q.C. MATRIX SPIKE PO-GW-0500			
CAS #	COMPOUNDS	SAMP. CONC. UG/L	MRL UG/L	BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	3.9	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	1.42	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND			
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND			
	TOTAL XYLENES	ND	1.0	ND	----	----	ND			
	ETHYLACETATE	ND	1	ND	----	----	ND	----	----	----

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PACE LABS, INC.
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QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0499 Customer Sample ID : 14687

		RESULTS		Q.C. BLANK & SPIKED BLANK			Q.C. MATRIX SPIKE PO-GW-0500			
CAS #	COMPOUNDS	SAMP. CONC. UG/L	MRL UG/L	BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	ND	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	1.3	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND			
	TOTAL XYLENES	ND	1.0	ND	----	----	ND			
	ETHYLACETATE	ND	1	ND	----	----	ND	----	----	----

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PACE LABS, INC.

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QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0500 Customer Sample ID : 14688

		RESULTS		Q.C. BLANK & SPIKED BLANK			Q.C. MATRIX SPIKE			PO-GW-0500
CAS #	COMPOUNDS	SAMP. CONC. UG/L	MRL UG/L	BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	ND	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	1.1	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND			
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND			
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND			
	TOTAL XYLENES	ND	1.0	ND	----	----	ND	----	----	----
	ETHYLACETATE	ND		ND			ND			

N.D. = Not Detected
[RESULTS TAKEN FROM DILUTED SAMPLE]

MRL = Minimum Reporting Level

****
PACE LABS, INC.
****

QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0501 Customer Sample ID : 14689

		RESULTS		Q.C. BLANK & SPIKED BLANK			Q.C. MATRIX SPIKE P0-GW-0500			
CAS #	COMPOUNDS	SAMP. CONC. UG/L	MRL UG/L	BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	ND	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	ND	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
	TOTAL XYLENES	ND	1.0	ND	----	----	ND			
	ETHYLACETATE	ND	1	ND	----	----	ND	----		

N.D. = Not Detected

****
PACE LABS, INC.
****

QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0502   Customer Sample ID : 14690

PO-GW-05C0

		RESULTS		Q.C. BLANK & SPIKED BLANK			Q.C. MATRIX SPIKE			
CAS #	COMPOUNDS	SAMP. CONC. UG/L	MRL UG/L	BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	ND	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	ND	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND			
	TOTAL XYLENES	ND	1.0	ND	----	----	ND			
	ETHYLACETATE	ND	1	ND	----	----	ND			-

N.D. - Not Detected

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PACE LABS, INC.

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QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0503 Customer Sample ID : 14691

PO-GW-0500

		RESULTS		Q.C. BLANK & SPIKED BLANK			Q.C. MATRIX SPIKE			
CAS #	COMPOUNDS	SAMP. CONC. UG/L	MRL UG/L	BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	ND	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	ND	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND			
	TOTAL XYLENES	ND	1.0	ND	----	----	ND			
	ETHYLACETATE	ND	1	ND	----	----	ND	----	----	----

$$$$$$$$$$$$$$$$$$
PACE LABS, INC.
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QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

PACE INC,/#10
1710 DOULAS DRIVE NORTH
MINNEAPOLIS, MN 55422

Date Received: 04/24/90
Date Reported: 04/27/90

INV# 30487
VOLATILE COMPOUNDS BY GC
METHODS 601 AND 602 & ETHYLACETATE

PACE Sample ID: PO-GW 0504 Customer Sample ID : 14692

CAS #	COMPOUNDS	RESULTS SAMP. CONC. UG/L	MRL UG/L	Q.C. BLANK & SPIKED BLANK BLANK UG/L	CONC. ADDED UG/L	% RECOVERY	Q.C. MATRIX SPIKE P0-GW-0500 UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	ND	1.0	ND	----	----	ND	----	----	----
75274	BROMODICHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75252	BROMOFORM	ND	1.0	ND	----	----	ND	----	----	----
74839	BROMOMETHANE	ND	1.0	ND	----	----	ND	----	----	----
56235	CARBON TETRACHLORIDE	ND	1.0	ND	----	----	ND	----	----	----
108907	CHLOROBENZENE	ND	1.0	ND	50	91	ND	50	96	103
75003	CHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
110758	2-CHLOROETHYLVINYL ETHER	ND	1.0	ND	----	----	ND	----	----	----
67663	CHLOROFORM	ND	1.0	ND	----	----	ND	----	----	----
74873	CHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
124481	DIBROMOCHLOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
95501	1,2-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	90	91
541731	1,3-DICHLOROBENZENE	ND	1.0	ND	----	----	ND	----	----	----
106467	1,4-DICHLOROBENZENE	ND	1.0	ND	50	90	ND	50	93	91
75718	DICHLORODIFLUOROMETHANE	ND	1.0	ND	----	----	ND	----	----	----
75353	1,1-DICHLOROETHANE	ND	1.0	ND	50	96	ND	50	102	100
107062	1,2-DICHLOROETHANE	ND	1.0	ND	50	99	ND	50	91	103
75354	1,1-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
156605	TRANS-1,2-DICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
78875	1,2-DICHLOROPROPANE	ND	1.0	ND	----	----	ND	----	----	----
10061015	CIS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
10061026	TRANS-1,3-DICHLOROPROPENE	ND	1.0	ND	----	----	ND	----	----	----
100414	ETHYLBENZENE	ND	1.0	ND	----	----	ND	----	----	----
75092	METHYLENE CHLORIDE	ND	1.0	1.42	----	----	ND	----	----	----
79345	1,1,2,2-TETRACHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
127184	TETRACHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
108883	TOLUENE	ND	1.0	ND	50	96	ND	50	101	90
71556	1,1,1-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79005	1,1,2-TRICHLOROETHANE	ND	1.0	ND	----	----	ND	----	----	----
79016	TRICHLOROETHENE	ND	1.0	ND	----	----	ND	----	----	----
75694	TRICHLOROFLUOROMETHANE	ND	1.0	ND	----	----	ND			
75014	VINYL CHLORIDE	ND	1.0	ND	----	----	ND			
	TOTAL XYLENES	ND	1.0	ND	----	----	ND			
	ETHYLACETATE	ND	1	ND	----	----	ND	----	----	----

N.D. = Not Detected

pace® laboratories, inc.
PROFESSIONAL ANALYTICAL CHEMISTRY & ENGINEERING

Offices:
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Tampa, Florida
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Robinson Lane, RD 6 ☐ Wappingers Falls, NY 12590 ☐ Phone (914) 227-2811 ☐ FAX (914) 227-6134

RAW DATA for
VOA 601 & 602
+ ETHYLACETATE

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                    NANCO LABORATORIES, INC.

                               Printed: 25-APR-1990   9:28:04

SAMPLE:  STD 4/25                                                      Type:  UNKN
                #6 in Method: CAPILLARY                          Instrument:  Instrument 1
                   Acquired: 25-APR-1990   7:11                    Filename: V92151
                       Rate: 3.0 points/sec                           Index: Disk
                   Duration: 48.002 minutes
                   ul. Inj.: LRT

  COLUMN:  PID

PK#  Retention Time   Peak  Area   Peak Height   Amount Percent   Original Conc    Solution Conc    Component Name
     (minutes)                                                    (PPB         )   (PPB         )
---  --------------   ----------   -----------   --------------   --------------   --------------   ---------------
 1       15.201         94673        11549
 2       22.538        177672        20519            9.58            46.51            46.51        BENZENE
 3       23.491        105923        13620            9.78            47.46            47.46        F2 BENZENE
 4       24.638         91322        12247
 5       27.930         48264         7370
 6       29.088        174248        24550           11.35            55.10            55.10        TOLUENE
 7       29.653         34796         5862
 8       31.360         72404        10260
 9       34.253        144576        26173            9.05            43.92            43.92        CL BENZENE
10       34.441        122377        21098            9.31            45.19            45.19        ETHYLBENZENE
11       34.719        392149        59241           10.30            50.02            50.02        XYLENE
12       36.281        249238        37697            9.97            48.40            48.40        XYLENE
13       42.560        243529        41113           11.15            54.14            54.14        1,3 CL2BENZENE
14       42.959        227902        41032            9.88            47.98            47.98        1,4 CL2BENZENE
15       44.344        195954        33098            9.63            46.76            46.76        1,2 CL2BENZENE
                      ----------   -----------                    --------------   --------------
TOTAL                 2375028       365430                           485.48           485.48


  COLUMN:  HALL

PK#  Retention Time   Peak  Area   Peak Height   Amount Percent   Original Conc    Solution Conc    Component Name
     (minutes)                                                    (PPB         )   (PPB         )
---  --------------   ----------   -----------   --------------   --------------   --------------   ---------------
 1        5.791        234231        12355            3.28            62.63            62.63        CL2 F2 METHANE
 2        6.927        472621        31419            3.04            58.00            58.00        VINYL CHLORIDE
 3        8.434         34241         2801          Invalid          Invalid          Invalid       BR METHANE
 4        8.734        602152        33592            3.79            72.28            72.28        CL ETHANE
 5        9.742       1012149        49611            3.84            73.32            73.32        CL3 F METHANE
 6       12.219       1222294        71740            3.49            66.63            66.63        1,1 CL2 ETHENE
 7       14.115       1731330       123848            3.49            66.52            66.52        METHYLENE CHLOR
 8       15.278       1404721       122151            3.52            67.12            67.12        TR 1,2CL2ETHENE
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  9      16.869    1431471     110804       3.40        64.88        64.88     1,1 CL2 ETHANE
 10      19.651    1660493     134648       3.42        65.16        65.16     CHLOROFORM
 11      20.233     950781      93299       4.58!!      87.38!!      87.38!!   BR CL METHANE
 12      21.086    1617062     117061       3.60        68.63        68.63     1,1,1CL3 ETHANE
 13      22.012    1541961     128174       3.82        72.86        72.86     CCL4
 14      22.505    1517086     166535       3.40        64.78        64.78     1.2CL2 ETHANE
 15      23.563     225349      13291       2.74        52.18        52.18     2 CLETVET
 16      24.705    1718601     184249       3.57        68.00        68.00     CL3 ETHENE
 17      25.292    1454922     143777       3.47        66.13        66.13     1,2 CL2PROPANE
 18      26.123    1462636     146673       3.77        71.99        71.99     BRCL2 METHANE
 19      27.997    1708111     194039       3.59        68.53        68.53     CIS1,3CL2PROPEN
 20      29.726     749994      92341       3.98        75.88        75.88     TR1,3CL2PROPENE
 21      30.274    1709749     198339       4.10        78.15        78.15     1,1,2CL3ETHANE
 22      31.421    1774572     201906       3.70        70.56        70.56     CL4 ETHENE
 23      32.125     912691     102052       3.49        66.61        66.61     BR2 CL METHANE
 24      34.320     674124      76101       3.47        66.10        66.10     CL BENZENE
 25      37.706     555357      64256       3.71        70.73        70.73     BROMOFORM
 26      38.215    1442873     173763       3.32        63.28        63.28     1,1,1,2CL4ETHAN
 27      42.627     987106     135283       3.40        64.81        64.81     1,3 CL2BENZENE
 28      43.020    1151407     153128       3.56        67.98        67.98     1,4 CL2BENZENE
 29      44.405    1133578     139220       3.47        66.12        66.12     1,2 CL2BENZENE
                  ----------  -----------          --------------  --------------
TOTAL              33093663    3216456                1907.26!!      1907.26!!

!! Result calculation based on peak response more than 10% outside of calibration range.
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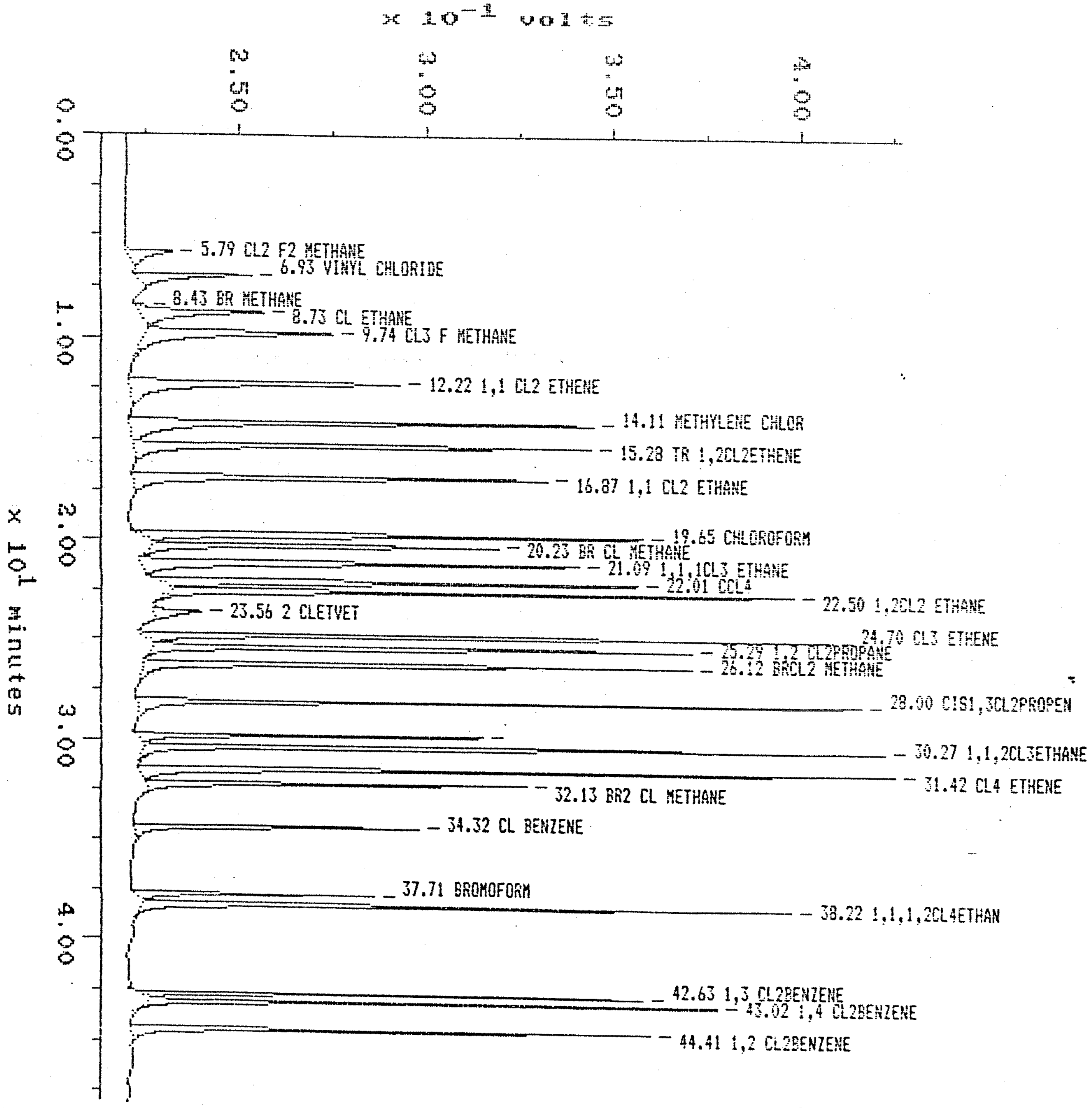
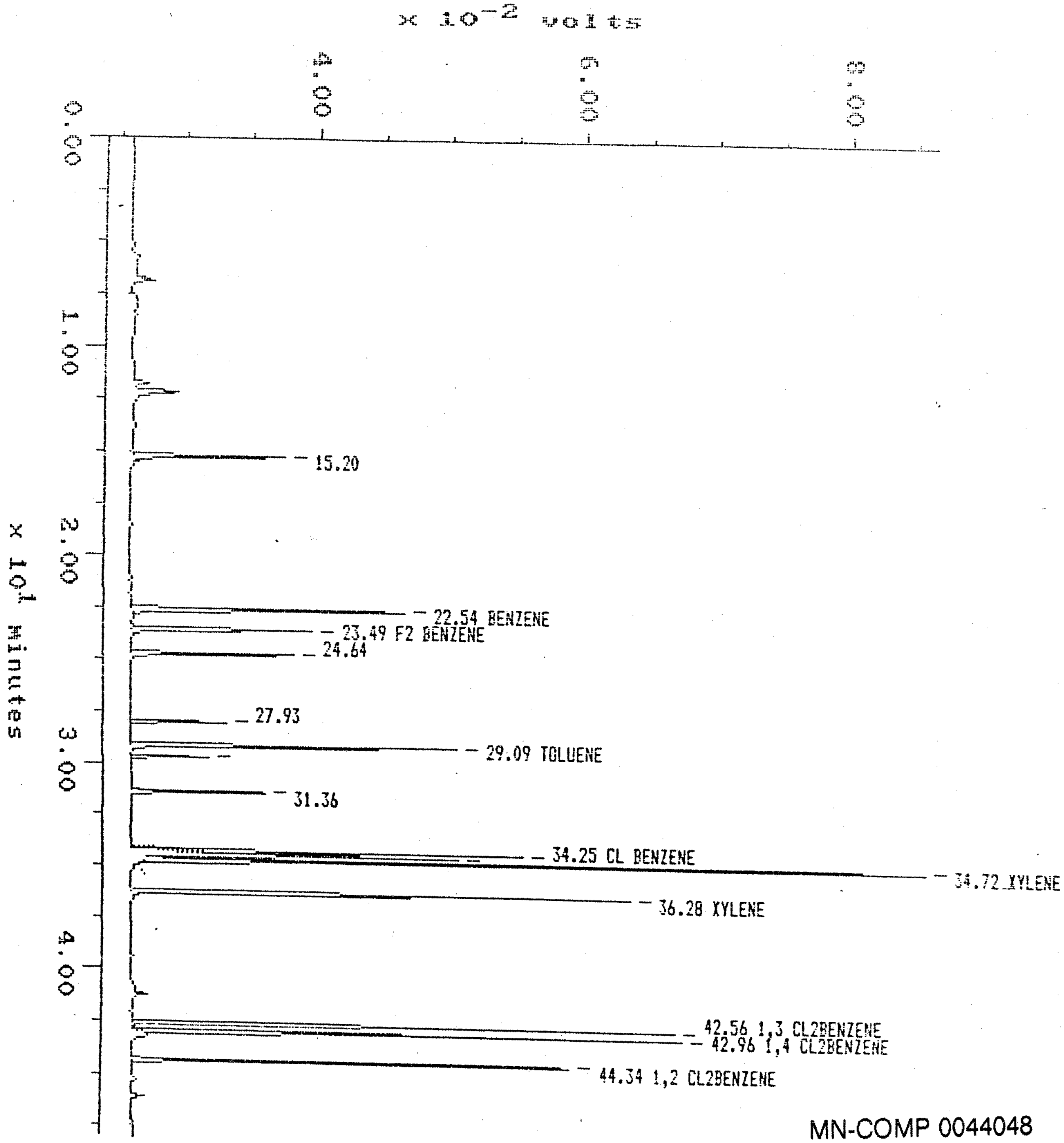
Sample: STD 4/25
Acquired: 25-APR-90 7:11

Channel: HALL
Method: C:\BASE\601-602A\CAPA

Filename: V82151
Operator: LRT



Sample: STD 4/25 Channel: PID Filename: V82151
Acquired: 25-APR-90 7:11 Method: C:\BASE\601-602A\CAPA Operator: LRT



NANCO LABORATORIES, INC.

Printed: 25-APR-1990 13:32:14

SAMPLE: BLANK 4/25

#7 in Method: CAPILLARY
Acquired: 25-APR-1990 8:53
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82252
Index: Disk

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	23.535	94310	12191	100.00	42.26	42.26	F2 BENZENE
TOTAL		94310	12191		42.26	42.26	

COLUMN: HALL

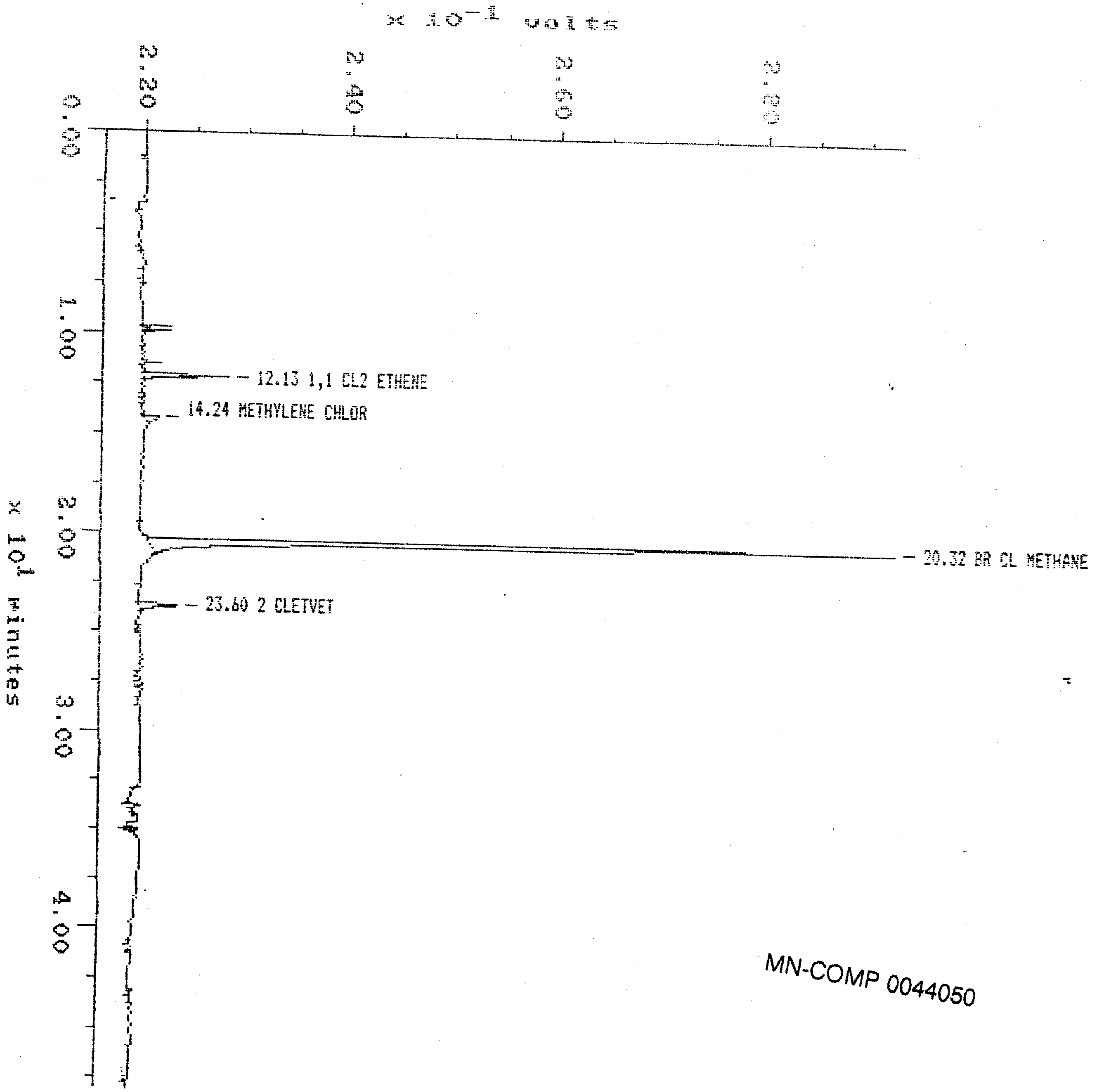
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	12.131	77883	8241	9.77	8.25	8.25	1,1 CL2 ETHENE
2	14.237	17397	1400	1.68	1.42	1.42	METHYLENE CHLOR
3	20.321	777918	71880	77.85!!	65.74!!	65.74!!	BR CL METHANE
4	23.602	39012	3651	10.70	9.03	9.03	2 CLETVET
TOTAL		912210	85171		84.45!!	84.45!!	

!! Result calculation based on peak response more than 10% outside of calibration range.

Sample: BLANK 4/25
Acquired: 25-APR-90 8:53

Channel: HALL
Method: C:\BASE\601-602A\CAPA

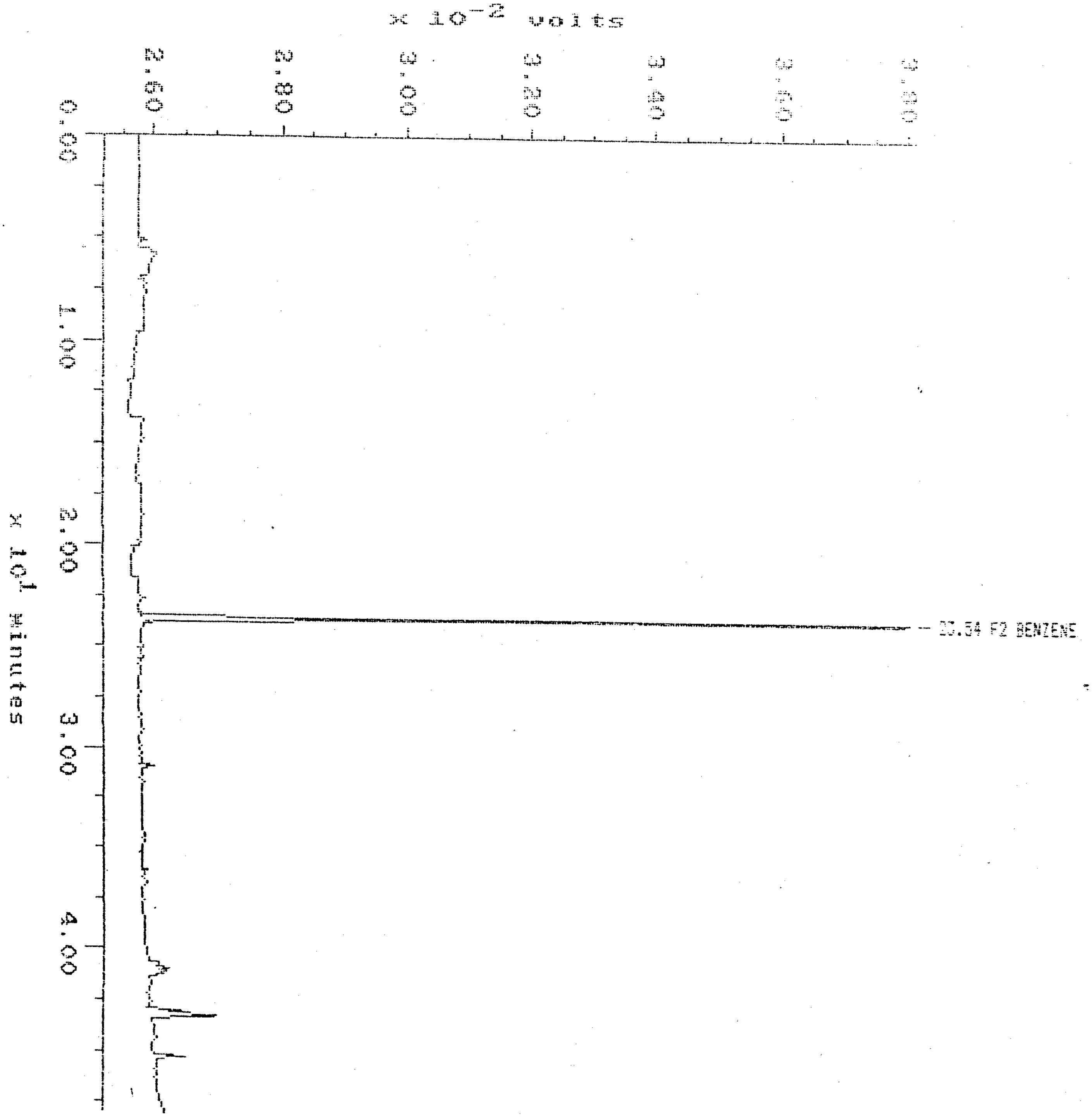
Filename: V82252
Operator: LRT



Sample: BLANK 4/25
Acquired: 25-APR-90 8:53

Channel: PID
Method: C:\BASE\601-602A\CAPA

Filename: V32252
Operator: LRT



NANCO LABORATORIES, INC.

Printed: 26-APR-1990 13:24:39

SAMPLE: STD 4/26

#7 in Method: CAPILLARY
Acquired: 26-APR-1990 11:50
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82168
Index: Disk

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	15.262	90726	11052				
2	22.649	156793	18199	8.94	40.56	40.56	BENZENE
3	23.591	87784	11295	8.67	39.34	39.34	F2 BENZENE
4	24.738	80511	10750				
5	28.019	41878	6401				
6	29.171	150976	21475	10.52	47.74	47.74	TOLUENE
7	29.737	31336	5267				
8	31.443	64622	9126				
9	34.353	127045	22999	8.32	37.75	37.75	CL BENZENE
10	34.541	108392	18622	8.62	39.11	39.11	ETHYLBENZENE
11	34.818	349421	51989	9.82	44.57	44.57	XYLENE
12	36.392	327879	49420	14.03	63.67	63.67	XYLENE
13	42.687	231531	39189	11.37	51.57	51.57	1,3 CL2BENZENE
14	43.086	216518	39234	10.05	45.58	45.58	1,4 CL2BENZENE
15	44.461	183871	31532	9.65	43.79	43.79	1,2 CL2BENZENE
TOTAL		2249282	346551		453.69	453.69	

COLUMN: HALL

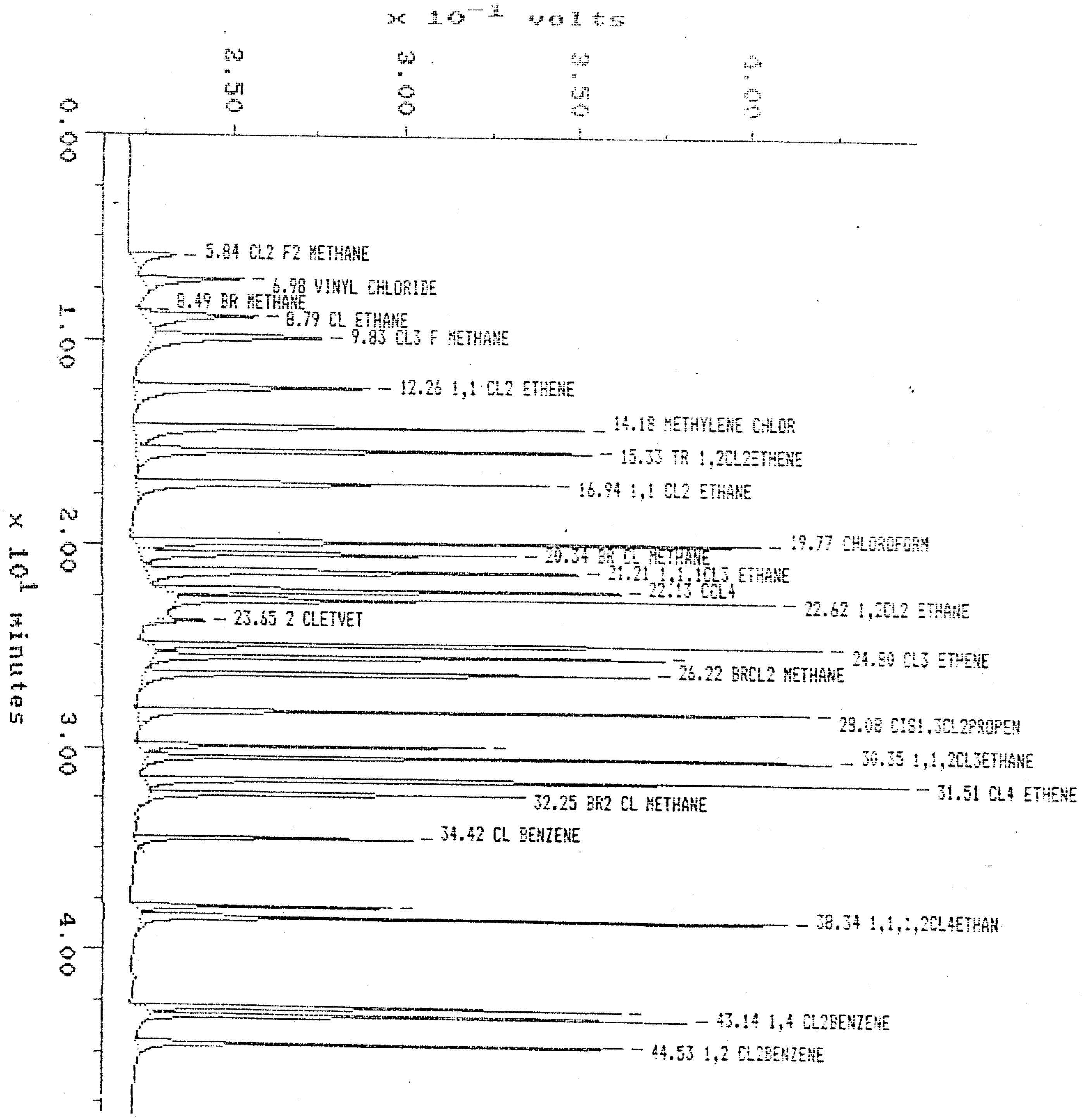
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	5.835	239034	12842	3.21	63.91	63.91	CL2 F2 METHANE
2	6.977	476215	30111	3.07	61.04	61.04	VINYL CHLORIDE
3	8.490	29863	2489	Invalid	Invalid	Invalid	BR METHANE
4	8.795	588397	32808	3.67	72.98	72.98	CL ETHANE
5	9.825	1053666	50019	4.25	84.55	84.55	CL3 F METHANE
6	12.264	1195888	68690	3.42	68.00	68.00	1,1 CL2 ETHENE
7	14.176	1787736	130299	3.45	68.66	68.66	METHYLENE CHLOR
8	15.334	1512366	131410	3.86	76.80	76.80	TR 1,2CL2ETHENE

```
  9      16.935     1526332      119200       3.57       70.90       70.90     1,1 CL2 ETHANE
 10      19.767     1942270      181050       3.87       76.93       76.93     CHLOROFORM
 11      20.343     1140138      108888       4.85!!     96.35!!     96.35!!   BR CL METHANE
 12      21.208     1757312      125127       3.75       74.58       74.58     1,1,1CL3 ETHANE
 13      22.128     1614990      132722       3.84       76.31       76.31     CCL4
 14      22.616     1568910      173640       3.37       66.99       66.99     1.2CL2 ETHANE
 15      23.646      131351       13052       1.53       30.42       30.42     2 CLETVET
 16      24.805     1768880      195819       3.52       69.99       69.99     CL3 ETHENE
 17      25.392     1459817      147573       3.34       66.35       66.35     1,2 CL2PROPANE
 18      26.218     1477485      146520       3.66       72.72       72.72     BRCL2 METHANE
 19      28.080     1733059      195090       3.50       69.53       69.53     CIS1,3CL2PROPEN
 20      29.803      796047       99912       4.00       79.51       79.51     TR1,3CL2PROPENE
 21      30.352     1747610      199053       4.00       79.60       79.60     1.1,2CL3ETHANE
 22      31.510     1936655      221801       3.87       77.01       77.01     CL4 ETHENE
 23      32.247      978626       83547       3.59       71.43       71.43     BR2 CL METHANE
 24      34.419      694199       80439       3.42       68.00       68.00     CL BENZENE
 25      37.833      630380       75096       3.91       77.68       77.68     BROMOFORM
 26      38.337     1559027      187534       3.34       66.48       66.48     1,1,1,2CL4ETHAN
 27      42.754     1030563      140007       3.40       67.66       67.66     1,3 CL2BENZENE
 28      43.142     1144663      156250       3.40       67.59       67.59     1,4 CL2BENZENE
 29      44.527     1134601      141320       3.33       66.18       66.18     1,2 CL2BENZENE
                   ----------  -----------           ------------  ------------
TOTAL              34656079      3382308                1988.14!!     1988.14!!


!! Result calculation based on peak response more than 10% outside of calibration range.
```

Sample: STD 4/26
Acquired: 26-APR-90 11:50

Channel: HALL
Method: C:\BASE\601-602A\CAPA

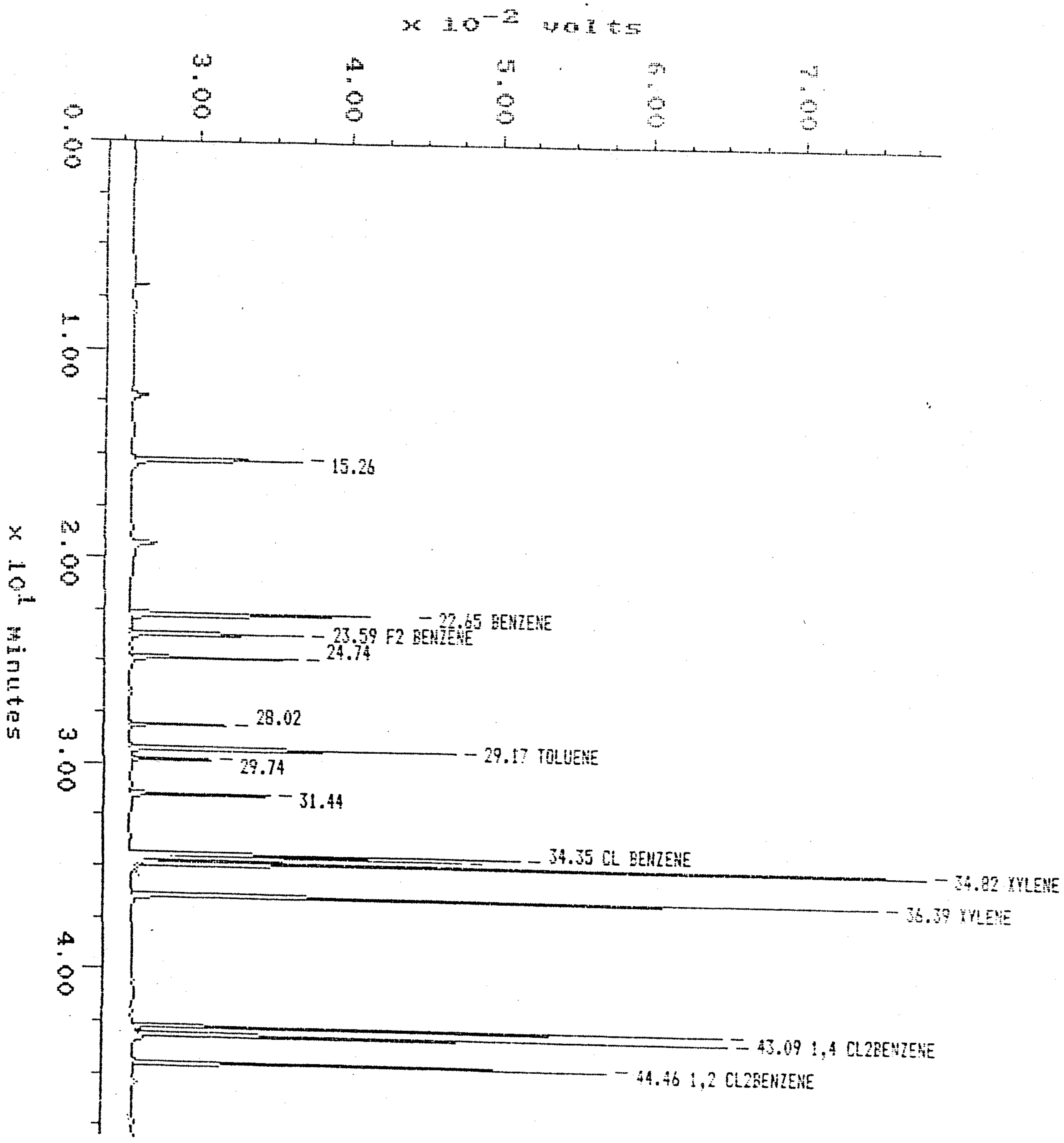
Filename: V82168
Operator: LRT



Sample: STD 4/26
Acquired: 26-APR-90 11:50

Channel: PID
Method: C:\BASE\601-602A\CAPA

Filename: V82168
Operator: LBT



NANCO LABORATORIES, INC.

Printed: 27-APR-1990 7:15:30

SAMPLE: GW 0500 MS 4/26
#8 in Method: CAPILLARY
Acquired: 26-APR-1990 14:16
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82170
Index: Disk

COLUMN: PID

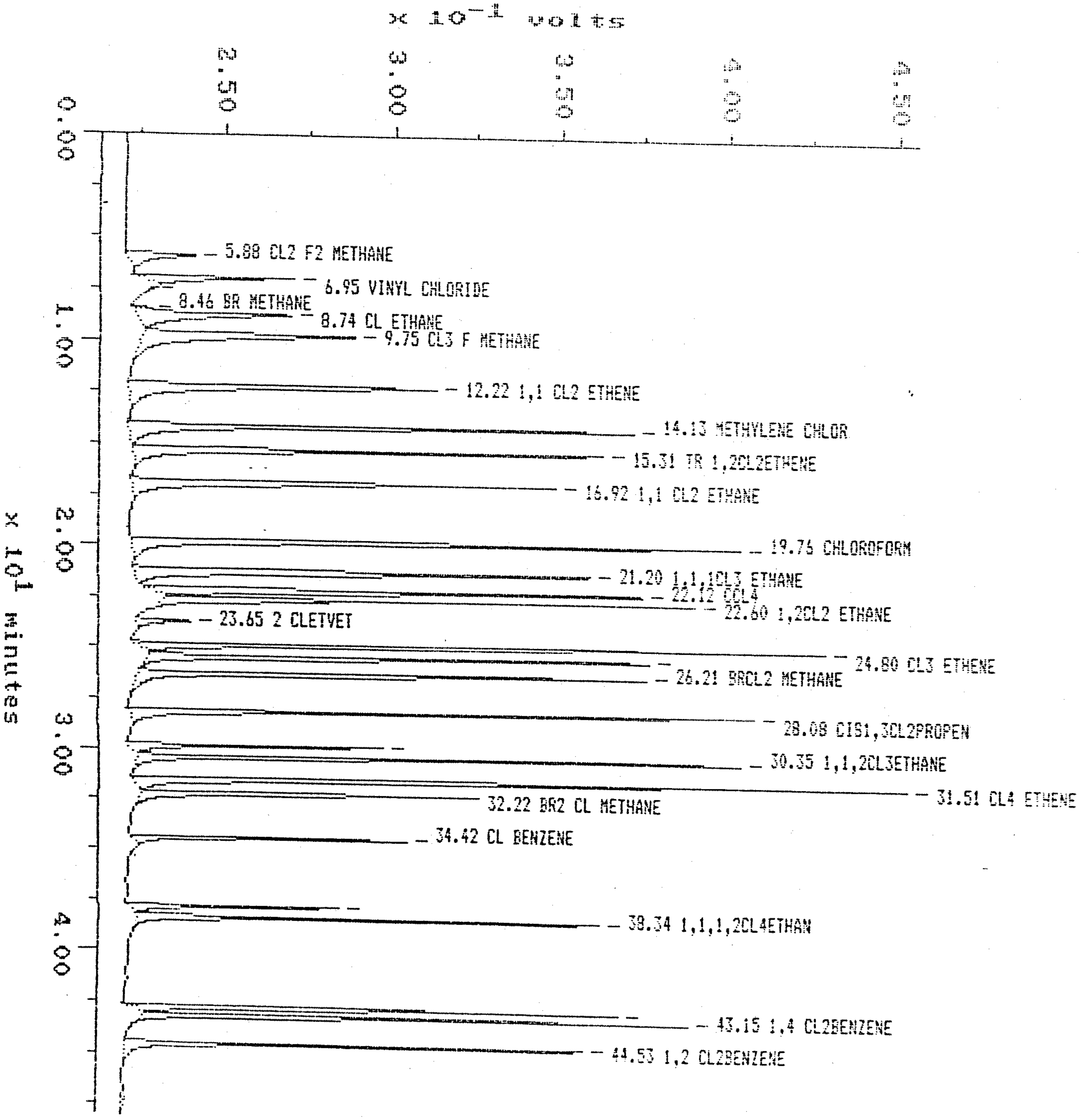
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	15.240	128381	15073				
2	22.638	161318	18682	10.81	41.85	41.85	BENZENE
3	24.727	83349	11166				
4	28.013	36103	5509				
5	29.171	152296	21524	12.44	48.16	48.16	TOLUENE
6	31.449	64435	9138				
7	34.353	116159	21620	8.76	33.92	33.92	CL BENZENE
8	34.536	106935	18463	9.94	38.48	38.48	ETHYLBENZENE
9	34.813	342596	51438	11.29	43.70	43.70	XYLENE
10	36.392	259568	38861	13.02	50.41	50.41	XYLENE
11	42.693	217867	37055	12.56	48.64	48.64	1,3 CL2BENZENE
12	43.086	202233	36626	11.00	42.58	42.58	1,4 CL2BENZENE
13	44.472	166282	28482	10.20	39.48	39.48	1,2 CL2BENZENE
TOTAL		2037522	313636		387.20	387.20	

COLUMN: HALL

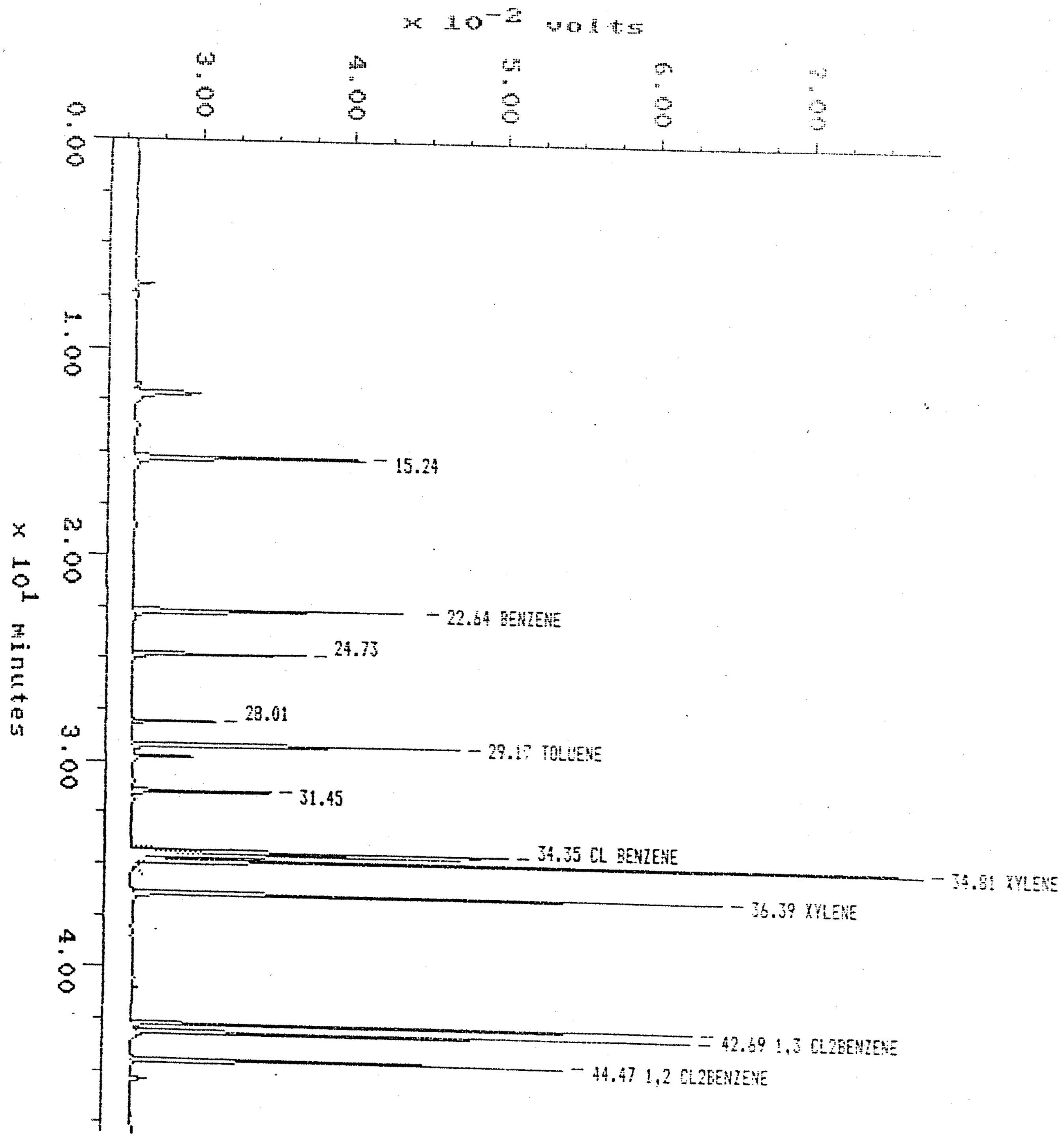
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	5.880	376948	20429	5.16	100.79	100.79	CL2 F2 METHANE
2	6.949	515851	45172	3.24	63.31	63.31	VINYL CHLORIDE
3	7.503	3066	294				
4	8.457	52880	4753	Invalid	Invalid	Invalid	BR METHANE
5	8.739	829983	45936	5.10	99.63	99.63	CL ETHANE
6	9.748	1303464	62803	4.82	94.20	94.20	CL3 F METHANE
7	12.219	1466361	91670	4.05	79.08	79.08	1,1 CL2 ETHENE
8	14.126	1868778	150602	3.67	71.74	71.74	METHYLENE CHLOR
9	15.306	1574937	140086	3.83	74.90	74.90	TR 1,2CL2ETHENE
10	16.919	1610987	126081	3.71	72.49	72.49	1,1 CL2 ETHANE

```
 11     19.756    2060577    182108      4.09      79.93      79.93    CHLOROFORM
 12     21.202    1913974    135579      4.16      81.23      81.23    1,1,1CL3 ETHANE
 13     22.122    1724459    146246      4.17      81.48      81.48    CCL4
 14     22.599    1423165    159233      3.11      60.77      60.77    1,2CL2 ETHANE
 15     23.646     173482     15651      2.06      40.17      40.17    2 CLETVET
 16     24.799    1878207    205232      3.80      74.32      74.32    CL3 ETHENE
 17     25.381    1477301    149744      3.43      67.15      67.15    1,2 CL2PROPANE
 18     26.212    1493133    151907      3.76      73.49      73.49    BRCL2 METHANE
 19     28.080    1612730    186385      3.31      64.71      64.71    CIS1,3CL2PROPEN
 20     29.803     625184     74844      3.38      66.06      66.06    TR1,3CL2PROPENE
 21     30.352    1547177    180464      3.68      71.90      71.90    1,1,2CL3ETHANE
 22     31.510    2039711    230439      4.15      81.10      81.10    CL4 ETHENE
 23     32.225     910979     94593      3.40      66.49      66.49    BR2 CL METHANE
 24     34.419     665200     81790      3.34      65.25      65.25    CL BENZENE
 25     37.827     526610     62015      3.48      69.06      68.06    BROMOFORM
 26     38.337    1145556    138559      2.60      50.92      50.92    1,1,1,2CL4ETHAN
 27     42.760    1046532    145844      3.51      68.71      68.71    1,3 CL2BENZENE
 28     43.147    1186115    163671      3.58      70.03      70.03    1,4 CL2BENZENE
 29     44.533    1147803    137423      3.42      66.94      66.94    1,2 CL2BENZENE
                 ----------  -----------          ---------- ----------
TOTAL             34201151    3329552              1954.83    1954.83
```

Sample: GW 0500 MS 4/26 **Channel:** HALL **Filename:** V82170
Acquired: 26-APR-90 14:16 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



Sample: GW 0500 MS 4/26 **Channel:** PID **Filename:** V82170
Acquired: 26-APR-90 14:16 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



NANCO LABORATORIES, INC.

Printed: 27-APR-1990 7:17:07

SAMPLE: GW 0500 MSD
#9 in Method: CAPILLARY
Acquired: 26-APR-1990 15:47
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82171
Index: Disk

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	15.245	81970	9867				
2	22.627	139550	16219	9.96	35.64	35.64	BENZENE
3	24.716	70540	9466				
4	28.013	38328	5829				
5	29.171	136202	19352	12.03	43.07	43.07	TOLUENE
6	31.443	55383	7806				
7	34.347	107344	20034	8.61	30.82	30.82	CL BENZENE
8	34.530	94853	16347	9.28	33.23	33.23	ETHYLBENZENE
9	34.813	308835	46575	11.00	39.39	39.39	XYLENE
10	36.392	247562	37545	13.43	48.08	48.08	XYLENE
11	42.693	206269	35467	12.89	46.15	46.15	1,3 CL2BENZENE
12	43.086	197854	35970	11.64	41.65	41.65	1,4 CL2BENZENE
13	44.466	168020	28489	11.15	39.90	39.90	1,2 CL2BENZENE
TOTAL		1852710	288967		357.95	357.95	

COLUMN: HALL

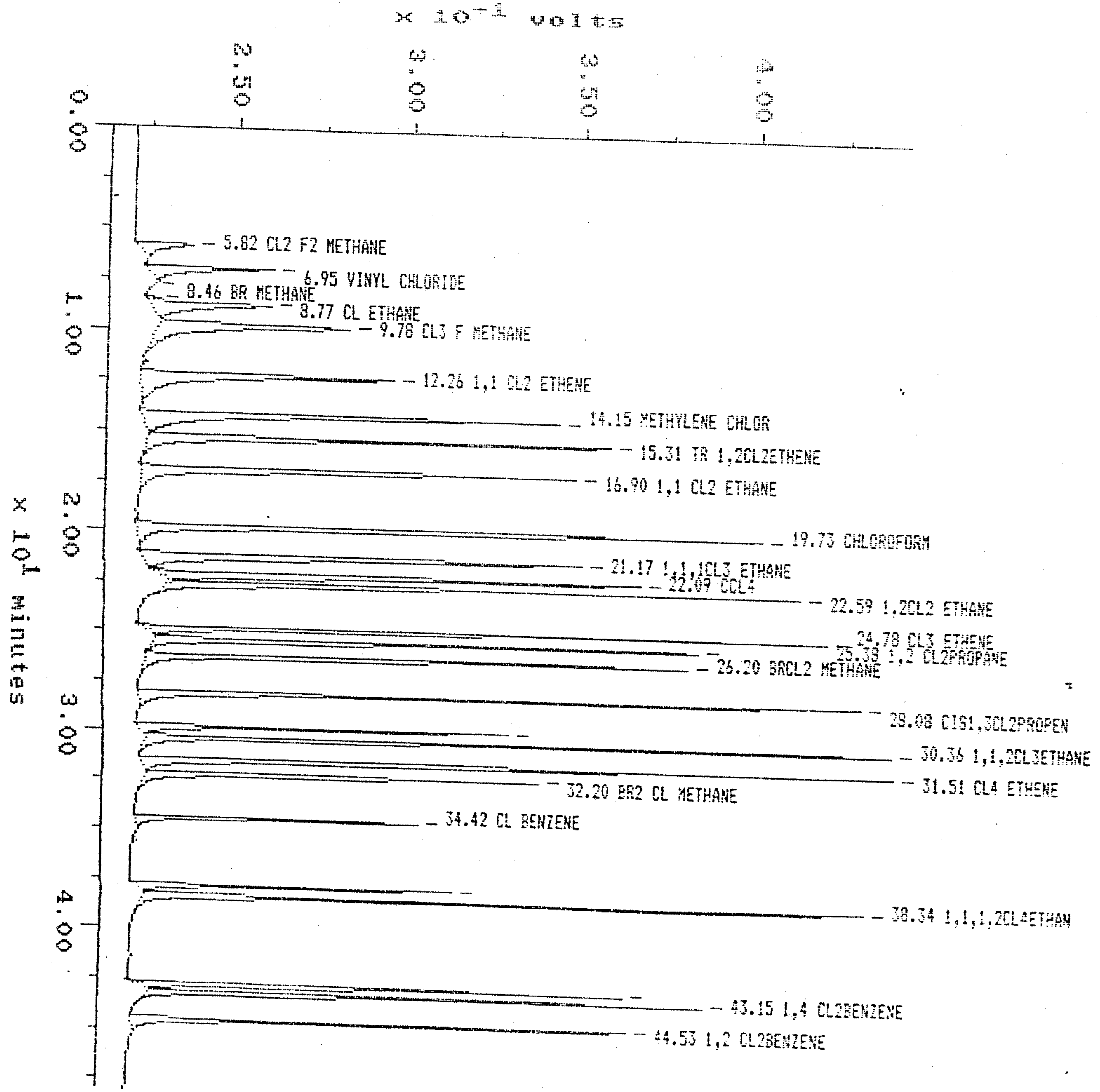
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	5.819	271597	16203	3.78	72.62	72.62	CL2 F2 METHANE
2	6.955	535442	36726	3.42	65.71	65.71	VINYL CHLORIDE
3	7.819	4091	253				
4	8.462	45649	3892	Invalid	Invalid	Invalid	BR METHANE
5	8.772	632701	34624	3.95	75.95	75.95	CL ETHANE
6	9.781	1163953	55021	4.38	84.20	84.20	CL3 F METHANE
7	12.258	1342103	72622	3.79	72.74	72.74	1,1 CL2 ETHENE
8	14.153	1759619	120587	3.52	67.59	67.59	METHYLENE CHLOR
9	15.306	1489391	133168	3.70	70.99	70.99	TR 1,2CL2ETHENE
10	16.902	1578865	125457	3.70	71.13	71.13	1,1 CL2 ETHANE

11	19.728	1990570	179654	4.03	77.35	77.35	CHLOROFORM
12	21.169	1769760	126826	3.91	75.11	75.11	1,1,1CL3 ETHANE
13	22.089	1663998	138649	4.09	78.62	78.62	CCL4
14	22.588	1622664	182086	3.61	69.29	69.29	1,2CL2 ETHANE
15	24.782	1735246	197046	3.57	68.66	68.66	CL3 ETHENE
16	25.375	1537592	157228	3.64	69.89	69.89	1,2 CL2PROPANE
17	26.201	1538362	157068	3.94	75.71	75.71	BRCL2 METHANE
18	28.080	1817605	207931	3.80	72.93	72.93	CIS1,3CL2PROPEN
19	29.803	845924	106421	4.34	83.44	83.44	TR1,3CL2PROPENE
20	30.357	1854470	214443	4.36	83.71	83.71	1,1,2CL3ETHANE
21	31.510	1872678	216256	3.88	74.46	74.46	CL4 ETHENE
22	32.203	1063357	114025	4.04	77.61	77.61	BR2 CL METHANE
23	34.419	717225	81816	3.65	70.19	70.19	CL BENZENE
24	37.822	739336	91368	4.57	87.79	87.79	BROMOFORM
25	38.337	1696585	207912	3.84	73.82	73.82	1,1,1,2CL4ETHAN
26	42.748	1017328	140885	3.48	66.79	66.79	1,3 CL2BENZENE
27	43.147	1150867	160434	3.54	67.95	67.95	1,4 CL2BENZENE
28	44.533	1145392	143356	3.48	66.80	66.80	1,2 CL2BENZENE
		----------	-----------		--------------	--------------	
TOTAL		34602369	3421957		1921.06	1921.06	

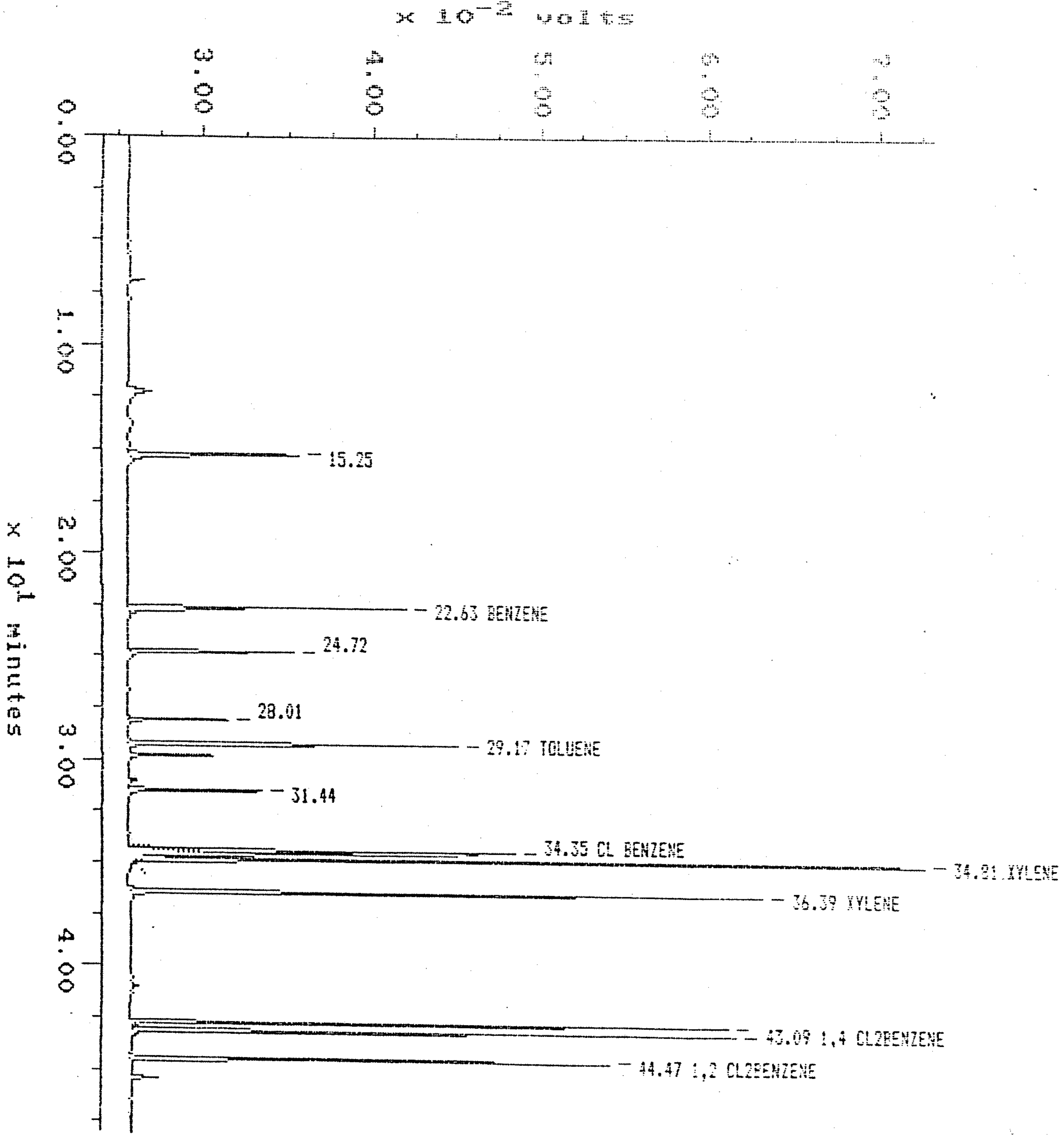
Sample: GW 0500 MSD
Acquired: 26-APR-90 15:47

Channel: HALL
Method: C:\BASE\601-602A\CAPA

Filename: V82171
Operator: LRT



Sample: GW 0500 MSD **Channel:** PID **Filename:** V82171
Acquired: 26-APR-90 15:47 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



NANCO LABORATORIES, INC.

Printed: 27-APR-1990 11:49:48

SAMPLE: BLANK MS

#7 in Method: CAPILLARY
Acquired: 27-APR-1990 7:20
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82178
Index: Disk

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	15.317	76491	9497				
2	22.677	147286	16980	9.58	37.85	37.85	BENZENE
3	23.613	87869	11292	9.96	39.37	39.37	F2 BENZENE
4	24.755	76208	10360				
5	28.035	40830	6235				
6	29.188	145527	20357	11.64	46.02	46.02	TOLUENE
7	29.753	29990	5090				
8	31.466	59873	8433				
9	34.353	110394	20543	8.07	31.89	31.89	CL BENZENE
10	34.536	97448	16874	8.69	34.36	34.36	ETHYLBENZENE
11	34.807	314751	47475	10.16	40.15	40.15	XYLENE
12	36.381	201326	30146	9.89	39.10	39.10	XYLENE
13	42.671	205713	35351	11.65	46.03	46.03	1,3 CL2BENZENE
14	43.070	195198	34643	10.40	41.10	41.10	1,4 CL2BENZENE
15	44.455	165797	28251	9.96	39.36	39.36	1,2 CL2BENZENE
TOTAL		1954703	301526		395.22	395.22	

COLUMN: HALL

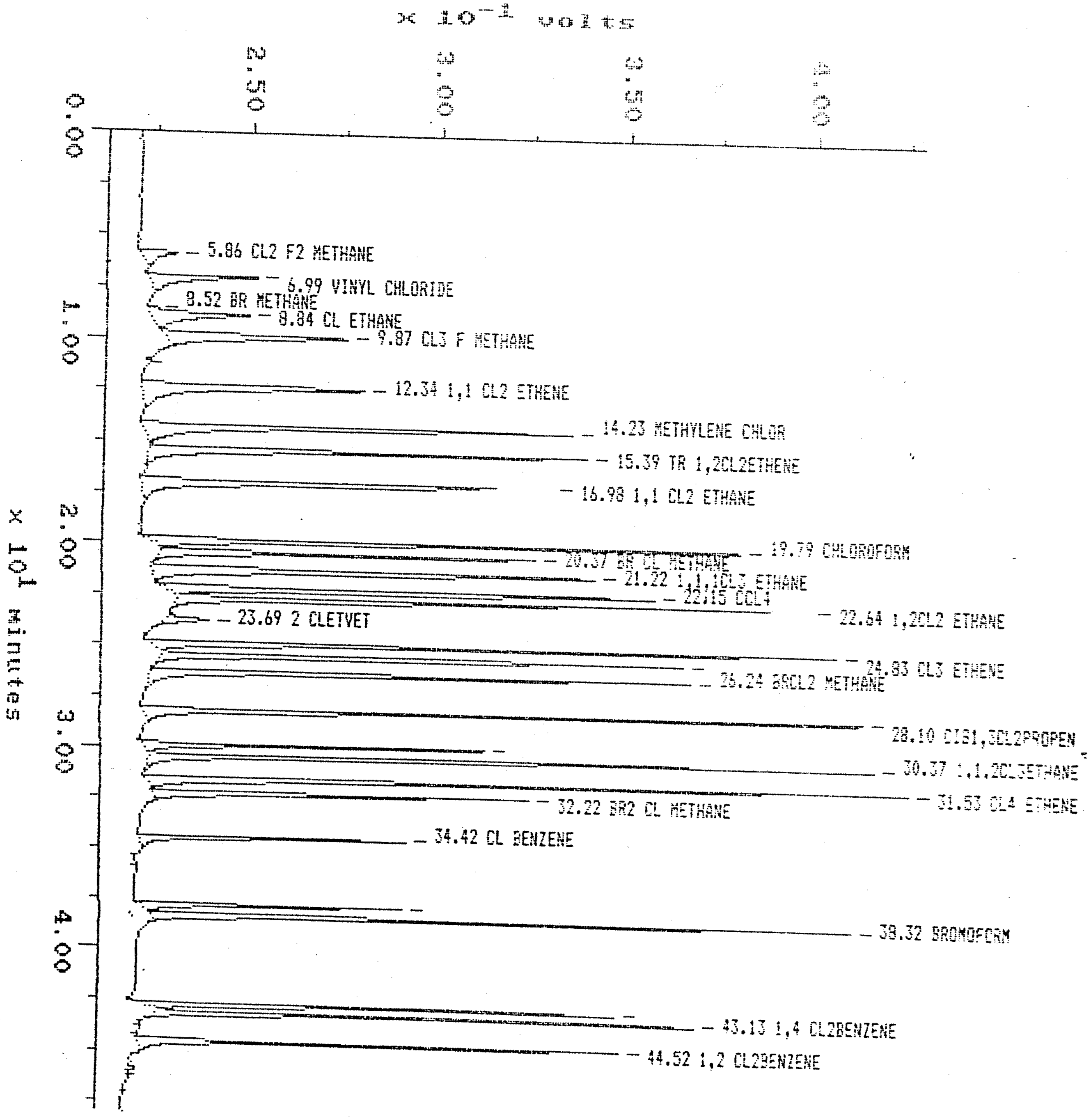
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	5.858	196452	10152	2.86	52.53	52.53	CL2 F2 METHANE
2	6.994	461094	28914	3.08	56.59	56.59	VINYL CHLORIDE
3	8.518	29183	2594	Invalid	Invalid	Invalid	BR METHANE
4	8.839	502405	26273	3.28	60.31	60.31	CL ETHANE
5	9.870	846478	48493	3.34	61.45	61.45	CL3 F METHANE
6	12.341	1195551	59437	3.55	65.27	65.27	1,1 CL2 ETHENE
7	14.231	1590599	114298	3.33	61.17	61.17	METHYLENE CHLOR
8	15.389	1348770	116625	3.51	64.57	64.57	TR 1,2CL2ETHENE

```
  9        16.980      1412947      109174        3.49        64.09        64.09     1.1 CL2 ETHANE
 10        19.789      1660982      158095        3.55        65.18        65.18     CHLOROFORM
 11        20.371       963833       99890        4.82!!      88.58!!      88.58!!   BR CL METHANE
 12        21.225      1638953      117828        3.79        69.56        69.56     1.1.1CL3 ETHANE
 13        22.150      1550326      130279        3.99        73.25        73.25     CCL4
 14        22.638      1495430      168087        3.48        63.85        63.85     1,2CL2 ETHANE
 15        23.685       160222       12167        2.02        37.10        37.10     2 CLETVET
 16        24.827      1661986      182430        3.58        65.76        65.76     CL3 ETHENE
 17        25.414      1400050      139583        3.46        63.64        63.64     1,2 CL2PROPANE
 18        26.240      1412879      144166        3.78        69.54        69.54     BRCL2 METHANE
 19        28.102      1636756      191493        3.57        65.67        65.67     CIS1.3CL2PROPEN
 20        29.820       736510       90947        4.07        74.82        74.82     TR1,3CL2PROPENE
 21        30.374      1684267      192992        4.20        77.17        77.17     1.1.2CL3ETHANE
 22        31.527      1776720      202763        3.84        70.65        70.65     CL4 ETHENE
 23        32.219       900800       99835        3.58        65.75        65.75     BR2 CL METHANE
 24        34.419       627492       71205        3.36        61.68        61.68     CL BENZENE
 25        37.805       623526       70041
 26        38.321      1499516      187119        8.61!      158.30!      158.30!    BROMOFORM
 27        42.737       918017      126240        3.28        60.27        60.27     1,3 CL2BENZENE
 28        43.131      1040639      144706        3.35        61.46        61.46     1,4 CL2BENZENE
 29        44.516      1014386      128932        3.23        59.28        59.28     1,2 CL2BENZENE
                       ----------   -----------             -------------- --------------
TOTAL                  31986765     3174758                   1837.47!!    1837.47!!


!! Result calculation based on peak response more than 10% outside of calibration range.
!  Result calculation based on peak response ratio outside of calibration range.
```

Sample: BLANK MS
Acquired: 27-APR-90 7:20

Channel: HALL
Method: C:\BASE\601-602A\CAPA

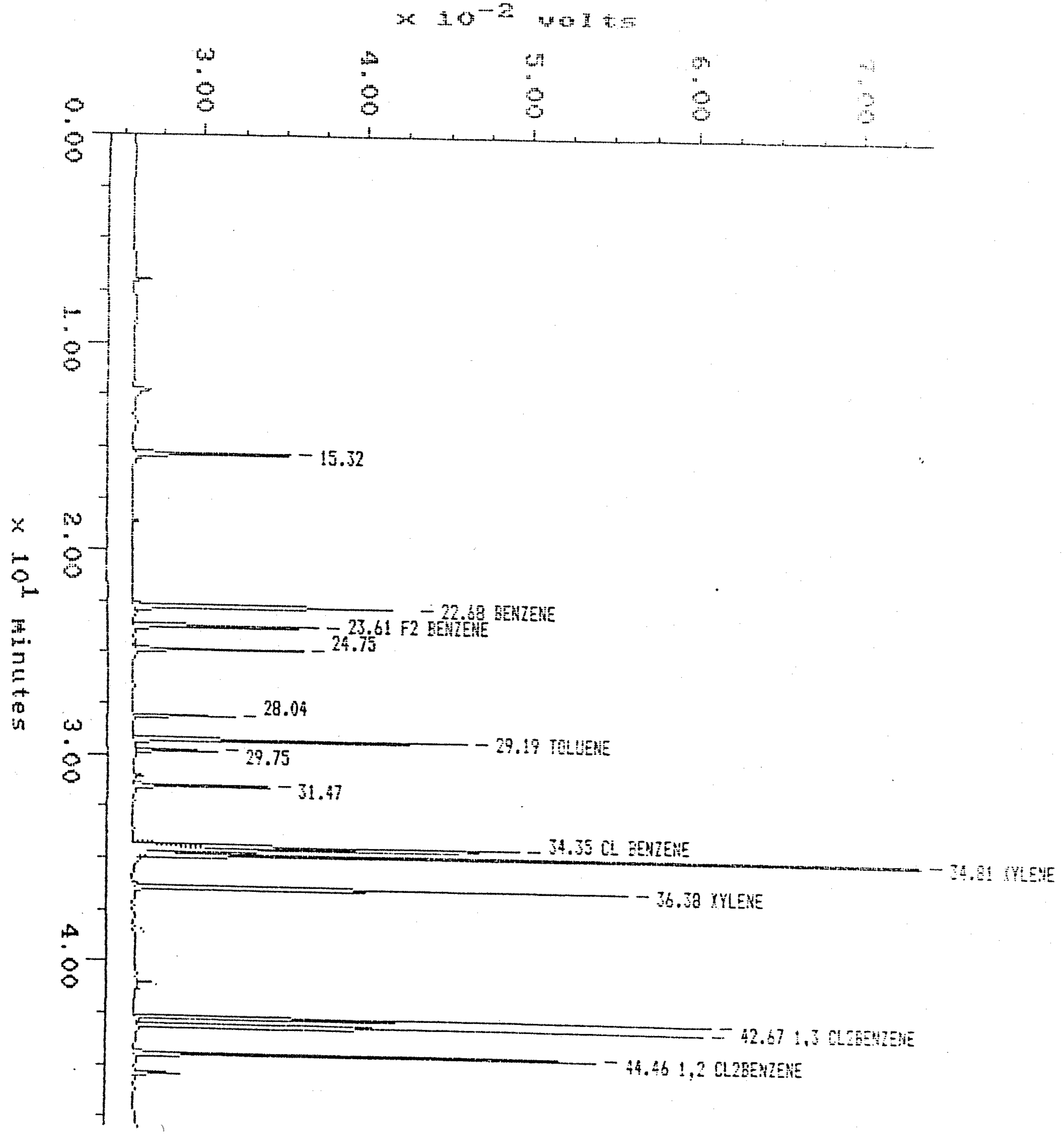
Filename: V82179
Operator: LRT



Sample: BLANK MS
Acquired: 27-APR-90 7:20

Channel: PID
Method: C:\BASE\601-602A\CAPA

Filename: V92173
Operator: LJT



NANCO LABORATORIES, INC.

Printed: 26-APR-1990 12:39:05

SAMPLE: GW 0498

#8 in Method: CAPILLARY
Acquired: 25-APR-1990 10:08
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82153
Index: Disk

COLUMN: PID

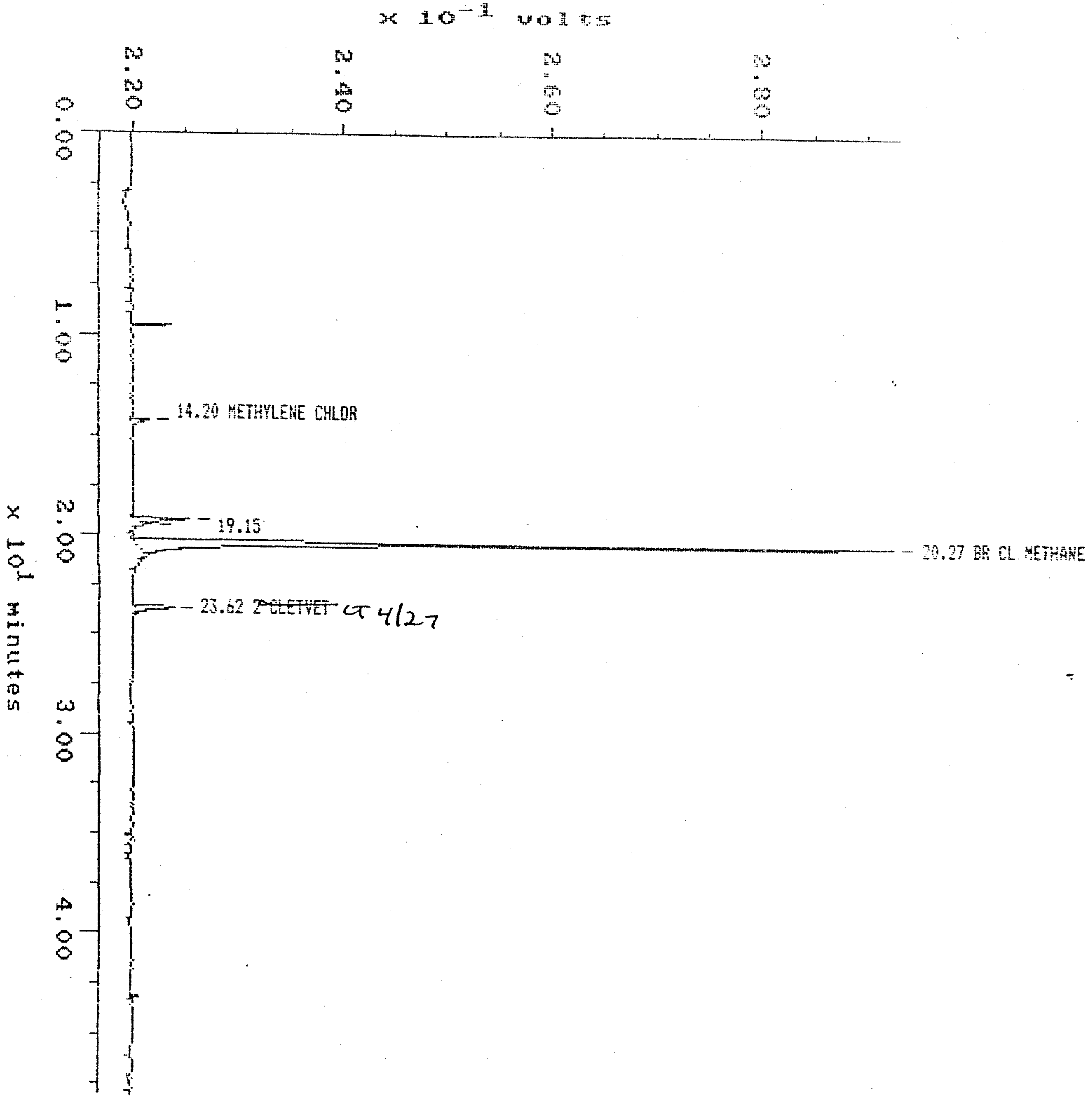
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	19.030	1995	234	0.53	0.26	0.26	ETHYL ACETATE
2	23.519	109833	14086	99.47	49.22	49.22	F2 BENZENE
TOTAL		111828	14320		49.48	49.48	

COLUMN: HALL

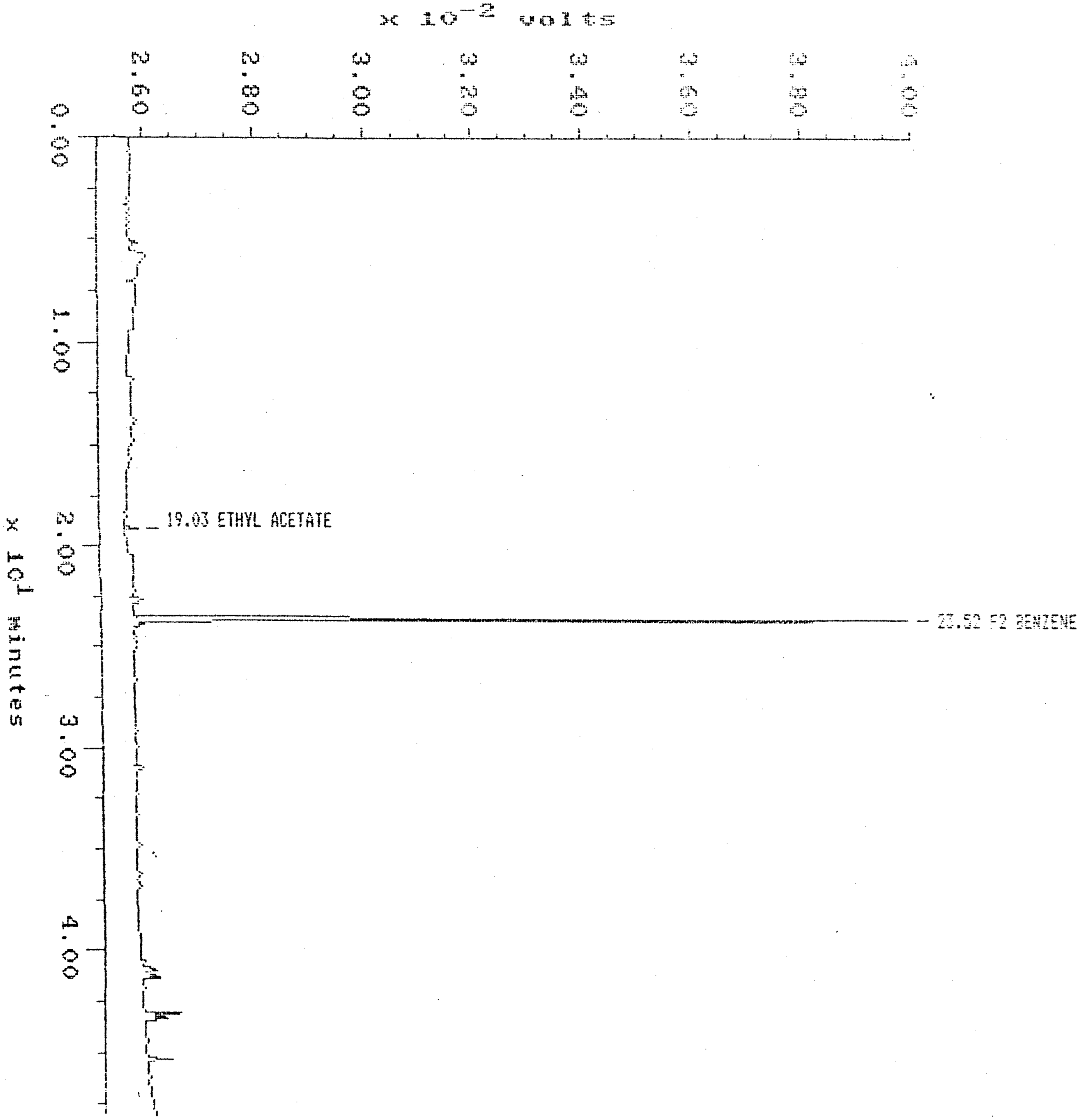
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	14.203	17210	1534	1.67	1.41	1.41	METHYLENE CHLOR
2	19.152	51518	4973				
3	19.424	2332	640	4.66	3.94	3.94	CHLOROFORM
4	20.271	765028	72316	83.11!!	70.31!!	70.31!!	BR CL METHANE
5	23.624	38589	3451	10.56	8.94	8.94	~~2 CLETVET~~ CT 4/27
TOTAL		874676	82915		84.60!!	84.60!!	

!! Result calculation based on peak response more than 10% outside of calibration range.

Sample: GW 0498 Channel: HALL Filename: V82153
Acquired: 25-APR-90 10:08 Method: C:\BASE\601-602A\CAPA Operator: LRT



Sample: GW 0498 Channel: PID Filename: V82153
Acquired: 25-APR-90 10:08 Method: C:\BASE\601-602A\CAPA Operator: LRT



NANCO LABORATORIES, INC.

Printed: 25-APR-1990 13:35:03

SAMPLE: GW 0499
#9 in Method: CAPILLARY
Acquired: 25-APR-1990 11:12
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82154
Index: Disk

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	23.541	100958	12932	100.00	45.24	45.24	FI BENZENE
TOTAL		100958	12932		45.24	45.24	

COLUMN: HALL

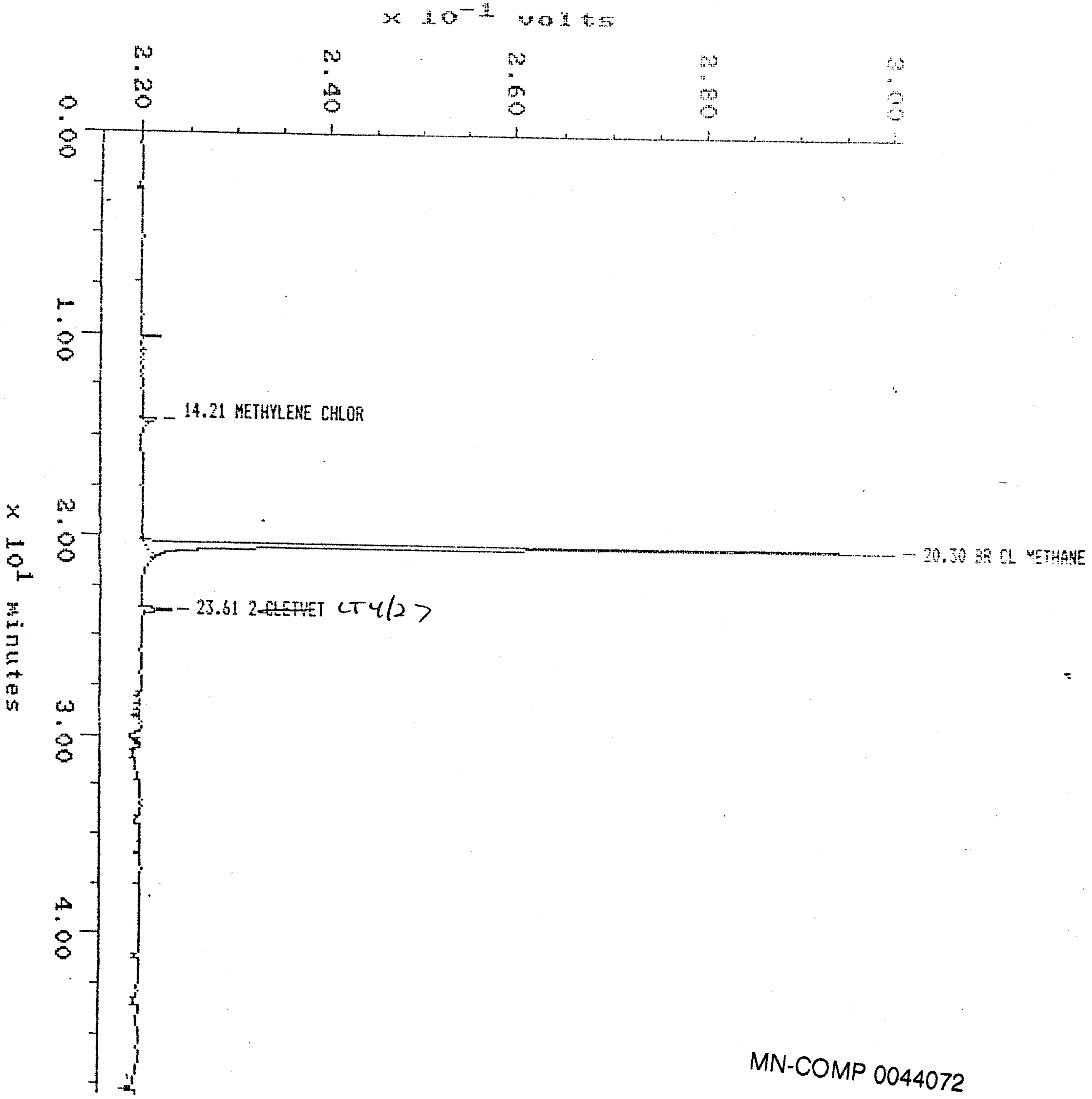
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	14.214	14565	1453	1.68	1.31	1.31	METHYLENE CHLOR
2	20.305	829181	79745	89.81!!	70.07!!	70.07!!	BR CL METHANE
3	23.613	28660	2813	8.51	6.64	6.64	~~2 CLETVE~~ CT 4/27
TOTAL		872407	84012		78.02!!	78.02!!	

!! Result calculation based on peak response more than 10% outside of calibration range.

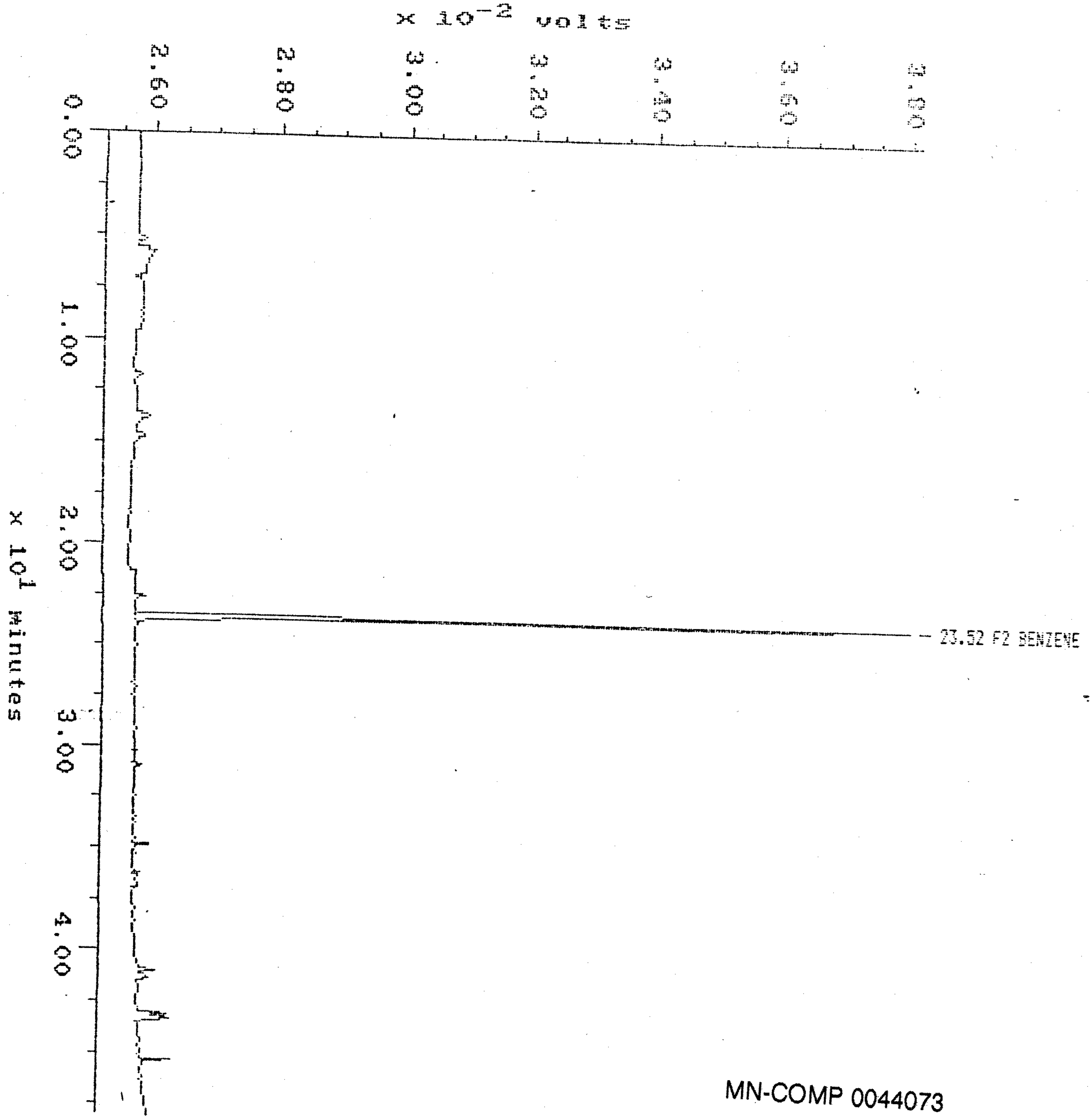
Sample: GW 0499
Acquired: 25-APR-90 11:12

Channel: HALL
Method: C:\BASE\601-602A\CAPA

Filename: V82154
Operator: LRT



Sample: GW 0500 **Channel:** PID **Filename:** V82155
Acquired: 25-APR-90 12:22 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



NANCO LABORATORIES, INC.

Printed: 26-APR-1990 8:18:49

SAMPLE: GW 0500
#10 in Method: CAPILLARY
Acquired: 25-APR-1990 12:22
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82155
Index: Disk

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	23.519	97426	12311	100.00	43.66	43.66	F2 BENZENE
TOTAL		97426	12311		43.66	43.66	

COLUMN: HALL

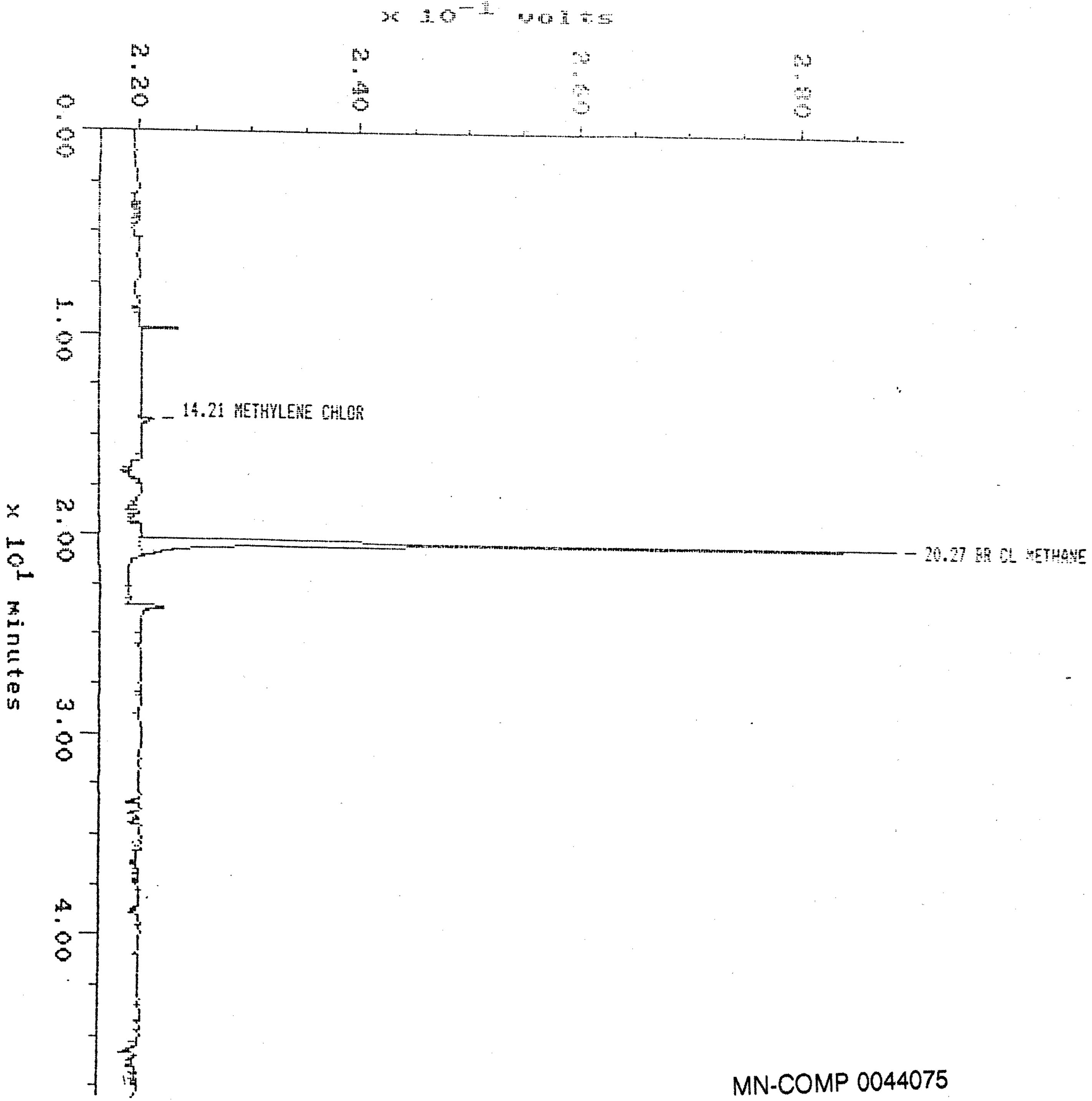
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	14.214	8236	986	1.60	1.07	1.07	METHYLENE CHLOR
2	20.266	782168	68671	98.40!!	66.10!!	66.10!!	BR CL METHANE
TOTAL		790404	69656		67.17!!	67.17!!	

!! Result calculation based on peak response more than 10% outside of calibration range.

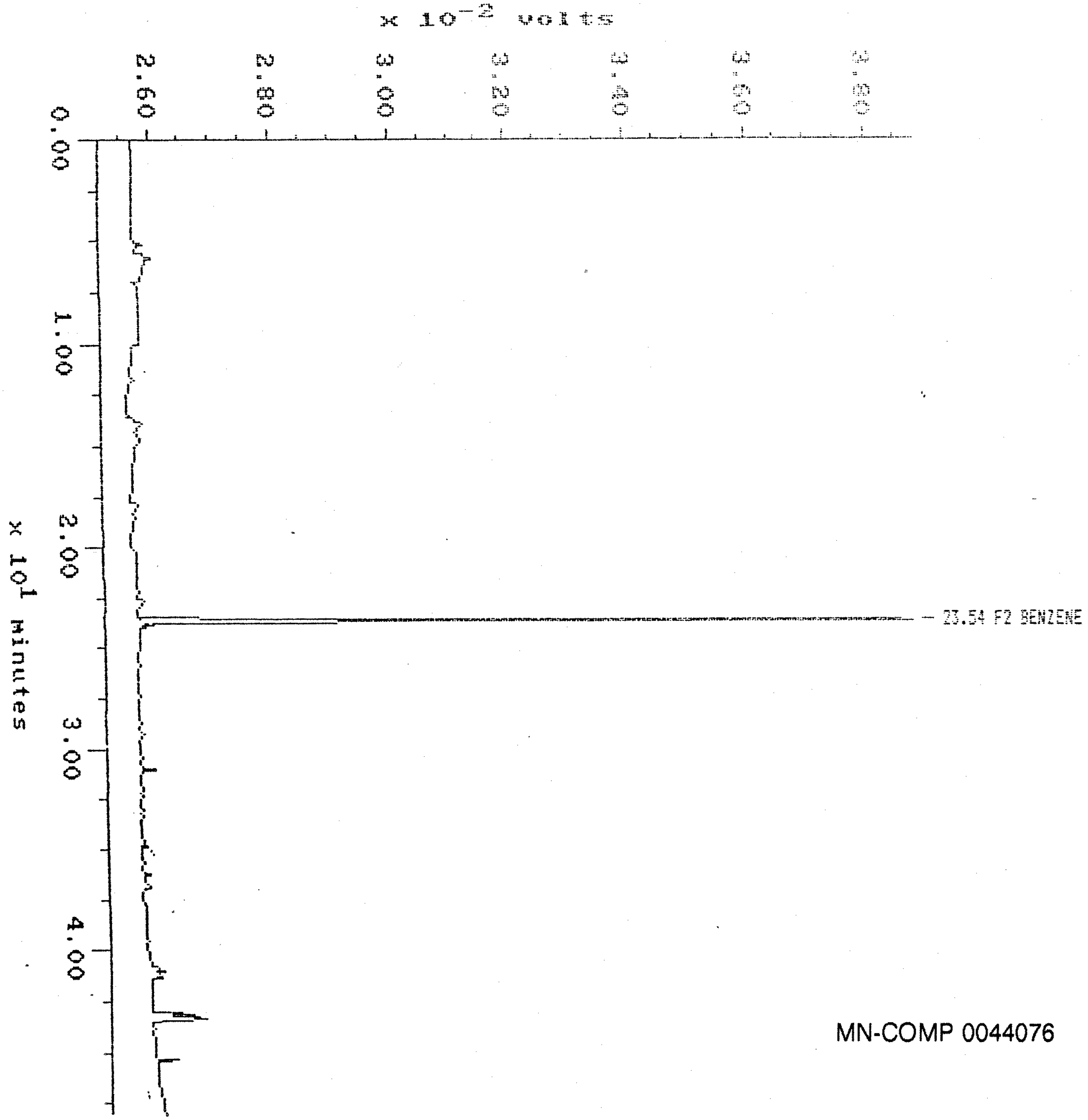
Sample: GW 0500
Acquired: 25-APR-90 12:22

Channel: HALL
Method: C:\BASE\601-602A\CAPA

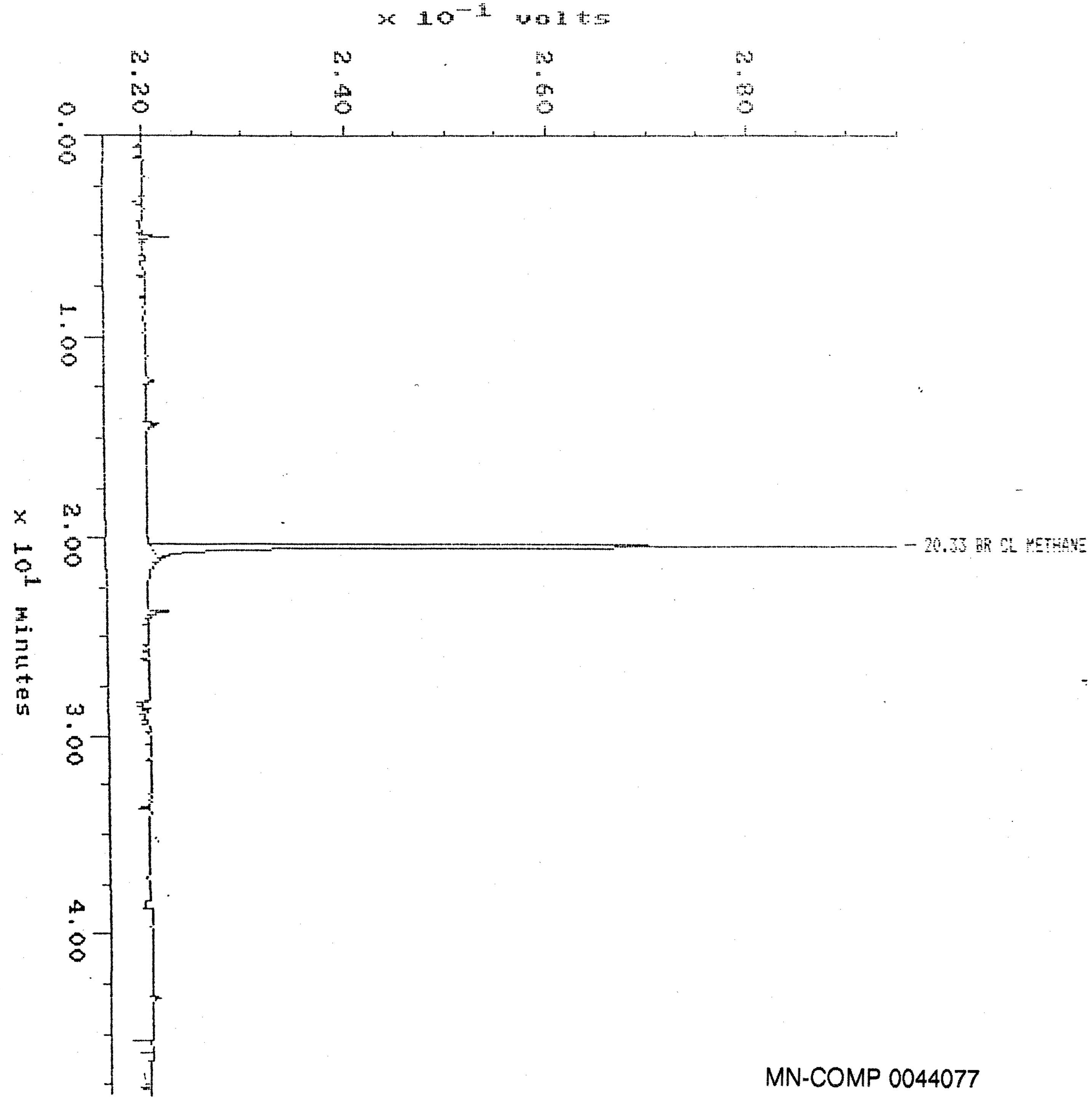
Filename: V82155
Operator: LRT



Sample: GW 0499 **Channel:** PID **Filename:** V82154
Acquired: 25-APR-90 11:12 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



Sample: GW 0501 **Channel:** HALL **Filename:** V82156
Acquired: 25-APR-90 13:33 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



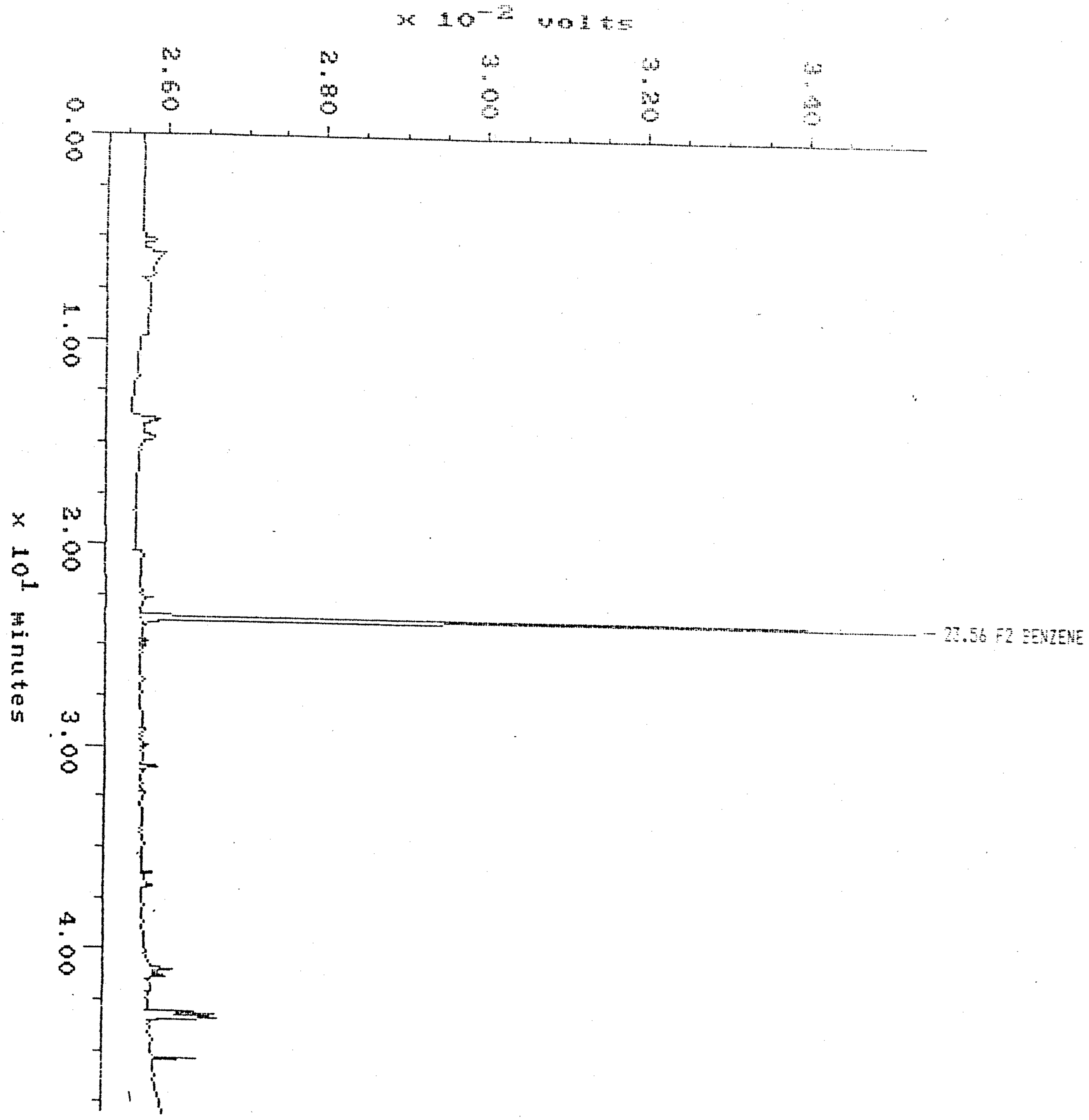
NANCO LABORATORIES, INC.

```
                              Printed: 26-APR-1990   8:20:13

SAMPLE:  GW 0501
            #11 in Method: CAPILLARY                                  Type:  UNKN
                Acquired: 25-APR-1990  13:33                   Instrument:  Instrument 1
                    Rate: 3.0 points/sec                         Filename: V82156
                Duration: 48.002 minutes                            Index: Disk
                ul. Inj.: LRT

  COLUMN:  PID

PK#  Retention Time   Peak  Area   Peak Height   Amount Percent   Original Conc    Solution Conc    Component Name
     (minutes)                                                    (PPB        )    (PPB        )
---  --------------   ----------   -----------   --------------   --------------   --------------   ---------------
 1       23.563         76194          9663          100.00            34.14            34.14       F2 BENZENE
                      ----------   -----------                    --------------   --------------
TOTAL                   76194          9663                            34.14            34.14


  COLUMN:  HALL

PK#  Retention Time   Peak  Area   Peak Height   Amount Percent   Original Conc    Solution Conc    Component Name
     (minutes)                                                    (PPB        )    (PPB        )
---  --------------   ----------   -----------   --------------   --------------   --------------   ---------------
 1       20.327         728236         74173         100.00!!          61.54!!          61.54!!     BR CL METHANE
                      ----------   -----------                    --------------   --------------
TOTAL                   728236         74173                           61.54!!          61.54!!

!! Result calculation based on peak response more than 10% outside of calibration range.
```

Sample: GW 0501
Acquired: 25-APR-90 13:33

Channel: PID
Method: C:\BASE\601-602A\CAPA

Filename: [illegible]92156
Operator: LRT



NANCO LABORATORIES, INC.

Printed: 25-APR-1990 16:21:43

SAMPLE: GW 0502
#12 in Method: CAPILLARY
Acquired: 25-APR-1990 15:10
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V82157
Index: 6

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	23.535	101560	12955	100.00	45.51	45.51	F2 BENZENE
TOTAL		101560	12955		45.51	45.51	

COLUMN: HALL

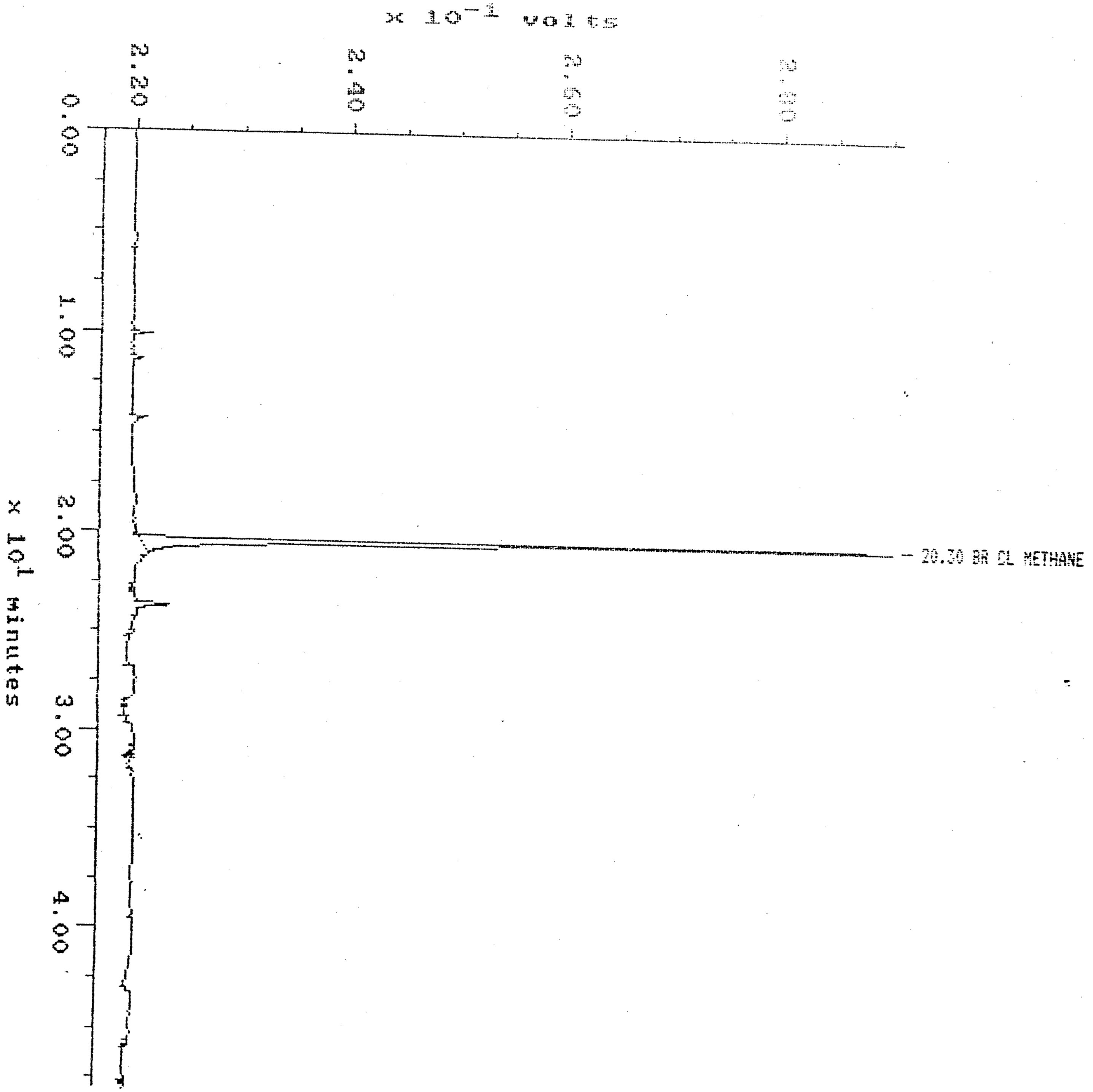
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	20.299	776033	69945	100.00!!	65.58!!	65.58!!	BR CL METHANE
TOTAL		776033	69945		65.58!!	65.58!!	

!! Result calculation based on peak response more than 10% outside of calibration range.

Sample: GW 0502
Acquired: 25-APR-90 15:10

Channel: HALL
Method: C:\BASE\601-602A\CAPA

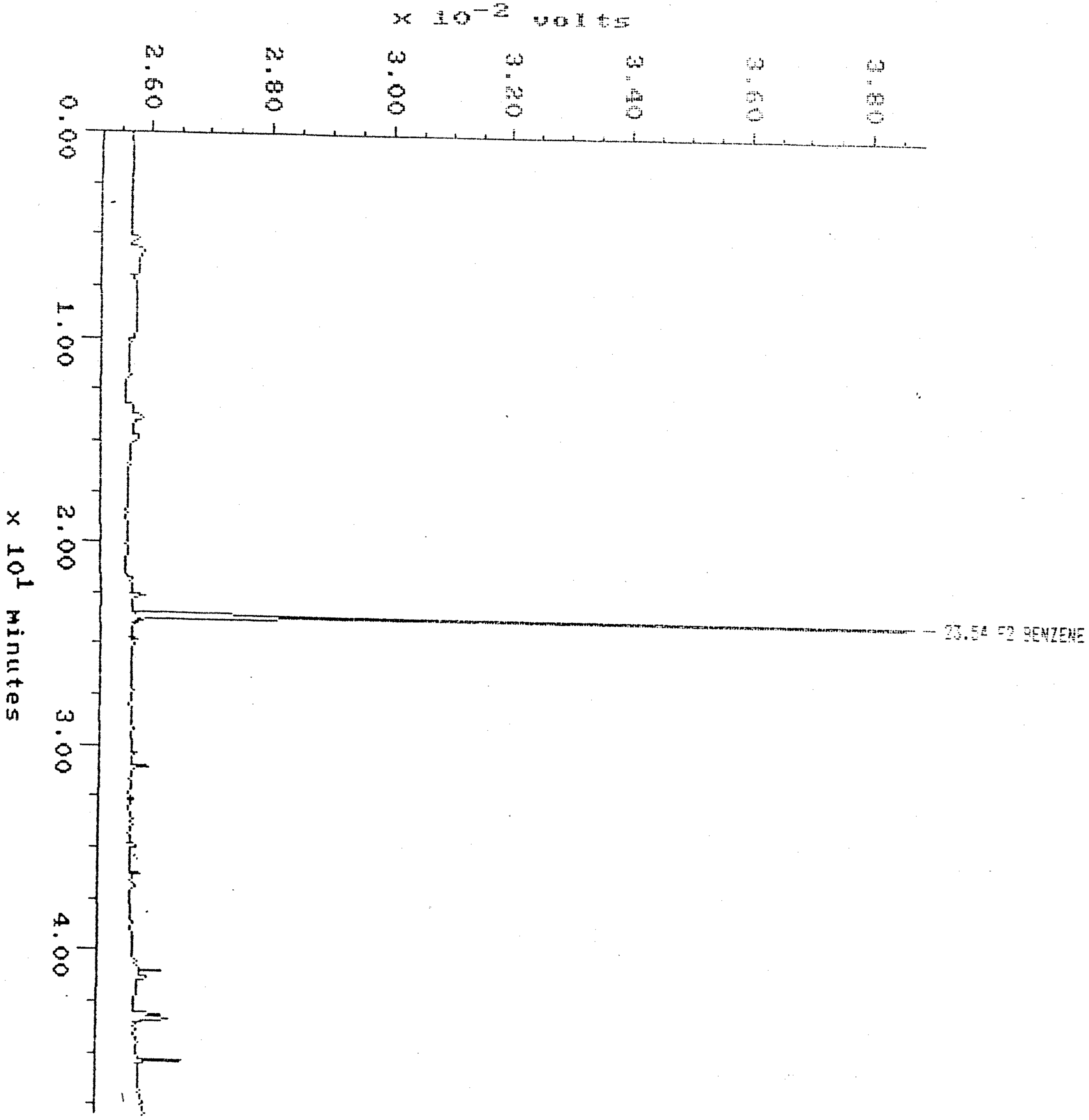
Filename: V82157
Operator: LRT



Sample: GW 0502
Acquired: 25-APR-90 15:10

Channel: PID
Method: C:\BASE\601-602A\CAPA

Filename: V82157
Operator: LRT



NANCO LABORATORIES, INC.

Printed: 25-APR-1990 17:32:07

SAMPLE: GW 0503

#13 in Method: CAPILLARY
Acquired: 25-APR-1990 16:19
Rate: 3.0 points/sec
Duration: 48.002 minutes
ul. Inj.: LRT

Type: UNKN
Instrument: Instrument 1
Filename: V92158
Index: 7

COLUMN: PID

PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	23.513	90720	11662	100.00	40.65	40.65	FZ BENZENE
TOTAL		90720	11662		40.65	40.65	

COLUMN: HALL

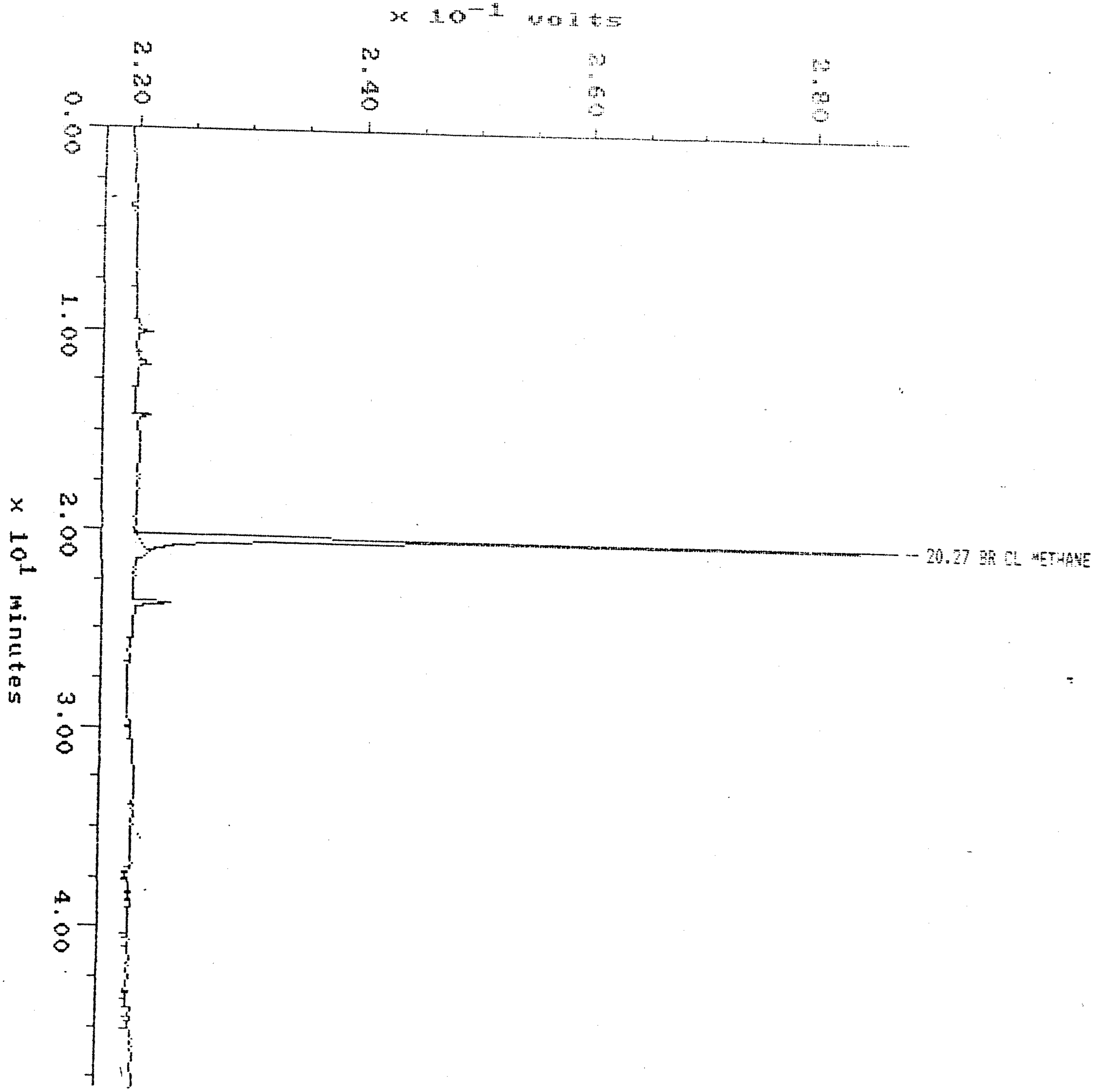
PK#	Retention Time (minutes)	Peak Area	Peak Height	Amount Percent	Original Conc (PPB)	Solution Conc (PPB)	Component Name
1	20.271	770586	67211	100.00!!	65.12!!	65.12!!	BR CL METHANE
TOTAL		770586	67211		65.12!!	65.12!!	

!! Result calculation based on peak response more than 10% outside of calibration range.

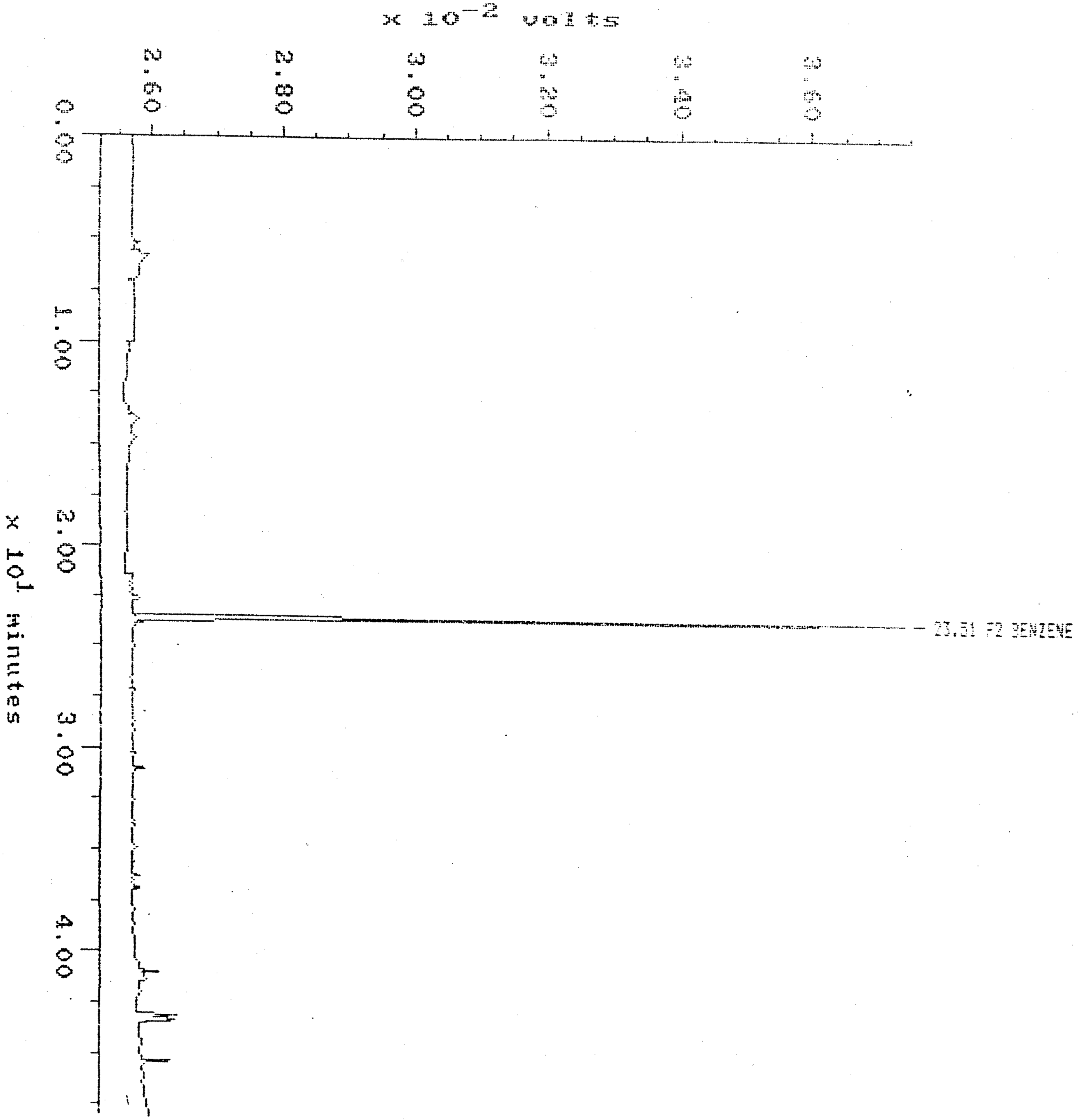
Sample: GW 0503
Acquired: 25-APR-90 16:19

Channel: HALL
Method: C:\BASE\601-602A\CAPA

Filename: V9215B
Operator: LRT



Sample: GW 0503 **Channel:** PID **Filename:** V82158
Acquired: 25-APR-90 16:19 **Method:** C:\BASE\601-602A\CAPA **Operator:** LRT



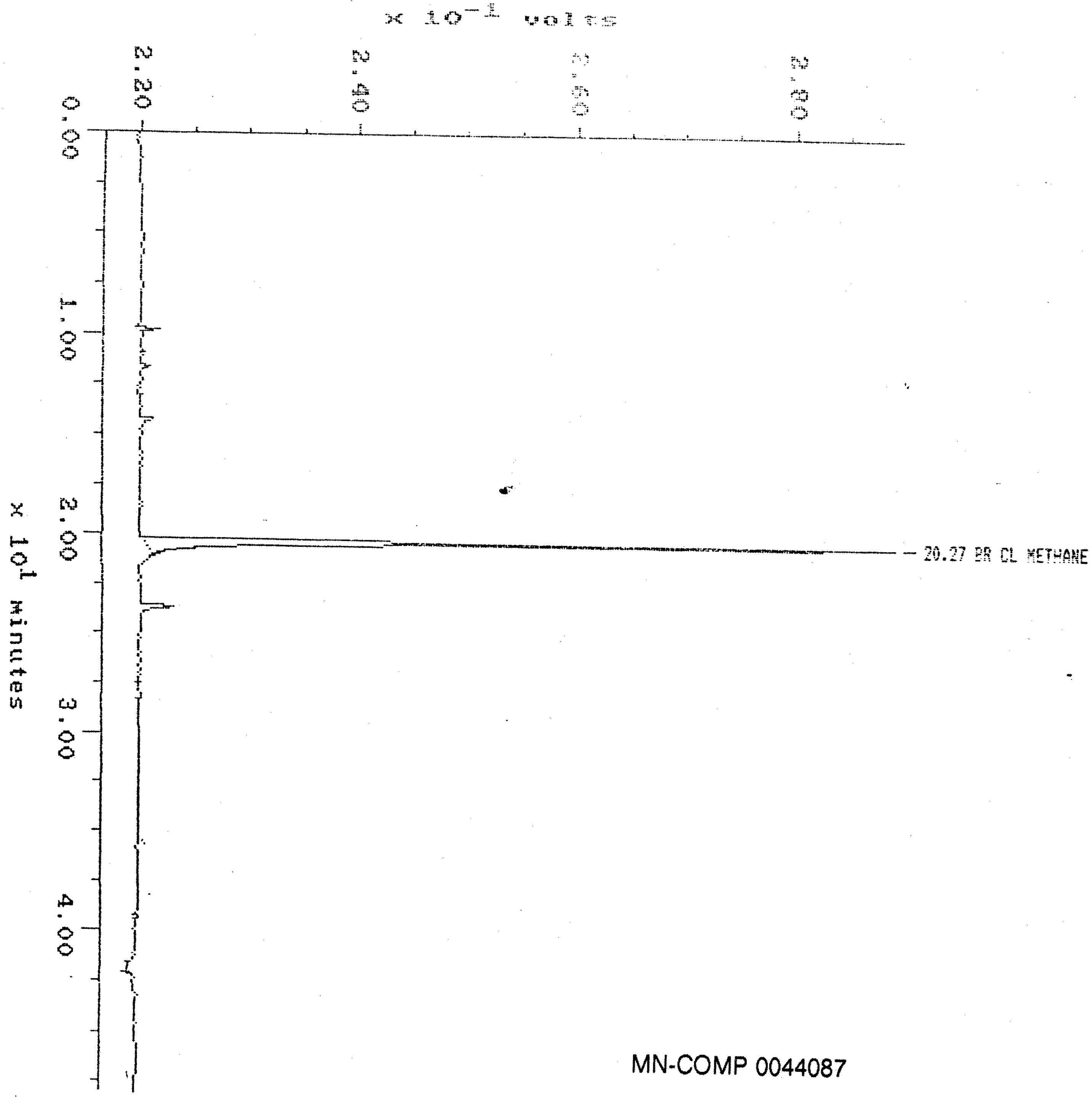
NANCO LABORATORIES, INC.

```
                         Printed: 26-APR-1990   9:22:50

SAMPLE:  GW 0504
                #14 in Method: CAPILLARY                             Type:  UNKN
                     Acquired: 25-APR-1990  17:29              Instrument:  Instrument 1
                         Rate: 3.0 points/sec                    Filename:  V82159
                     Duration: 48.002 minutes                       Index:  Disk
                     ul. Inj.: LRT

  COLUMN:  PID

 PK#   Retention Time   Peak  Area   Peak Height   Amount Percent   Original Conc    Solution Conc    Component Name
       (minutes)                                                    (PPB        )    (PPB        )
 ---   --------------   ----------   -----------   --------------   --------------   --------------   ---------------
  1        23.513         88527         11125          100.00           39.67            39.67        F2 BENZENE
                        ----------   -----------                    --------------   --------------
TOTAL                     88527         11125                           39.67            39.67


  COLUMN:  HALL

 PK#   Retention Time   Peak  Area   Peak Height   Amount Percent   Original Conc    Solution Conc    Component Name
       (minutes)                                                    (PPB        )    (PPB        )
 ---   --------------   ----------   -----------   --------------   --------------   --------------   ---------------
  1        20.266        771584         68927          100.00!!         65.20!!          65.20!!      BR CL METHANE
                        ----------   -----------                    --------------   --------------
TOTAL                    771584         68927                           65.20!!          65.20!!

!! Result calculation based on peak response more than 10% outside of calibration range.
```

Sample: GW 0504
Acquired: 25-APR-90 17:29

Channel: HALL
Method: C:\BASE\601-602A\CAPA

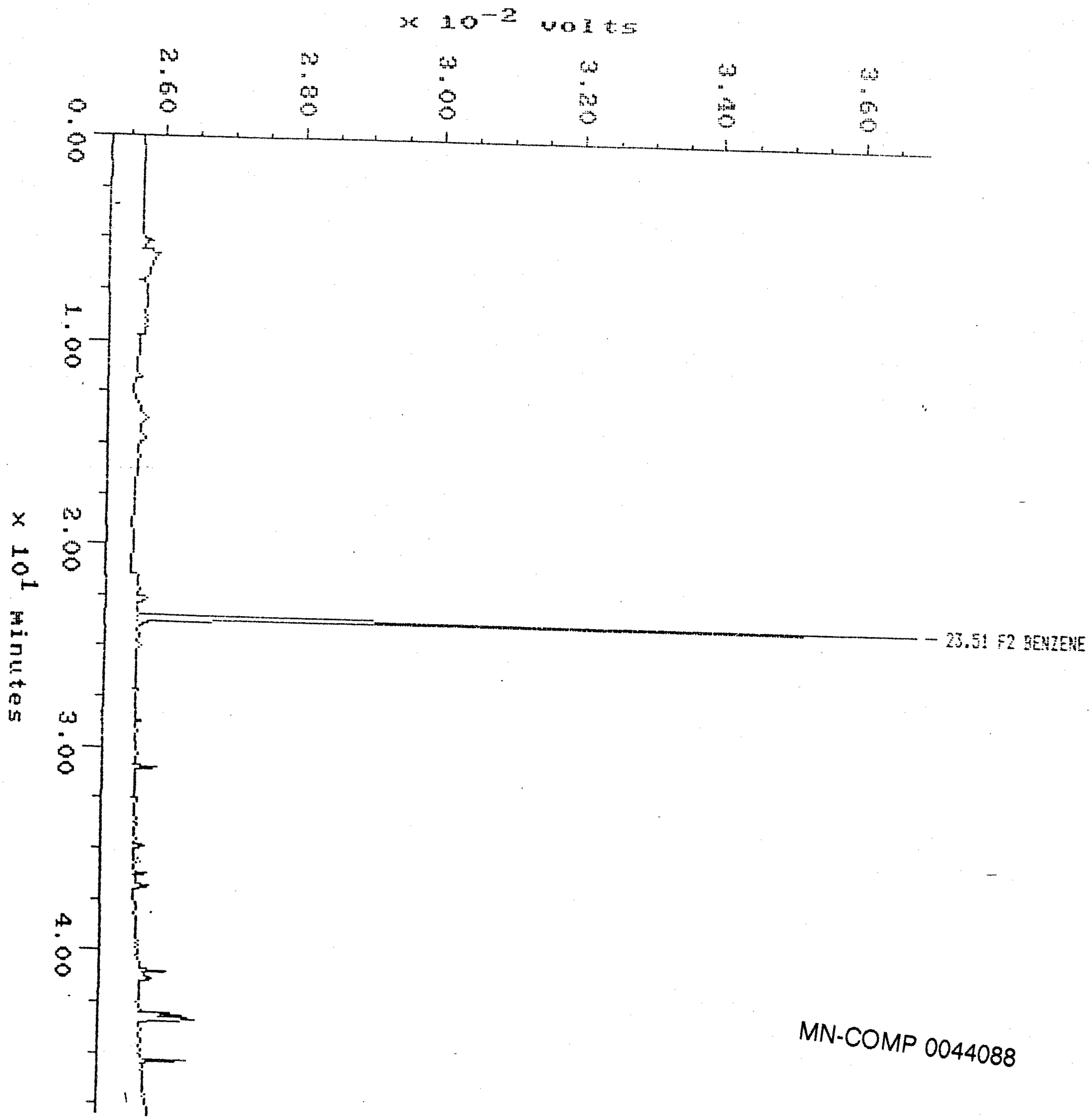
Filename: V82159
Operator: LRT



Sample: GW 0504
Acquired: 25-APR-90 17:29

Channel: PID
Method: C:\BASE\601-602A\CAPA

Filename: V82159
Operator: LRT



Varian DS-15 AA-1275/1475 Report

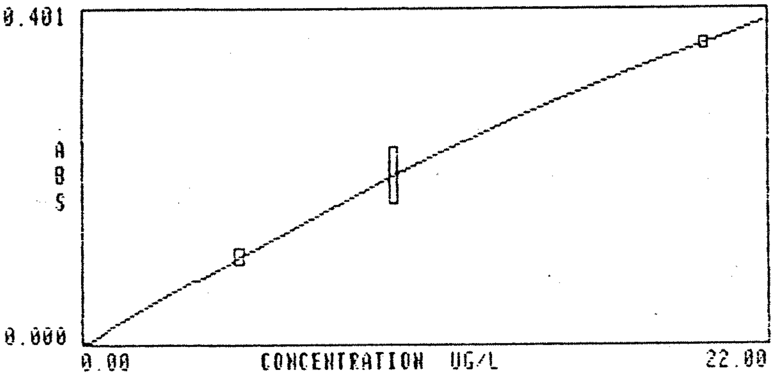
Pace Laboratory
1710 Douglas Drive Minneapolis,MN 55422
(612) 544-5543

Calculated: / / By:
Entered: 5/9/90 By: LMR
Reviewed: 5/10/90 By: Meg

OPERATOR LAURIE RYAN
DATE 05-09-90 09:35
BATCH As FURNACE #2

PROGRAM 1 As FURNACE

SAMPLE	CONC UG/L	%RSD	MEAN ABS	READINGS	
BLANK	0.00		-0.039	-0.040	-0.039
STANDARD 1	5.00	2.6	0.105	0.107	0.103
STANDARD 2	10.00	8.6	0.205	0.192	0.217
STANDARD 3	20.00	1.5	0.365	0.369	0.361



MDL=0.002 mg/L

EPA 378 6.20		6.75 109%	6.5	0.140	0.134	0.147	
2.00		1.43	23.5	0.030	0.035	0.025	
16760	ND	0.17mg/L	99.9	0.003	0.007	0.000	
16760AW TV=10.0		9.67 97%	0.0	0.198	0.198	0.198	
16761	ND	0.17mg/L	99.9	0.003	0.007	0.000	
16390 25X		OVER	2.3	0.752	0.765	0.740	Rerun at 125x 250x ~~5x or 10x~~
16390 25X AG		0.00	99.9	0.000	0.000	0.000	
16391 25X		OVER	2.8	1.025	1.046	1.004	Rerun at 200x or 500x
16391 25X AG		0.02	99.9	0.000	0.001	0.000	
16392 25X		OVER	2.3	0.884	0.870	0.899	Rerun at 125x or 250x
16392 25XAF		OVER	1.4	0.929	0.920	0.939	
16392 25X AG		0.02	99.9	0.000	0.002	-0.001	
16392 25XAF TV=10.0		8.97 70%	1.1	0.184	0.186	0.183	
10.0		9.02	2.6	0.185	0.189	0.182	
EPA 378 6.20		6.36 102%	4.8	0.132	0.128	0.137	
16393 25X	<2.5µg	-0.02	99.9	-0.000	-0.001	0.000	
16393 25X AG		-0.05	99.9	-0.001	-0.002	0.000	
14686	ND	0.57mg/L	47.1	0.012	0.008	0.016	
14686AW TV=10.6		7.76 73%	3.9	0.160	0.165	0.156	

SAMPLE	CONC UG/L	%RSD	MEAN ABS	READINGS	
14687	ND 0.38 mg/L	17.6	0.008	0.009	0.007
14688	ND 0.10	99.9	0.002	0.004	0.000
14689	ND 0.67	10.1	0.014	0.013	0.015
14690	ND 0.29	70.7	0.006	0.009	0.003
14691	ND 0.12	99.9	0.002	-0.001	0.006
14691AW TV=10.1	6.98 67%	0.9	0.145	0.144	0.146
~~14691AW~~ 14692	ND 0.33 mg/L	80.8	0.007	0.003	0.011
~~14692~~ 14664 2x	ND 0.69 mg/L	4.8	0.014	0.015	0.014 MDL=0.004
10.0	8.29	7.4	0.171	0.180	0.162
EPA 378 6.20	6.26 101%	4.8	0.130	0.126	0.135
14866 2X	ND 0.05 mg/L	99.9	0.001	0.000	0.002
14868 2X	ND 0.02	99.9	0.000	0.003	-0.002
14870 2X	ND -0.10	99.9	-0.002	0.000	-0.004
14870 2XAW TV=10.0	8.46 85%	2.8	0.175	0.171	0.178
14870 2XDAW	8.74 87%	5.4	0.180	0.187	0.173
14874 2X	ND 0.12 mg/L	84.8	0.002	0.001	0.004
14876 2X	ND 0.10	70.7	0.002	0.003	0.001
14878 2X	ND 0.86	54.9	0.018	0.025	0.011
14880 2X	ND -0.12	28.2	-0.002	-0.002	-0.003
14882 2X	ND 1.17	20.2	0.024	0.021	0.028
14882 2XAW TV=11.2	10.72 96%	2.5	0.218	0.214	0.222
14883 2X	ND 1.19 mg/L	16.9	0.025	0.022	0.028
14885 2X	ND 0.90	14.8	0.019	0.021	0.017
EPA 378 6.20	5.81 94%	5.2	0.121	0.117	0.126
2.00	1.19	33.9	0.025	0.031	0.019

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT		DATE ANALYZED:	4-27-90	CLIENT NAME:	
		ANALYZED BY:	JER	PROJECT NUMBER:	
ABBREVIATION	Hg-U	TIME:	07:55	PROJECT NAME.	
		CALCULATED BY:	JSm	FILE #:	
		DATA REVIEWED BY:	SWE	DATE RECEIVED:	
		ENTERED BY:	JER	DATE COLLECTED:	
		INSTRUMENT ID #	3	HIGH STD. CONC.:	10
				ABS:	0.240
		MDL	0.0002	R FACTOR:	Linreg

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
BLK	N.D	ug/L					
Std 10	10.00	↓					
Std 7	6.93	↓					
Std 5	5.04	↓					
Std 3	3.06	↓					
Std 1	1.00	↓					
Std 0.2	0.25	↓					
EPA	2.89	↓	WS 378	3.00		96	
12702	0.0114	mg/L					0.0115
15247	N.D	↓					
solid BLK	N.D	↓					
66154	N.D	mg/kg	0.02				
15375	N.D	mg/L					
15377	N.D	↓	0.004				
15376	N.D	↓					
15503	N.D	↓		5.00 5.00	4.93 4.60	89 92	

A - Analytical spike or duplicate
M - Matrix spike or duplicate

FOR CLP USE ONLY? ☐

MIC ABSORPTION ELEMENT

ABBREVIATION Hg-U

DATE ANALYZED: 4-27-90
ANALYZED BY: JEM
TIME: 07:55
CALCULATED BY: JEM
DATA REVIEWED BY:
ENTERED BY: JER
INSTRUMENT ID # 3

MDL 0.0002

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.: 10
ABS: 0.240
R FACTOR: Linrg

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
14281	N.D	mg/L	0.0008 Leachate	5.00	4.87	97	
14293	N.D			5.00	4.65	93	
14015	N.D			5.00	4.91	98	
15188	N.D						
15189	N.D						
14886	N.D						
14687	N.D			5.00 5.00	4.91 4.91	98 98	
14688	N.D						
14689	N.D						
Std.5	4.95	ug/L					
14690	N.D	mg/L					
14691	N.D						
14692	N.D						
14864	N.D						
14796	N.D		0.0008 Leachate	5.00	5.04	101	
14868	N.D						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

14866 N.D

FOR CLP USE ONLY? ☐

MIC ABSORPTION ELEMENT

ABBREVIATION Hg-U

DATE ANALYZED: 4-27-90

ANALYZED BY: JEm

TIME: 07:55

CALCULATED BY: JEm

DATA REVIEWED BY:

ENTERED BY: JEV

INSTRUMENT ID # 3

MDL 0.002

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.: 10

ABS: 0.240

R FACTOR: Linear

Sample	Analysis		Comments	Spike Rec			Duplicate
	Results	Units		True	Found	% REC	
14870	N.D	mg/L					
14874	N.D						
14876	N.D						
14878	N.D			5.00 5.00	5.04 5.04	101 101	
14880	N.D						
14882	N.D						
14883	N.D						
EPA	3.11		WS379	3.00		104	
14885	N.D						
14887	N.D						
14889	N.D						
14891	N.D			5.00 5.00	4.78 4.55	96 100	
14893	N.D						
14896 ~~[illegible]~~	N.D						
14903	0.0003						
14940	N.D						

A - Analytical spike or duplicate

M - Matrix spike or duplicate

14894 N.D

FOR CLP USE ONLY? ☐

OMIC ABSORPTION ELEMENT

ABBREVIATION Hg-U

DATE ANALYZED: 4-27-90

ANALYZED BY: JSM

TIME: 07:55

CALCULATED BY: JSM

DATA REVIEWED BY:

ENTERED BY: JSR

INSTRUMENT ID # 3

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.: 10

ABS: 0.240

R FACTOR: Linreg

MDL 0.0002

ample	Results	Analysis Units	Comments	Spike Rec True	Found	% REC	Duplicate
4942	N.D	mg/l					
14944	N.D			5.00	4.82	96	N.D
4946	N.D						
14947	N.D						
4949	N.D						
4951	N.D						
14675	N.D						
4677	N.D		Diss				
EPA	3.11	ug/l	WS 378 concls	3.00		104	
4679	N.D	mg/l					
4681	N.D			5.00	5.04	101	
4792	N.D		0.0008	5.00	5.00	101	
BLK Hcr	N.D	ug	Leachate	5.00	4.43	89	
wbe BLK	N.D			5.00	4.87	97	
324	<0.0076	mg/m3	IH	5.00	4.69	94	
378	0.0128						

Analytical spike or duplicate
- Matrix spike or duplicate

FOR CLP USE ONLY? ☐

ABSORPTION ELEMENT

ABBREVIATION Hg-U

DATE ANALYZED: 4-27-90
ANALYZED BY: JEm
TIME: 07:55
CALCULATED BY: JEm
DATA REVIEWED BY:
ENTERED BY: JEm
INSTRUMENT ID # 3

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.: 10
ABS: 0.240
R FACTOR: Linrty

MDL 0.0002

Sample	Analysis Results	Analysis Units	Comments	Spike Rec True	Spike Rec Found	% REC	Duplicate
15379	0.0431		IH Hg				
15380	0.0168		↓				
15381	0.0223						
15382	0.0133						
std 5	4.95	ug/L					
15055	<0.0031						
EPA	2.89	ug/L	WS 378 conc 18	3.00		96	
15056	0.0367		IH Hg				
15057	0.0534		↓				
15058	0.0542						
15060	<0.25	ug					
EPA	2.98	ug/L	WS 378 conc 18	3.00		100	
Solid Blk	N.P	mg/Kg					
14156	N.P	↓					
14157	N.P						
15383	<0.25	ug	IH Hg				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

FOR CLP USE ONLY? ☐

MIC ABSORPTION ELEMENT

ABBREVIATION Hg-4

DATE ANALYZED: 4-27-90
ANALYZED BY: JEm
TIME: 07:55
CALCULATED BY: JEm
DATA REVIEWED BY:
ENTERED BY: JEm
INSTRUMENT ID # 3

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

MDL 0.0002

ample	Analysis Results	Analysis Units	Comments	Spike Rec True	Spike Rec Found	% REC	Duplicate
13707	1.8	mg/Kg	0.08				
4479	N.D			2.00	2.01	102	
3412	0.17			2.00	2.10	105	
4572	N.D						
BLK	N.D	ug L					
Std 10	10.36						
td5	4.95						
td 1	1.04						
PA	2.98		WS 378	3.00		100	

Analytical spike or duplicate
Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cr, Cr-N
Cr-D

DATE ANALYZED: 5-10-90
ANALYZED BY: MKG
TIME: 20:25
CALCULATED BY: Meg
DATA REVIEWED BY: Izr
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.1 mg/l

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.100 std	0.101	mg/l	101.0%				
1.00 std	0.979		97.9%				
2.00 std	1.96		98.0%				
4.00 std	3.95		98.8%				
EPA 283	3.46		TV = 3.25 106.5%				
ICP Blank	0.023						
	0.000		ND				
	0.023						
Blank	0.036						
	0.032		ND				
	0.023						
13061	13	mg/kg	ICP MDL = 2.5				
13063	180			8.25	8.50	103.0	8.95 2.6
13412	24			1.95	1.97	101.0	1.97 0.0K
14686	ND	mg/l					
14687	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cr, Cr-N, Cr-D

DATE ANALYZED: 5-10-90
ANALYZED BY: MKG
TIME: 20:25
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.1

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

Sample	Analysis			Spike Rec			
	Results	Units	Comments	True	Found	% REC	Duplicate
14688	ND	mg/l	ICP				
14689	ND						
14690	ND						
14691	ND						
14692	ND						
1.00 std	0.972		97.2%				
2.00 std	1.97		98.5%				
15966	ND		under RCRA 8	1.00	0.988	98.8	
14208 rev	14	mg/kg	recheck				
17266	ND	mg/l					
17463	ND						
17779	ND			1.02	1.15	112.7	1.19 1.7
16170	ND						
16171	ND						
16172	ND						
16173	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cr, Cr-N, Cr-D

DATE ANALYZED: 5-10-90

ANALYZED BY: MKG

TIME: 20:25

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

MDL 0.1 mg/l

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
16174	ND	mg/l					
16175	ND						
16176	ND						
16177	ND						
16178	ND						
0.100 std	0.108		108.0%				
1.00 std	0.990		99.0%				
2.00 std	2.00		100.0%				
4.00 std	4.00		100.0%				
EPA 283	3.50		TV = 3.25 107.8%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cr-D

DATE ANALYZED: 5-10-90
ANALYZED BY: MKG
TIME: 20:55
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

MDL 0.1 mg/l

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.100 std	0.119	mg/l	119.0%				
1.00 std	0.977		97.7%				
2.00 std	2.01		100.5%				
4.00 std	4.04		101.0%				
EPA 283	3.48		TV = 3.25 107.1%				
17260	ND						
17262	ND						
17264	ND			1.00	1.09	109.0%	1.10 0.46

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Ag-N

DATE ANALYZED: 5-10-90

ANALYZED BY: MKG

TIME: 22:50

CALCULATED BY: Meg

DATA REVIEWED BY: Jer

ENTERED BY: Meg

INSTRUMENT ID # 3

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.: 2.0

ABS: 0.45

MDL 0.04 mg/l

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.040 std	0.040	mg/l	100.0%				
0.500 std	0.482	|	96.4%				
1.00 std	.991	|	99.1%				
2.00 std	2.02	|	101.0%				
EPA 283	3.04	|	TV=3.00 101.3%				
ICP Blank	0.002	|					
|	0.002	|	ND				
|	0.003	|					
13061	ND	mg/Kg	MDL=1.0				
13063	ND	|					
13412	ND	|		0.511	0.484	94.7	0.487 031
14686	ND	mg/l					
14687	ND						
14688	ND						
14689	ND						
14690	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Ag-N

DATE ANALYZED: 5-10-90

ANALYZED BY: MKG

TIME: 22:50

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

MDL 0.04 mg/l

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
14691	ND	mg/l					
14692	ND						
15966	ND		logged under RCRA 8	0.502	0.480	95.6	
0.040 std	0.038		95.0%				
0.500 std	0.488		97.6%				
1.00 std	1.00		100.0%				
2.00 std	2.05		102.5%				
EPA 283	3.02		TV=3.00 100.7%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cu, Cu-N, Cu-D ①

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 16:25
CALCULATED BY: Meg
DATA REVIEWED BY: Meg
ENTERED BY: Meg
INSTRUMENT ID # 3

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.: 4.0 mg/l
ABS: 0.70
R FACTOR:

MDL 0.01 mg/l

Sample	Analysis Results	Units	Comments	Spike Rec True	Found	% REC	Duplicate
0.010 std	0.011	mg/l	110%				
1.00 std	0.978		97.8%				
2.00 std	1.99		99.5%				
4.00 std	4.01		100.2%				
ERA 9923	0.117		TV = 0.121 96.7%				
ICP Blank	0.080						
ICP Blank	0.084		0.089				
ICP Blank	0.103						
Blank	0.039						
Blank	0.016		0.023				
Blank	0.015						
13061	18	mg/kg	ICP MDL = 0.25				
13063	11		ICP	1.43 ~~2.43~~	1.35	94.5 ~~55.6~~	1.31 1.4R
13412	8.8		ICP	1.35 ~~2.35~~	1.18	87.4 ~~50.2~~	1.16 0.79
14686	ND	mg/l	ICP				
14687	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

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ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cu, Cu-N, ~~Cu-D~~ ②

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 16:25
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.01 mg/l

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
14688	ND	mg/l	ICP				
14689	ND						
14690	ND						
14691	0.01						
14692	ND						
17127	0.05						
17168	0.88						
17169	0.04						
17285	ND						
1.00 std	0.981		98.1%				
2.00 std	1.97		98.5%				
17286	0.10						
17287	0.10						
17288	7.0						
17293	0.14						
17475	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION CU, CU-N, ~~CU-D~~ ③

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 16:25
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.01 mg/l

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

Sample	Analysis			Spike Rec			
	Results	Units	Comments	True	Found	% REC	Duplicate
17477	ND	mg/l					
17479	ND						
17481	ND						
17519	11,000	mg/kg					
17520	18	mg/l					
17557	35	mg/kg		1.72	1.76	102.3	1.74 0.57
0.010 std	0.010	mg/l	100.0%				
1.00 std	.984		98.4%				
2.00 std	2.00		100.0%				
4.00 std	3.97		99.2%				
ERA9923	0.116		TV=0.121 95.9%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cu-D

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 16:55
(4) CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.: 4.00
ABS: 0.70
R FACTOR:

MDL 0.01 mg/l

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
0.010 std	0.009	mg/l	90.0%				
1.00 std	0.983		98.3%				
2.00 std	1.99		99.5%				
4.00 std	4.01		100.2%				
ERA 9923	0.115		TV=0.121 95.0%				
17260	ND						
17262	ND						
17264	ND			1.00	0.976	97.6	0.975 0.10R

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Zn, Zn-N ①

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 23:20
CALCULATED BY: Meg
DATA REVIEWED BY: Meg
ENTERED BY: Meg
INSTRUMENT ID # 3
MDL 0.10 mg/l digested
0.01 mg/l undigested

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.10 std	0.09	mg/l	90.0%				
5.00 std	4.90		98.0%				
10.0 std	9.86		98.6%				
20.0 std	20.0		100.0				
ERA 9923	0.27		TV = 0.28 96.4%				
ICP Blank	0.10						
ICP Blank	0.11		0.09				
ICP Blank	0.05						
Blank	0.06						
Blank	0.05		0.05				
Blank	0.03						
-13061	26	mg/kg	ICP MDL = 2.5				
-13063	150		ICP	9.97	10.41	104.4	10.21 0.97RP
17519	260						
17520	11	mg/l	MDL = 0.10				
17557	65	mg/kg	MDL = 2.5				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Zn, Zn-N

②

DATE ANALYZED: 5-9-90

ANALYZED BY: MKG

TIME: 23:20

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

0.10 mg/l digested

MDL 0.01 mg/l digested

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
0.10 std	0.11	mg/l	110%				
5.00 std	4.94		98.8%				
10.0 std	9.87		98.7%				
20.0 std	20.5		102.5%				
ERA 9923	0.27		96.4%				
0.10 std	0.009	mg/l	90.0%				
0.250 std	0.246		98.4%				
0.500 std	0.502		100.4%				
1.00 std	0.996		99.6%				
ERA 9923	0.293		TV = 0.280 104.6%				
Blank ICP	0.062						
	0.062		0.061				
	0.058						
-13412	17	mg/kg	ICP MDL = 2.5	4.69	4.74	101.2	4.55 2.0R
46554	0.07	mg/l	MDL = 0.01				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Zn, Zn-N

③

DATE ANALYZED: 5-9-90

ANALYZED BY: MKG

TIME: 23:20

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

0.10 mg/l digested

MDL 0.01 mg/l digested

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
17281	0.08	mg/l	MDL=0.01				
17282	0.03						
15207	0.25						
15457	0.26						
15458	0.01						
17127	0.13		MDL = 0.10				
17169	ND						
17293	0.95						
Blank	0.057						
Blank	0.043		0.05				
Blank	0.045						
0.250 std	0.245		98.0%				
0.500 std	0.498		99.6%				
14686	ND		ICP MDL = 0.01				
14687	ND						
14688	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Zn, Zn-N

④

DATE ANALYZED: 5-9-90

ANALYZED BY: MKG

TIME: 23:20

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

0.10 mg/l digested

MDL 0.01 mg/l digested

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
-14689	ND	mg/l	ICP MDL=0.01				
-14690	ND						
-14691	ND			0.250	0.252	100.8	0.252 0.0RP
-14692	ND						
0.010 std	0.011		110.0%				
0.250 std	0.251		100.4%				
0.500 std	0.507		101.4%				
1.00 std	1.011		101.1%				
ERA 9923	0.296		TV= 0.280 105.7%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cd, Cd-N ①

DATE ANALYZED: 5-9-90

ANALYZED BY: MKG

TIME: 15:30

CALCULATED BY: Meg

DATA REVIEWED BY: Jem

ENTERED BY: Meg

INSTRUMENT ID # 3

CLIENT NAME: ________

PROJECT NUMBER: ________

PROJECT NAME. ________

FILE #: ________

DATE RECEIVED: ________

DATE COLLECTED: ________

HIGH STD. CONC.: 1.0

ABS: 0.67

R FACTOR: ________

MDL 0.01 mg/l

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.010 std	0.010	mg/l	100.0%				
0.250 std	0.252		100.8%				
0.500 std	0.498		99.6%				
1.00 std	1.00		100.0%				
EPA 283	0.610		TV = 0.650 93.8%				
ICP Blank	0.011		0.011				
|	0.011						
	0.010						
Blank	0.005		ND				
|	0.002						
	0.002						
13061	ND	mg/kg	ICP MDL = 0.25				
13063	0.35	|	| |	0.414	.396	95.5	.397 0.1
13412	1.0	|	| |	0.441	0.407	91.5	0.393 1.8R
14686	ND	mg/l	| MDL = 0.01				
14687	ND	|	|				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cd, Cd-N ②

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 15:30
CALCULATED BY: Meg
DATA REVIEWED BY: JEW
ENTERED BY: Meg
INSTRUMENT ID # 3

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

MDL 0.01

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
14688	ND	mg/l	ICP				
14689	ND						
14690	ND						
14691	ND						
14692	ND						
0.250 std	0.248		99.2%				
0.500 std	0.498		99.6%				
15966	ND		logged in under RCRA8	0.250	0.252	100.8	
14208 rev	2.8	mg/kg	MDL = 0.25				
17521	0.50	mg/kg					
17293	0.04	mg/l					
17519	3.1	mg/kg					
17520	0.04	mg/l					
17331	0.50	mg/kg					
17309	0.82			0.433	0.417	96.3	.391 3.2R
17535	0.30						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Cd, Cd-N ③

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 15:30
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.01

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.010 std	0.010	mg/l	100.0%				
0.250 std	0.249		99.6%				
0.500 std	0.498		99.6%				
1.00 std	1.00		100.0%				
EPA 283	0.611		TV = 0.650 94.0%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

FOR CLP USE ONLY:

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Pb, Pb-N

①

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 20:30
CALCULATED BY: Meg
DATA REVIEWED BY: Rer
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.1 mg/l

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.: 4.0
ABS: 0.12
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.100 std	0.090	mg/l	90.0%				
1.00 std	0.989		98.9%				
2.00 std	2.01		100.5%				
4.00 std	3.94		98.5%				
EPA 283	3.90		T.V=4.00 97.5%				
Blank-ICP	0.049						
	0.050		ND				
	0.045						
Blank	0.049						
	0.028		ND				
	0.002						
13061	7.3	mg/kg	ICP MDL=2.5				
13063	15			4.61	4.19	90.8	4.12 0.08R
13412	7.9			4.32	3.62	83.8	3.47 2.1R
14686	ND	mg/l	MDL=0.1				
14687	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

ANALYSIS

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Pb, Pb-N ②

DATE ANALYZED: 5-9-90
ANALYZED BY: MKG
TIME: 20:30
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.1

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
14688	ND	mg/l	ICP MDL = 0.1				
14689	ND						
14690	ND						
14691	ND						
14692	ND						
1.00 std	0.968		96.8%				
2.00 std	2.03		101.5%				
15966	ND		logged under RCRA 8	1.03	1.03	100.0	1.07 1.9 RPD
17521	43	mg/kg	MDL = 2.5				
17531	13	mg/kg					
17532	63						
17570	9.4						
17572	11						
17573	12						
17574	42						
17575	5.5						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Pb, Pb-N

③

DATE ANALYZED: 5-9-90

ANALYZED BY: MKG

TIME: 20:30

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

MDL 0.1 mg/l

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
17576	26	mg/kg					
17577	26			5.05	4.56	90.3	4.82 2.8
1.00 std	1.00	mg/l	100.0%				
2.00 std	1.99		99.5%				
4.00 std	4.00		100.0%				
17468	2,500	mg/kg	MDL = 2.5				
17470	57						
17519	13,000						
17520	0.28	mg/l	MDL = 0.1				
17533	15	mg/kg	MDL = 2.5				
17534	11						
17535	4.2						
17536	13						
17537	6.3						
17557	6.0						
17558	12			4.46	3.91	86.2	4.04

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Pb, Pb-N ④

DATE ANALYZED: 5-9-90

ANALYZED BY: MKG

TIME: 20:30

CALCULATED BY: Meg

DATA REVIEWED BY:

ENTERED BY: Meg

INSTRUMENT ID # 3

MDL 0.1 mg/l

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
0.100 std	0.096	mg/l	96.0%				
1.00 std	0.980		98.0%				
2.00 std	2.00		100.0%				
4.00 std	4.02		100.5%				
EPA 283	3.95		TV=4.00 98.8%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Ni

DATE ANALYZED: 5-7-90
ANALYZED BY: TEM
TIME: 14:00
CALCULATED BY: Meg
DATA REVIEWED BY: Meg
ENTERED BY: Meg
INSTRUMENT ID #

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

MDL 0.05

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
17145	ND	mg/l					
17146	0.59						
17147	ND						
17148	0.46			1.23	1.25	101.6	1.22
17149	0.23						
17168	ND						
17285	ND						
17286	ND						
17287	ND						
17288	0.08						
14686	ND		entered under Ni-N				
14687	ND						
14688	ND						
14689	ND						
14690	ND			1.00	1.04	104.0	1.02
14691	ND						
14692	ND						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

38 WPPLABFM pg 1

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Ni

DATE ANALYZED: 5-7-90

ANALYZED BY: TEM

TIME: 14:00

CALCULATED BY: Meg

DATA REVIEWED BY: Meg

ENTERED BY: Meg

INSTRUMENT ID #

MDL 0.05

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.:

ABS:

R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
blank	0.012	mg/l					
blank	0.008		0.007=ND				
blank	ND						
16934	0.28						
13212	1.026	mg/kg	MDL= 1.3 mg/kg				
13213	15						
16390	5.15	μg	MDL= 2.5 μg				
16391	5.60						
16392	8.35						
16393	ND						
16758	0.82	mg/l					
16759	4.5						
16023	0.20			1.10	1.13	102.7	
16814	1.1			1.10	1.13	102.7	
16935	0.41						
17127	0.12						

A - Analytical spike or duplicate
M - Matrix spike or duplicate

4/26/90 MR 16:05

Entered 4/26/90 LMR

```
        PROGRAM 2   Se   Furnace #2

SAMPLE              CONC        %RSD   MEAN                        READINGS
                    ug/L               ABS

BLANK                 0.0              0.000      -0.001      0.001
STANDARD 1           12.5        9.2   0.084       0.090      0.079
TANDARD 2            25.0        5.6   0.164       0.157      0.170
TANDARD 3            50.0        0.9   0.290       0.292      0.288
EPA 378 28.0         33.1 118%   3.7   0.209       0.215      0.204
5.00                  4.4        7.1   0.029       0.031      0.028
 3721            ND  -0.7 mg/L  15.7  -0.004      -0.004     -0.005
13721A TV=20.0       19.3 96%    2.2   0.128       0.126      0.130
13722            ND  -0.7 mg/L  99.9  -0.004      -0.001     -0.008
 3723            ND  -0.7        0.0  -0.005      -0.005     -0.005
 3724            ND  -0.2       99.9  -0.001       0.000     -0.003
13725            ND   1.2       99.9   0.008       0.002      0.014
 3726            ND  -0.9        0.0  -0.006      -0.006     -0.006
 3726A TV>20.0       12.7 64%    0.8   0.085       0.085      0.086
13727            ND  -1.2 mg/L  35.3  -0.008      -0.010     -0.006
14686            ND  -0.3       70.7  -0.002      -0.001     -0.003
 4687            ND  -0.5       20.2  -0.003      -0.004     -0.003
25.0                 22.3        2.8   0.147       0.144      0.150
EPA 378 28.0         29.2 104%   1.5   0.188       0.186      0.190
 4688            ND  -0.8 mg/L  12.8  -0.005      -0.005     -0.006
 4689            ND  -0.5       20.2  -0.003      -0.003     -0.004
14689A TV=20.0       12.1 60%    4.3   0.082       0.079      0.084
~~14689DA~~ 14690    ND  -0.7 mg/L  28.2  -0.005      -0.004     -0.006
 4691            ND  -0.4       94.2  -0.003      -0.001     -0.005
14692            ND  -0.6        0.0  -0.004      -0.004     -0.004
14788            ND   0.2       99.9   0.001      -0.001      0.004
 4789            ND  -0.7        0.0  -0.005      -0.005     -0.005
 4839            ND   0.1       99.9   0.000      -0.002      0.003
14839A TV=20.0       15.4 77%    2.0   0.103       0.105      0.102
 4840            ND  -0.4 mg/L   0.0  -0.003      -0.003     -0.003
 4841            ND   0.0       99.9   0.000       0.000      0.000
14842            ND  -0.6       99.9  -0.004       0.000     -0.008
25.0                 21.5        1.9   0.142       0.140      0.144
EPA 378 28.0         29.8 106%   1.4   0.191       0.189      0.193
14843            ND  -0.2 mg/L  99.9  -0.001      -0.003      0.000
14864                -0.9       23.5  -0.006      -0.005     -0.007 }
 4864A TV=20.0        1.0       97.9   0.006       0.002      0.011 }
 4864DA               0.1       99.9   0.001      -0.001      0.003 }
14866                -0.7       15.7  -0.004      -0.005     -0.004 }
14868                -0.4       47.1  -0.003      -0.004     -0.002 }
 4870                -0.3       70.7  -0.002      -0.003     -0.001 }
14874                -0.4       99.9  -0.002      -0.005      0.000 } Rerun at 2x or 5x
14876                -0.4       99.9  -0.002      -0.005      0.000 }
14876A TV=20.0        1.3       24.9   0.009       0.007      0.010 }
14878                -0.4       47.1  -0.003      -0.004     -0.002 }
14880                -0.1       99.9  -0.001       0.000     -0.002 }
14689DA TV>20.0      12.1 60%   10.3   0.082       0.088      0.076
EPA 378 28.0         30.1        1.4   0.193       0.191      0.195
5.00                  3.3       21.9   0.022       0.026      0.019
```

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Ba

DATE ANALYZED: 5-8-90
ANALYZED BY: TEM
TIME: 9:45
CALCULATED BY: Meg
DATA REVIEWED BY:
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.2 mg/l

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
14687	ND	mg/l		5.00	5.10	102.0	5.19 0.87 RP
14688	ND						
14689	ND						
14690	ND						
14691	0.2						
14692	ND			2.50	2.66	106.4	2.63 0.57 RP
15966	ND		listed under subset RCRA-8	2.50	2.60	104.0	
0.2 std	0.23		115.0%				
2.5 std	2.58		103.2%				
5.0 std	5.16		103.2%				
10.0 std	10.24		102.4%				
EPA 686	10.18		101.8%				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Ba and Ba-N

DATE ANALYZED: 5-8-90
ANALYZED BY: TEM
TIME: 9:45
CALCULATED BY: Meg
DATA REVIEWED BY: Meg
ENTERED BY: Meg
INSTRUMENT ID # 3

MDL 0.2 mg/l

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.:
ABS:
R FACTOR:

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
0.2 std	0.21	mg/l	~~95.2%~~ 105.0%				
2.5 std	2.61	|	104.4 %				
5.0 std	5.04	|	100.8 %				
10.0 std	10.21	|	102.1%				
EPA 686	10.06	|	TV=10.00 100.6%				
Blank	ND	|					
Blank	ND	|					
Blank	ND	|					
15044	1.0	|					
Blank-ICP	ND	|					
Blank-ICP	ND	|					
Blank-ICP	ND	|					
13061	20	mg/kg	MDL = 5.0				
13063	100	|	|				
13412	27	|					
14686	ND	mg/l					

A - Analytical spike or duplicate
M - Matrix spike or duplicate

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): Pace Labs

CHAIN OF CUSTODY RECORD

PROJECT №: 2853

PROJECT NAME: Ford - Site C

SAMPLER'S SIGNATURE Jon M (SIGN)

~~SEQ. №~~	SAMPLE №.	~~DATE~~	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
W-	041990-JM	-01	14686		Water	4	See Below:
"	"	-02	87		↓	4	
"	"	-03	88			4	
"	"	-04	89			4	
"	"	-05	90			4	
"	"	-06	91			4	
"	"	-07	92			3	

Analyze For:

① VOC's via EPA Methods 601: 602, + cis-1,2, dichloroethylene + ethylacetate.

② As, Se, Hg via EPA atomic Absorption methods.

③ Ba, Cd, Cr, Cu, Pb, Ag, Zn, Ni via ICP analysis EPA method 6010.

* Call Jon Christofferson or Jon Michals for questions.

TOTAL NUMBER OF CONTAINERS 27

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 Jon M (SIGN)	4-19-90 1430	② (SIGN)
RELINQUISHED BY: 2 (SIGN)	DATE/TIME	RECEIVED BY: ③ (SIGN)
RELINQUISHED BY: 3 (SIGN)	DATE/TIME	RECEIVED BY: ④ (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT: Courrier (Pace)

SHIPPED BY:

RECEIVED FOR LABORATORY BY: (SIGN)

DATE/TIME

CONDITION OF SEAL UPON RECEIPT:

GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN)

DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 008930

MEMORANDUM

TO: Jon Christofferson REFERENCE NO.: 2853

FROM: David Dempsey DATE: June 7, 1990

RE: Data Quality Assessment and Validation for Seven Groundwater Samples Collected During the April 1990 Sampling Event at the Ford Site C Project Site

The following details a data quality assessment and validation for seven groundwater samples collected on April 19, 1990 at the Ford Site C Project Site. The samples were analyzed for site-specific parameters, namely, volatile organic compounds (VOC) and metals by Pace Laboratories, Inc. (Pace).[1] Quality assurance criteria were established by the analytical methods.[2]

Holding Time Periods

Holding time periods were established by the analytical methods and are summarized below:

VOC	-14 days from sample collection to completion of analysis
Metals	-6 months from sample collection to completion of analysis, except for mercury -28 days from sample collection to completion of analysis for mercury

As all samples met the above criteria, the data were found to be acceptable based upon the holding time periods.

Method Blank Samples

The potential for sample contamination through laboratory protocols was measured by means of method blank samples. The VOC method blank sample contained methylene chloride at a concentration of 1.42 μg/*l*. Methylene chloride data for samples

---

[1] Analytical methods were taken from 40 CFR Part 136 Appendix A and "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, revised March 1983 and are summarized below:

VOC	-601/602
Metals	-200 Series

[2] Application of quality assurance criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988 and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, July 1, 1988.

W-041990-JM-01, W-041990-JM-02 and W-041990-JM-03 were qualified as non-detect (U), as a result. Similarly, the metals method blank sample was found to contain analytes copper and zinc at concentrations of 0.023 mg/*l* and 0.05 mg/*l*, respectively. Sample W-041990-JM-06 had its copper datum qualified as non-detect (U), while no action upon the zinc data was required. Of interest was the fact that no method blank sample was reported for selenium. However, as all samples were reported to be free of selenium, no action upon the selenium data was necessary.

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was to be monitored via surrogate recoveries. To date, no surrogate data have been received from Pace. Therefore, matrix spike/matrix spike duplicate data were solely used to judge the VOC data.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy was monitored by MS/MSD analyses. An in-house sample at Pace underwent MS/MSD analyses for VOC. Therefore, direct application of these data was not possible. The method was shown to have been precise as the percent recoveries were within control limits established by Pace.

Sample W-041990-JM-04 underwent a matrix spike analysis for the metal analyte selenium, while sample W-041990-JM-06 had matrix spike analyses performed for metal analytes arsenic and zinc. All remaining metal analytes had matrix spike analyses performed upon in-house samples. Arsenic and selenium percent recoveries fell below the control limits set by Pace; therefore, the results for all samples for these analytes were qualified as estimated (UJ). As the percent recoveries for the remaining metals were within limits, the methods were shown to be accurate.

Laboratory Duplicate Analyses

The level of analytical precision for metals analyses was measured through laboratory duplicate analyses. The duplicate analysis for barium was performed upon sample W-041990-JM-02, while in-house samples at Pace were used for the remaining analytes duplicate analyses. Only lead analyses were shown to have an unacceptable level of precision. Therefore, all lead data were qualified as estimated (UJ).

Rinsate Sample

Cleanliness of sampling equipment was checked by collection of rinsate sample W-041990-JM-03. The only analyte detected within the sample was methylene chloride. However, this methylene chloride datum was qualified as non-detect (U) based upon the method blank sample. Therefore, the sampling equipment was properly cleaned prior to collection of samples.

Field Duplicate Samples

Overall precision of this sampling event was monitored by collection of field duplicate samples W-041990-JM-04 and W-041990-JM-05. Both samples were found to be free of all target analytes, indicating that an acceptable level of precision was achieved.

Overall Assessment

Methylene chloride data for sample W-041990-JM-01, W-041990-JM-02 and W-041990-JM-03 were qualified as non-detect (U) based upon method blank sample data. Metals analytes arsenic, lead and selenium had all results qualified as estimated (UJ). The remaining data were found to be acceptable for the quanitative assessment of analytes within the groundwater at the project site.

cc: Bruce Clegg

pace
INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

July 13, 1990

Waterloo File Copy

MN. FILE COPY

Rec'd CRA
JUL 20 90

Mr. Jon Christofferson
Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

RE: PACE Project No. 900607.552
2853

Dear Mr. Christofferson:

Enclosed is the report of laboratory analyses for samples received June 07, 1990.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Helen L Addie

Helen L.S. Addie
Project Manager

Enclosures

1710 Douglas Drive North
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3377

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REPORT OF LABORATORY ANALYSIS

Conestoga Rovers & Associates, Inc.
382 West County Road D
St. Paul, MN 55112

July 13, 1990
PACE Project
Number: 900607552

Attn: Mr. Jon Christofferson

2853

			RB	B3	B1
PACE Sample Number:			10 0219118	10 0219126	10 0219134
Date Collected:			06/06/90	06/06/90	06/06/90
Date Received:			06/07/90	06/07/90	06/07/90
Parameter	Units	MDL	W-060690-RF-01	W-060690-RF-02	W-060690-RF-03
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.006	ND	0.18	0.060
Cadmium	mg/L	0.006	ND	ND	ND
Chromium	mg/L	0.010	ND	ND	ND
Copper	mg/L	0.005	ND	ND	ND
Lead	mg/L	0.045	ND	ND	ND
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.021	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.005	ND	ND	ND
Zinc	mg/L	0.006	0.024	0.019	ND
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Date Analyzed			06/14/90 F	06/14/90 F	06/14/90 F
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.5	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.5	ND	ND	ND
Vinyl chloride	ug/L	1.5	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	ND
Trichlorofluoromethane	ug/L	0.4	ND	ND	ND
1,1-Dichloroethylene	ug/L	0.3	0.6	ND	ND
1,1-Dichloroethane	ug/L	0.2	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND	ND	ND
Chloroform	ug/L	0.5	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

REPORT OF LABORATORY ANALYSIS

Mr. Jon Christofferson
Page 2

July 13, 1990
PACE Project
Number: 900607552

2853

PACE Sample Number:			10 0219118	10 0219126	10 0219134
Date Collected:			06/06/90	06/06/90	06/06/90
Date Received:			06/07/90	06/07/90	06/07/90
Parameter	Units	MDL	W-060690-RF-01	W-060690-RF-02	W-060690-RF-03
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
1,2-Dichloroethane	ug/L	0.2	ND	ND	ND
1,1,1-Trichloroethane	ug/L	0.5	6.9	ND	ND
Carbon tetrachloride	ug/L	0.3	ND	ND	ND
Bromodichloromethane	ug/L	0.2	ND	ND	ND
1,2-Dichloropropane	ug/L	0.2	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND	ND	ND
Benzene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	2.8	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	4.0	ND	ND	ND
cis-1,2-Dichloroethylene	ug/L	0.5	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Christofferson
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July 13, 1990
PACE Project
Number: 900607552

			B6	B6 Dup	upstrem
PACE Sample Number:			10 0219142	10 0219150	10 0219169
Date Collected:			06/06/90	06/06/90	06/06/90
Date Received:			06/07/90	06/07/90	06/07/90
Parameter	Units	MDL	W-060690-RF-04	W-060690-RF-05	W-060690-RF-06
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Arsenic	mg/L	0.002	ND	ND	ND
Barium	mg/L	0.006	0.073	0.083	0.058
Cadmium	mg/L	0.006	ND	ND	ND
Chromium	mg/L	0.010	ND	ND	ND
Copper	mg/L	0.005	ND	ND	ND
Lead	mg/L	0.045	ND	ND	ND
Mercury	mg/L	0.0002	ND	ND	ND
Nickel	mg/L	0.021	ND	ND	ND
Selenium	mg/L	0.005	ND	ND	ND
Silver	mg/L	0.005	ND	ND	ND
Zinc	mg/L	0.006	0.007	0.006	0.009
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Date Analyzed			06/14/90 F	06/14/90 F	06/14/90 F
Chloromethane	ug/L	1.0	ND	ND	ND
Bromomethane	ug/L	1.5	ND	ND	ND
Dichlorodifluoromethane	ug/L	1.5	ND	ND	ND
Vinyl chloride	ug/L	1.5	ND	ND	ND
Chloroethane	ug/L	1.0	ND	ND	ND
Methylene chloride	ug/L	1.0	ND	ND	1.0
Trichlorofluoromethane	ug/L	0.4	ND	ND	ND
1,1-Dichloroethylene	ug/L	0.3	ND	ND	ND
1,1-Dichloroethane	ug/L	0.2	ND	ND	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND	ND	ND
Chloroform	ug/L	0.5	ND	ND	ND
1,2-Dichloroethane	ug/L	0.2	ND	ND	ND
1,1,1-Trichloroethane	ug/L	0.5	ND	ND	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

REPORT OF LABORATORY ANALYSIS

Mr. Jon Christofferson
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July 13, 1990
PACE Project
Number: 900607552

2853

PACE Sample Number: Date Collected: Date Received: Parameter	Units	MDL	10 0219142 06/06/90 06/07/90 W-060690- RF-04	10 0219150 06/06/90 06/07/90 W-060690- RF-05	10 0219169 06/06/90 06/07/90 W-060690- RF-06
ORGANIC ANALYSIS					
PURGEABLE HALOCARBONS AND AROMATICS					
Carbon tetrachloride	ug/L	0.3	ND	ND	ND
Bromodichloromethane	ug/L	0.2	ND	ND	ND
1,2-Dichloropropane	ug/L	0.2	ND	ND	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND	ND	ND
1,1,2-Trichloroethylene	ug/L	0.5	0.5	0.6	ND
Benzene	ug/L	1.0	ND	ND	ND
Dibromochloromethane	ug/L	1.0	ND	ND	ND
1,1,2-Trichloroethane	ug/L	1.0	ND	ND	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND	ND	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND	ND	ND
Bromoform	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND	ND	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND	ND	ND
Toluene	ug/L	1.0	ND	ND	ND
Chlorobenzene	ug/L	1.0	ND	ND	ND
Ethyl benzene	ug/L	1.0	ND	ND	ND
1,3-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,2-Dichlorobenzene	ug/L	4.0	ND	ND	ND
1,4-Dichlorobenzene	ug/L	4.0	ND	ND	ND
cis-1,2-Dichloroethylene	ug/L	0.5	5.5	5.5	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Christofferson
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July 13, 1990
PACE Project
Number: 900607552

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Parameter	Units	MDL	
PACE Sample Number:			10 Downstream 0219177
Date Collected:			06/06/90
Date Received:			06/07/90
			W-060690-RF-07
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Arsenic	mg/L	0.002	ND
Barium	mg/L	0.006	0.055
Cadmium	mg/L	0.006	ND
Chromium	mg/L	0.010	ND
Copper	mg/L	0.005	ND
Lead	mg/L	0.045	ND
Mercury	mg/L	0.0002	ND
Nickel	mg/L	0.021	ND
Selenium	mg/L	0.005	ND
Silver	mg/L	0.005	ND
Zinc	mg/L	0.006	ND
ORGANIC ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
Date Analyzed			06/14/90 F
Chloromethane	ug/L	1.0	ND
Bromomethane	ug/L	1.5	ND
Dichlorodifluoromethane	ug/L	1.5	ND
Vinyl chloride	ug/L	1.5	ND
Chloroethane	ug/L	1.0	ND
Methylene chloride	ug/L	1.0	ND
Trichlorofluoromethane	ug/L	0.4	ND
1,1-Dichloroethylene	ug/L	0.3	ND
1,1-Dichloroethane	ug/L	0.2	ND
trans-1,2-Dichloroethylene	ug/L	0.3	ND
Chloroform	ug/L	0.5	ND
1,2-Dichloroethane	ug/L	0.2	ND
1,1,1-Trichloroethane	ug/L	0.5	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

REPORT OF LABORATORY ANALYSIS

Mr. Jon Christofferson
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July 13, 1990
PACE Project
Number: 900607552

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Parameter	Units	MDL	PACE Sample Number: 10 0219177 Date Collected: 06/06/90 Date Received: 06/07/90 W-060690-RF-07
ORGANIC ANALYSIS			
PURGEABLE HALOCARBONS AND AROMATICS			
Carbon tetrachloride	ug/L	0.3	ND
Bromodichloromethane	ug/L	0.2	ND
1,2-Dichloropropane	ug/L	0.2	ND
cis-1,3-Dichloro-1-propene	ug/L	0.5	ND
1,1,2-Trichloroethylene	ug/L	0.5	ND
Benzene	ug/L	1.0	ND
Dibromochloromethane	ug/L	1.0	ND
1,1,2-Trichloroethane	ug/L	1.0	ND
trans-1,3-Dichloro-1-propene	ug/L	0.3	ND
2-Chloroethylvinyl ether	ug/L	5.0	ND
Bromoform	ug/L	1.0	ND
1,1,2,2-Tetrachloroethane	ug/L	1.0	ND
1,1,2,2-Tetrachloroethylene	ug/L	1.0	ND
Toluene	ug/L	1.0	ND
Chlorobenzene	ug/L	1.0	ND
Ethyl benzene	ug/L	1.0	ND
1,3-Dichlorobenzene	ug/L	4.0	ND
1,2-Dichlorobenzene	ug/L	4.0	ND
1,4-Dichlorobenzene	ug/L	4.0	ND
cis-1,2-Dichloroethylene	ug/L	0.5	ND

MDL	Method Detection Limit
ND	Not detected at or above the MDL.

Mr. Jon Christofferson
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July 13, 1990
PACE Project
Number: 900607552

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

Starla Enger

Starla Enger
Inorganic Chemistry Manager

Liesa Shanahan

Liesa A. Shanahan
Organic Chemistry Manager

CONESTOGA-ROVERS & ASSOCIATES
382 West County Road D
St. Paul, Minnesota 55416

ANALYTICAL REPORT SUBMISSION CHECK LIST

Date Samples Received 6/7/90

Date Report Sent to CRA ____________

Method
☐ Overnight
☐ Regular Mail
☐ Fax
☐ Other ____________

Items Included

1. ✓ Summary List of Samples Analyzed
2. ✓ Date of Sample Receipt
3. NA Date of Sample Extraction
4. ✓ Date of Sample Analysis
5. ✓ Method Blank Data for all Parameters
6. ✓ Matrix Spike Recoveries
7. ✓ Matrix Spike Duplicate Recoveries
8. ✓ QC Check Sample Data
9. ✓ Surrogate Spike Recoveries

All samples extracted and analyzed within specified holding times:

☑ Yes ☐ No

If no is checked please list CRA sample IDs of any samples that exceeded their holding times.

Lab ____________ Check List Completed by MKG

CRA USE ONLY

Date Received ____________ Complete: ☐ Yes ☐ No

Received by ____________ Copies to ____________

PACE LABORATORIES, INC.

SUBSET ABBREVIATION: 465C

SAMPLE NO: _______._

PAGE 2

UNITS: ug/L

PARAMETER NAME	ABBREV	MDL	Calib Std DATE: DIL: INST:	True Value DATE: DIL: INST:	Method Blank FINAL RESULTS
Dichloroacetonitrile	DCACETONIT	1.0	80.6	80.0	ND
2,3-Dichloro-1-propene	23DCPENE	0.5	19.3	20.0	
1,2-Dichloropropane	12DCPANE	0.2	19.2		
1,1-Dichloro-1-propene	11DCPENE	1.0	17.9		
cis-1,3-Dichloro-1-propene	CIS13DCP	0.5	19.2		
1,1,2-Trichloroethylene	TCE	0.5	19.0		
Benzene	BENZENE	1.0	18.5		
1,3-Dichloropropane	13DCPANE	0.6	18.2		
)ibromochloromethane	DBCMETHANE	1.0	18.7		
,1,2-Trichloroethane	112TCEANE	1.0	19.0		
rans-1,3-Dichloro-1-propene	TRANS13DCP	0.3	19.2		
,2-Dibromoethane	EDB	4.0	18.7		
-Chloroethylvinyl ether	2CEVETHER	5.0	—		
romoform	BROMOFORM	1.0	18.1		
,1,1,2-Tetrachloroethane	1112TTEANE	0.3	17.8		
ethyl isobutyl ketone	MIBK	1.0	18.3		
,2,3-Trichloropropane	123TCPANE	4.0	18.7		
,1,2,2-Tetrachloroethane	1122TTEANE	1.0	18.2		
,1,2,2-Tetrachloroethylene	1122TTEENE	1.0	19.5		
entachloroethane	PENTACEANE	2.0	18.1		
oluene	TOLUENE	·1.0	18.5		
hlorobenzene	CHLOROBENZ	1.0	18.5		
thyl benzene	ETHYLBENZ	1.0	18.6		
umene	CUMENE	1.0	17.8		
-Xylene	M-XYLENE	1.0	18.6		
-Xylene	P-XYLENE	1.0	17.7		
-Xylene	O-XYLENE	1.0	17.8		
,3-Dichlorobenzene	13DCBENZ	4.0	19.8		
,2-Dichlorobenzene	12DCBENZ	4.0	19.6		
,4-Dichlorobenzene	14DCBENZ	4.0	19.8		
ichlorofluoromethane	FREON21	1.0	17.9		

DKS
6/24/90

COMMENTS: CH_3Cl high - watch for trend.

DATE: 08/22/89

DAILY HATRIX SPKIE/HATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601, 602, 4658
INSTRUHENT: F
STANDARD: A
SAHPLE SPIKED: 21699
SAHPLE HATRIX: WATER

FILE HUHBER:
PREPED BY:
DAJE PREPED:
ANALYZED BY: LJH
DATE ANALYZED 6-14-90

CLIENT NAHE:
PROJECT NAHE:
PROJECT NUHBER:

Compound	True Value	Sample Result	HS	% REC	HSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
Chloromethane	20.0	ND	38.7.	194	31.5	158	20.4		30%	21699
Bromomethane			21.0	105	19.7	99	5.9		30%	21700
Vinyl Chloride			24.2	121	22.7	114	6.0		30%	21701
Chloroethane			27.1	136	26.2	131	3.7		30%	21702
Hethylene Chloride			20.1	101	18.7	94	7.2	136 - 33	30%	21703
1,1-Dichloroethylene			24.2	121	23.2	116	4.2	159 - 24	30%	21704
1,1-Dichloroethane			21.8	109	20.2	101	7.6	128 - 72	30%	21911
Chloroform			18.2	91	17.3	87	4.5	150 - 51	30%	21912
Carbon Tetrachloride			20.8	104	18.8	94	10.1	155 - 44	30%	21913
1,2-Dichloropropane			18.4	92	17.3	87	5.6	131 - 63	30%	21914
1,1,2-Trichloroethylene			17.2	86	15.7	79	8.5	128 - 61	30%	21915
Benzene			18.9	95	18.0	90	5.4	133 - 68	30%	21916
Dibromochloro Hethane	↓	↓	14.6	83	15.2	76	8.8	133 - 64	30%	21917

DAILY HATRIX SPKIE/HATRIX SPIKE DUPLICATE RECOVERY

ANALYSIS: 601, 602, 465B
INSTRUHENT: F
STANDARD: A
SAMPLE SPIKED: ~~[illegible]~~ 811099
SAMPLE HATRIX 610 WATER

FILE NUMBER:
PREPED BY:
DATE PREPED:
ANALYZED BY: LSH
DATE ANALYZED 6-14-90

CLIENT NAME:
PROJECT NAME:
PROJECT NUMBER:

Compound	True Value	Sample Result	MS	% REC	MSD	% REC	RPD	Accuracy Limits	Precision Limit	Associated Samples
1,1,2-Trichloroethane	20.0	ND	17.1	86	15.7	79	8.5		30%	
2-Chloroethylvinyl Ether	↓	—	—	—	—	—	—		30%	
Tetrachloroethylene		ND	19.0	95	16.8	84	12.3	132 - 55	30%	
Chlorobenzene			18.1	91	15.9	80	12.9	119 - 58	30%	
1,3-Dichlorobenzene			17.9	90	15.5	78	14.3	117 - 57	30%	
1,4-Dichlorobenzene	↓	↓	17.6	88	15.1	76	14.6	116 - 57	30%	

* Asterisked Value are outside QC limits.
RPD: VOAs ______ out of ____ outside of QC limits.
Recovery: VOAS ______ out of ____ outside of QC limits.
Blank:
Comments:

QC Reviewed by: RRL
DATE: 6/24/90

74HPPLAS

PACE LABORATORIES, INC.

SUBSET ABBREVIATION: 465C

SUBSET NAME: MDH VOLATILE ORGANICS-465C

DATE COLLECTED: ______

CLIENT NAME: ______

DATE RECEIVED: ______

PROJECT NUMBER: ______

MATRIX: ______

DATA REVIEWED BY: ______

DATE EXTRACTED/BY: ______

ENTERED BY: ______

INITIAL VOL: ______

SAMPLE NAME: 6-14-90-F

FINAL VOL: ______

SAMPLE NUMBER: Daily Calibration Check

ANALYZED BY: ______

PARAMETER NAME	ABBREV	UNITS: MDL	Calib Stds DATE: 6-14-90 DIL: INST: Ⓕ←Ⓓ	True Value DATE: DIL: INST:	Met Bl FIN RESU
Date Analyzed	465C DA		6-14-90		6-1
Chloromethane	CHLOROMETH	1.0	44.3	20.0	ND
Bromomethane	BROMOMETH	1.5	20.3		
Dichlorodifluoromethane	FREON12	1.5	25.3		
Vinyl chloride	VINYLCHLOR	1.5	22.6		
Chloroethane	CHLOROETH	1.0	21.7		
Methylene chloride	MECL	1.0	18.7		
Acetone	ACETONE	40	189	200	
Trichlorofluoromethane	FREON11	0.4	19.2	20.0	
Allyl chloride	ALLYL CHL	4.0	17.9		
1,1-Dichloroethylene	11DCEENE	0.3	19.2		
Tetrahydrofuran	THF	15	187	200	
1,1-Dichloroethane	11DCEANE	0.2	19.4	20.0	
trans-1,2-Dichloroethylene	TRANS12DCE	0.3	19.5		
cis-1,2-Dichloroethylene	CIS12DCE	0.5	19.2		
Ethyl ether	ETHYLETHER	0.3	17.5		
Chloroform	CHLOROFORM	0.5	19.4		
1,1,2-Trichlorotrifluoroethane	FREON113	0.7	18.3		
Methyl ethyl ketone	MEK	20	77.2	80.0	
1,2-Dichloroethane	12DCEANE	0.2	18.9	20.0	
Dibromomethane	DIBROMETH	1.5	17.8		
1,1,1-Trichloroethane	111TCEANE	0.5	19.5		
Carbon tetrachloride	CARBONTET	0.3	19.1		
Bromodichloromethane	BDCMETHANE	0.2	19.6		

COMMENTS:

PACE LABORATORIES, INC.

SUBSET ABBREVIATION: 465C

PAGE 2

SAMPLE NO: ________.__

ARAMETER NAME	ABBREV.	MDL	Calib Std UNITS: ug/L DATE: DIL: INST:	True Value DATE: DIL: INST:	Method Blank FINAL RESULTS
Dichloroacetonitrile	DCACETONIT	1.0	80.6	80.0	ND
,3-Dichloro-1-propene	23DCPENE	0.5	19.3	20.0	
,2-Dichloropropane	12DCPANE	0.2	19.2		
1,1-Dichloro-1-propene	11DCPENE	1.0	17.9		
is-1,3-Dichloro-1-propene	CIS13DCP	0.5	19.2		
,1,2-Trichloroethylene	TCE	0.5	19.0		
enzene	BENZENE	1.0	18.5		
3-Dichloropropane	13DCPANE	0.6	18.2		
bromochloromethane	DBCMETHANE	1.0	18.7		
,1,2-Trichloroethane	112TCEANE	1.0	19.0		
ans-1,3-Dichloro-1-propene	TRANS13DCP	0.3	19.2		
2-Dibromoethane	EDB	4.0	18.7		
-Chloroethylvinyl ether	2CEVETHER	5.0	—		
omoform	BROMOFORM	1.0	18.1		
,1,1,2-Tetrachloroethane	1112TTEANE	0.3	17.8		
ethyl isobutyl ketone	MIBK	1.0	18.3		
2,3-Trichloropropane	123TCPANE	4.0	18.7		
,1,2,2-Tetrachloroethane	1122TTEANE	1.0	18.2		
1,2,2-Tetrachloroethylene	1122TTEENE	1.0	19.5		
tachloroethane	PENTACEANE	2.0	18.1		
luene	TOLUENE	1.0	18.5		
lorobenzene	CHLOROBENZ	1.0	18.5		
yl benzene	ETHYLBENZ	1.0	18.6		
ene	CUMENE	1.0	17.8		
ylene	M-XYLENE	1.0	18.6		
ylene	P-XYLENE	1.0	17.7		
Xylene	O-XYLENE	1.0	17.8		
-Dichlorobenzene	13DCBENZ	4.0	19.8		
-Dichlorobenzene	12DCBENZ	4.0	19.6		
-Dichlorobenzene	14DCBENZ	4.0	19.8		
hlorofluoromethane	FREON21	1.0	17.9		

6/24/90

MENTS: CH_3Cl high - watch for trend.

DATE: 08/22/89

Surrogates

VOLATILE ORGANICS BY GC

INSTRUMENT: F

ANALYZED BY: LJH

STANDARD:

DATE ANALYZED: 6-14-90

SAMPLE MATRIX: WATER

	LAB SAMPLE NO.	FLUORO-BENZENE	#
01	DEXTRAS STD	9.5	
02	D 602 STD	10.0	
03	METHOD BLANK	10.1	
04	21911.8	10.1	
05	21912.6	9.9	
06	21913.4	9.8	
07	21914.2	10.1	
08	21915.0	9.5	
09	21916.9	9.3	
11	21917.7	9.5	
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Advisory QC Limits
± 20%

Sample = Fluorobenzene

Column to be used to flag recovery values
* Values outside of QC limits
D Surrogates diluted out

Project Name 900607552

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	Spiked Value	% Rec	Acc. Range	Sample A	Sample A Dup	RPD	RPD Rang
Arsenic	6/12/90	0.0	102	7.83	78	85-115	NA	NA	—	—
PACE Sample#				21915						
Mercury	6/21/90	ND	68	4.70	94	85-115	4.70	3.79	21	± 3
PACE Sample#				21913			21913			
Selenium	7/8/90	0.0	102	14.7	74	85-115	14.7	15.2	3.3	± 3
PACE Sample#				21916			21916			
Barium	7/11/90	ND	93	1.06	106	85-115	NA	NA	—	—
PACE Sample#				21917						
Cadmium	7/11/90	<0.006	92	1.05	105	85-115	NA	NA	—	—
PACE Sample#				21917						
Chromium	7/11/90	<0.010	96	1.06	106	85-115	NA	NA	—	—
PACE Sample#				21917						
Copper	7/11/90	<0.005	93	1.01	101	85-115	NA	NA	~~NA~~	—
PACE Sample#				21917						
Lead	7/11/90	<0.045	88	1.02	102	85-115	NA	NA	—	—
PACE Sample#				21917						

NA Not Analyzed
ND Not Detected at or above the method detection limit

Project Name ______________________________

SUMMARY OF INORGANIC ACCURACY AND PRECISION DATA

Parameter	Date of Analysis	Mthd Blk	Check Std. % Rec	Spiked Value	% Rec	Acc. Range	Sample A	Sample A Dup	RPD	RPD Rang
Nickel	7/11/90	<0.021	88	1.01	101	85-115	NA	NA	—	—
PACE Sample#				21917						
Siver	7/11/90	<0.005	94	0.637	64	85-115	NA	NA	—	—
PACE Sample#				21917						
Zinc	7/11/90	0.066	94	1.04	104	85-115	NA	NA	—	—
PACE Sample#				21917						
PACE Sample#										
PACE Sample#										
PACE Sample#										
PACE Sample#										
PACE Sample#										

NA Not Analyzed
ND Not Detected at or above the method detection limit

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): PACE LABS

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2853

PROJECT NAME: FORD

SAMPLER'S SIGNATURE Robert Field, Jr. (SIGN)

SEQ. Nº.	SAMPLE Nº.	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	~~REMARKS~~ ANALYSIS: SEE BELOW
	W-060690-RF-01			21911	WATER	4	601,602 VOC'S; METALS
	-02			12	WATER	4	601,602 VOC'S; METALS
	-03			13	WATER	4	601,602 VOC'S; METALS
	-04			14	WATER	4	601,602 VOC'S; METALS
	-05			15	WATER	4	601,602 VOC'S; METALS
	-06			16	WATER	3	601,602 VOC'S; METALS
	-07			17	WATER	4	601,602 VOC'S; METALS

NOTE: METALS SAMPLES W-060690-RF-01 THRU W-060690-RF-05 HAVE BEEN FIELD FILTERED. THE OTHER TWO SAMPLES (METALS) ARE NOT.

ANALYZE FOR:

① VOC VIA EPA METHODS 601, 602 & CIS-1,2 DICHLOROETHYLENE & ETHYLACETATE. CIS12DCE ETOACE

② As, Se, Hg. VIA EPA ATOMIC ABSORPTION METHODS.

③ Ba, Cd, Cr, Cu, Pb, Ag, Zn, Ni VIA ICP ANALYSIS. EPA METHOD 6010.

④ CALL JON CHRISTOFFERSON FOR QUESTIONS. 078912

TOTAL NUMBER OF CONTAINERS 27

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY: ① Robert Field, Jr. (SIGN)	DATE/TIME 6/7/90 | 12:00	RECEIVED BY: ② (SIGN)
RELINQUISHED BY: ② (SIGN)	DATE/TIME	RECEIVED BY: ③ (SIGN)
RELINQUISHED BY: ③ (SIGN)	DATE/TIME	RECEIVED BY: ④ (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT: HAND DELIVERED	SHIPPED BY: R. FIELD	RECEIVED FOR LABORATORY BY: (SIGN)	DATE/TIME 6/7/90 4:15
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 009000

Varian DS-15 AA-1275/1475 Report

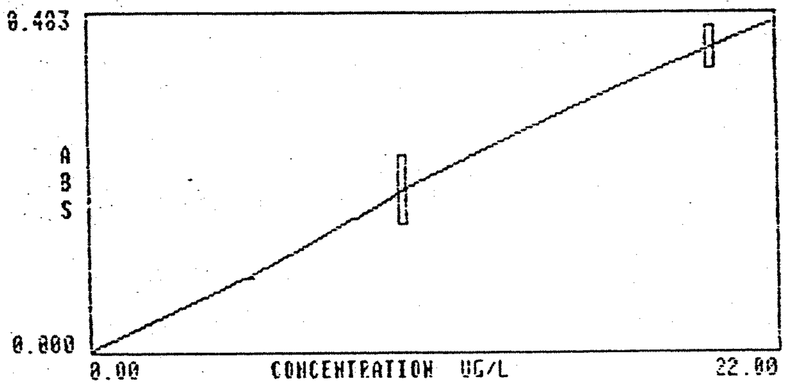
Pace Laboratory
1710 Douglas Drive   Minneapolis, MN 55422
(612) 544-5543

Calculated: 6/13/90 By: LMR/P
Entered: 6/13/90 By: PAS
Reviewed: / / By:

OPERATOR PAS
DATE 06-12-90 07:00
BATCH As FURNACE #2

PROGRAM 1 As FURNACE

SAMPLE	CONC UG/L	%RSD	MEAN ABS	READINGS	
BLANK	0.00		-0.072	-0.078	-0.066
STANDARD 1	5.00	0.0	0.108	0.108	0.108
STANDARD 2	10.00	9.9	0.235	0.218	0.251
STANDARD 3	20.00	6.2	0.440	0.420	0.459



MDL = 0.002 mg/L

EPA287 TV5.0	5.09 102%	7.7	0.110	0.116	0.104	
MDL 2.00PPB	1.64	17.9	0.035	0.040	0.031	
21171-D	13.97	8.8	0.319	0.339	0.299	Rerun 2x dilution low spk recovery
21171 AW-D	OVER	3.2	0.483	0.472	0.494	
21172-D	9.98	2.4	0.234	0.230	0.238	
21173-D	11.62	4.9	0.269	0.260	0.279	
21174-D	-0.14	47.1	-0.003	-0.002	-0.004	
PB 25X 5/31	-0.23	56.5	-0.005	-0.003	-0.007	MDL = 1.3 mg/kg
20976 25X 7.8	12.53 mg/kg	1.4	0.289	0.292	0.286	(12.53)(25)(5%)(1/1000) = 7.8
20977 25X 2.0	3.17 84%	9.2	0.069	0.073	0.064	(3.17)(25)(50%)(1/1000) = 2.0
20977 25X AS 13.2 TV=10.0	11.08 ~~110%~~	3.2	0.258	0.252	0.264	
20978 25X	OVER	1.0	0.675	0.680A	0.670A	
20978 25XMS	OVER	26.7	0.563	0.669A	0.456A	
20978 25XMSD	OVER	15.4	0.647	0.576A	0.717A	
EPA287 TV5.0	4.07 81%	0.0	0.088	0.088	0.088	
21866	0.07	99.9	0.001	0.003	0.000	
21868	0.07	99.9	0.001	0.005	-0.002	
21869	0.16	99.9	0.003	-0.003	0.010	
21870	-0.30	76.1	-0.006	-0.010	-0.003	
21870 AW TV=10.0	5.87 56%	7.7	0.128	0.126	0.131	

SAMPLE	CONC UG/L	%RSD	MEAN ABS	READINGS	
21870 DAW TV=10.0	5.60 56%	9.2	0.122	0.130	0.114
21911	ND -0.14 mg/L	99.9	-0.003	-0.006	0.000
21912	ND -0.25	38.5	-0.005	-0.004	-0.007
21913	ND 0.02	99.9	0.000	0.000	0.001
21914	ND -0.39	41.5	-0.009	-0.011	-0.006
21915	ND -0.30 ↓	54.3	-0.006	-0.009	-0.004
21915 AW TV=10.0	7.83 78%	0.7	0.177	0.178	0.176
21916	ND 0.39 mg/L	24.9	0.009	0.010	0.007
21917	ND 0.28 ↓	99.9	0.006	0.001	0.011
~~21267~~ EPA 287 TV=5.0	4.75 95%	4.8	0.102	0.106	0.099
21268	17.69	99.9	0.394	0.789A	0.000
21268 AW	-0.19	35.3	-0.004	-0.005	-0.003
~~21269 AW~~ 21158	-0.30	99.9	-0.006	0.000	-0.013
22346	ND -0.12 mg/L	99.9	-0.002	-0.006	0.001
22346 AW TV=10	8.58 86%	8.2	0.196	0.209	0.185
21786	ND -0.05 mg/L	99.9	-0.001	0.000	-0.002
21787	ND -0.35 ↓	9.4	-0.007	-0.008	-0.007
21787 AW TV=10	8.91 89%	2.0	0.205	0.202	0.208
~~10.0 PPB~~ 19617 5x	3.63	99.9	0.078	-0.005	0.162
~~EPA287 TV5.0~~ 19618 5x	4.65	99.9	0.100	-0.003	0.204
~~2.00 PPB~~ 19620 5x	1.55	99.9	0.033	-0.005	0.072
19620 5x AW TV=10	3.54	19.4	0.076	0.066	0.087
21171 Diss AW 2x TV=10	10.11	6.5	0.237	0.248	0.226
10.0 PPB	7.69	1.2	0.173	0.172	0.175
EPA 287 TV=5.0	3.63 73%	0.9	0.078	0.078	0.079

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Hg-u

DATE ANALYZED: 6-21-90
ANALYZED BY: CAT / JSM
TIME: 11:00
CALCULATED BY: CAT / JSM
DATA REVIEWED BY: MEG
ENTERED BY:
INSTRUMENT ID # 3

MDL 0.0002

CLIENT NAME:
PROJECT NUMBER:
PROJECT NAME.
FILE #:
DATE RECEIVED:
DATE COLLECTED:
HIGH STD. CONC.: 10
ABS: 0.230
R FACTOR: Linrey

Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
BLK	N.D	ug/L					
Std 0.2	0.22						
Std 1.00	0.96						
Std 3.00	3.05						
Std 5.00	5.13						
Std 7.00	7.00						
Std 10.00	9.42						
EPA	1.35		EPA 985	2.02		65	
EPA	2.52		EPA 283	2.50		101	
19111	N.D.	mg/L	0.0008 Leachate	5.00	0	0	
19797	ND			5.00	4.02	80	
19800	ND			5.00	4.83	97	
19863	ND			5.00	5.09	102	
19809	N.D			5.00 5.00	4.87 5.00	97 100	
19922	ND			5.00	4.48	90	
19923	ND			5.00	4.74	95	

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Hg-11

DATE ANALYZED: 6-21-90

ANALYZED BY: CAT/TEM

TIME: 11:00

CALCULATED BY: CAT/TEM

DATA REVIEWED BY:

ENTERED BY:

INSTRUMENT ID # 3

MDL 0.0002

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.: 10

ABS: 0.230

R FACTOR: Linreg

	Analysis			Spike Rec			
Sample	Results	Units	Comments	True	Found	% REC	Duplicate
Std 5	4.83	ug/L					
20230	ND	mg/L	0.0008 Leachate	5.00	4.74	95	
20231	ND			5.00	4.79	96	
20232	ND			5.00	4.61	92	
20277	0.0009 ~~0.22~~			2.50	2.09	84	
22333	ND		0.0002				
22588	ND						
22898	ND			5.00 5.00	4.53 4.92	91 98	
23361 ~~22898~~	ND						
23362	ND						
23363	ND						
23364	ND		0.				
23139	ND						
20823	ND						
EPA	1.53	ug/L	EPA 989	2.02		76	
20824	0.002	mg/L	0.0002				

A - Analytical spike or duplicate
M - Matrix spike or duplicate

ANALYSIS:

FOR CLP USE ONLY? ☐

ATOMIC ABSORPTION ELEMENT

ABBREVIATION Hg-u

DATE ANALYZED: 6-21-90

ANALYZED BY: CAT/TEM

TIME: 11:00

CALCULATED BY: CAT/TEM

DATA REVIEWED BY:

ENTERED BY:

INSTRUMENT ID # 3

MDL 0.0002

CLIENT NAME:

PROJECT NUMBER:

PROJECT NAME.

FILE #:

DATE RECEIVED:

DATE COLLECTED:

HIGH STD. CONC.: 10

ABS: 0.230

R FACTOR: Linreg

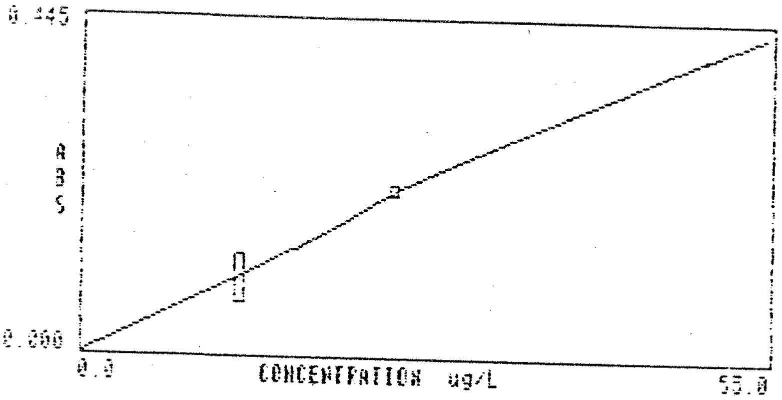
Sample	Analysis			Spike Rec			Duplicate
	Results	Units	Comments	True	Found	% REC	
20825	0.0018	mg/L	0.0002	5.00	3.73	75	
std 5	4.48	µg/L					
20826	0.0020	mg/L	0.0002				
20829	0.0007						
21911	ND						
21912	ND			~~5.00~~	~~4.70~~	~~94~~	
21913	ND			5.00	3.79	76	
21914	ND						
21915	ND						
21916	ND						
21917	ND						
BLK	ND						
BLK	ND						
EPA	1.52	µg/L	EPA 989	2.02		75	

A - Analytical spike or duplicate
M - Matrix spike or duplicate

LmR 7/8/90 12:50   Entered 7/9/90 LmR

```
 PROGRAM 2   Se  Furnace #2
SAMPLE               CONC      %RSD   MEAN               READINGS
                     ug/L             ABS

BLANK                  0.0            0.002      0.004      0.000
STANDARD 1            12.5       7.5  0.102      0.097      0.108
STANDARD 2            25.0       1.5  0.222      0.219      0.224
STANDARD 3            50.0       0.0  0.405      0.405      0.405
```



MDL=0.005 mg/L

```
EPA 378 28.0           28.7 102%   0.2  0.250      0.250      0.251
5.00                    4.7        1.8  0.039      0.039      0.038
021269.5 50X       ND  -0.2 mg/L  99.9 -0.001      0.002     -0.005 MDL=0.25
021269.5AW TV=20.0     20.3 102%   6.0  0.175      0.167      0.182
022361.7           ND  -0.5 mg/L  35.3 -0.004     -0.003     -0.005
022362.5           ND   0.2 |     99.9  0.002      0.004      0.000
022363.3           ND   0.1 |     99.9  0.000      0.000      0.001
022364.1           ND   0.7 |     12.8  0.005      0.005      0.006
021911.8           ND   0.5 ↓     35.3  0.004      0.005      0.003
021911.8AW TV=20.0     23.6 118%   4.0  0.207      0.201      0.213
021912.6           ND  -0.9 mg/L  40.4 -0.007     -0.005     -0.009
021913.4           ND  -0.4 |     99.9 -0.003      0.001     -0.007
021914.2           ND  -1.3 ↓     20.2 -0.011     -0.011     -0.009
25.0                   23.3        3.8  0.205      0.199      0.210
EPA 378 28.0           27.3 98%    2.7  0.240      0.235      0.245
021915.0           ND  -1.5 mg/L  35.3 -0.012     -0.009     -0.015
021916.9           ND  -0.7 ↓     47.1 -0.006     -0.004     -0.008
021916.9AW TV=20.0     14.7 74%    8.1  0.122      0.129      0.115
021916.9DAW            15.2 76%   16.7  0.127      0.142      0.112
021917.7           ND  -0.9 mg/L  54.8 -0.007     -0.003     -0.012
022435.9           ND  -1.0       41.5 -0.009     -0.011     -0.006 }
022435.9AW              1.8       47.1  0.012      0.016      0.008 } Rerun at 5x dil
021726.7           ND  -1.0 mg/L   0.0 -0.008     -0.008     -0.008
021727.5           ND  -0.8 ↓     54.3 -0.006     -0.004     -0.009
021727.5AW TV=20.0     10.8 54%   11.9  0.088      0.081      0.096
022311.0               -0.2       99.9 -0.002      0.002     -0.006 }
022311.0AW TV=20.0      6.1 30%   31.1  0.050      0.039      0.061 } Rerun at 2x dil.
022313.7               -0.7       47.1 -0.006     -0.008     -0.004 }
25.0                   25.0        5.4  0.222      0.213      0.230
EPA 378 25.0           24.7 88%    0.3  0.218      0.219      0.218
023538.7               -0.4       54.5 -0.005
```

MN-COMP 0044150

```
SAMPLE              CONC      %RSD   MEAN              READINGS
                    ug/L             ABS

025588.2AW TV=20.0    4.7 24%  27.5   0.039     0.046     0.031
024144.0        ND  -0.2 mg/L  99.9  -0.001    -0.003     0.000
024144.0AW TV=20.0   21.7 108%   3.7   0.188     0.193     0.183
PB 6/28              -0.5      47.1  -0.004    -0.003    -0.006
023975.5             13.7       1.8   0.113     0.115     0.112 Rerun at 5x dil.
023975.5AW           16.4       4.6   0.138     0.142     0.133 16.4-13.7=2.7
023775.5DAW          16.8      14.0   0.141     0.155     0.127 16.8-13.7=3.1
25.0                 21.9       1.1   0.190     0.188     0.191
EPA 378 28.0         25.4 91%   3.4   0.224     0.230     0.219
5.00                  3.7       4.7   0.030     0.031     0.029
```

Meg
7-11-90
10:15
Jal. dated SWE

calc, entered Meg

INORGANIC DATA REPORT

(concentrations in [✓ mg/l] or mg/kg)

SAMPLE ID	Ba	Cd	Cr	Cu ☆	Pb	Ni	Ag	Zn				
1. 22046.9	DNR 0.086	0.007	0.031	0.12	0.085	ND	DNR ND	0.88				
2. 21911.8	ND	ND	ND	ND	ND	ND	ND	0.024				
3. 21912.6	0.18	ND	ND	ND	ND	ND	ND	0.019				
4. 21913.4	0.060	ND	ND	ND	ND	ND	ND	ND				
5. 21914.2	0.073	ND	ND	ND	ND	ND	ND	0.007				
6. 21915.0	0.083	ND	ND	ND	ND	ND	ND	0.006				
7. 21916.9	0.058	ND	ND	ND	ND	ND	ND	0.009				
8. 21917.7	0.055	ND	ND	ND	ND	ND	ND	ND				
9.												
10.												
11.												
12.												
13.												
14.												
15.												
16.												
17.												
18.												
19.												
20.												

BMQL = Below Method Quantitation Limit
MQL = Method Quantitation Limit
ND = Not Detected
mg/kg = ppm (parts-per-million)
ug/l = ppb (parts-per-billion)
< = Indicates concentration less than value detailed

MEMORANDUM

TO: Steve Mockenhaupt REFERENCE NO.: 2853
FROM: Dave Dempsey DATE: August 1, 1990
RE: Data Quality Assessment and Validation for Seven Groundwater Samples Collected during the June 1990 Sampling Event at the Ford Site C Site

The following details a data quality assessment and validation for seven groundwater samples collected on June 6, 1990, at the Ford Site C site. Samples were analyzed for volatile organic compounds (VOC) and metals by Pace Laboratories Inc. (Pace).[1] Quality assurance criteria were established by analytical methods.[2]

Holding Time Periods

Holding time periods are established in analytical methods and are summarized below:

VOC - 14 days from sample collection to completion of analysis

Metals- 6 months from sample collection to completion of analysis, except for mercury
- 28 days from sample collection to completion of mercury analysis

Reviewing analysis dates showed that all holding time periods were met.

Method Blank Sample

Laboratory contamination of samples was checked for with method blank samples. The VOC method blank sample contained no target analytes. However, zinc was detected at a concentration of 0.066 mg/*l* within metals method blank sample. Zinc data for samples W-060690-RF-01, W-060690-RF-02, W-060690-RF-04 through W-060690-RF-06 were qualified as non-detect (U).

Surrogate Compound Percent Recoveries

Individual sample results for VOC analyses were assessed using surrogate compound fluorobenzene recoveries. Examining the recoveries revealed that VOC Method 602 was in control. No surrogate compound was used to check the accuracy of Method 601. Hence, MS/MSD recoveries were used to assess Method 601 results.

---

[1] Analytical methods are taken from 40 CFR Part 136, Appendix A, and "Chemical Methods for Analysis of Water and Wastes", USEPA-600/4-79-020, Revised March 1983 and are summarized below:

VOC - 40 CFR 601/602
Metals - USEPA 200 Series

[2] Application of quality assurance criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988, and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses", July 1, 1988.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Effects upon the data due to matrix interference were checked via MS/MSD analyses. Pace sample 21699 underwent VOC MS/MSD analyses. As all percent recoveries fell within limits, the level of precision was acceptable.

Sample W-060690-RF-07 underwent matrix spike analysis for target metals. The silver percent recovery was low. Therefore, silver data were qualified as estimated (UJ) for all samples.

Laboratory Duplicate Analyses

Precision for metals analyses was measured by means of duplicate analyses. Samples W-060690-RF-03 and W-060690-RF-06 had duplicate analyses for analytes mercury and selenium, respectively. Precision for both were acceptable. No other duplicate analyses were performed by Pace, therefore, field duplicate samples were used to assess precision.

Rinsate Sample

Cleanliness of sampling equipment was checked with rinsate sample W-060690-RF-01. Target VOC detected were 1,1,1-trichloroethane, tetrachloroethene and 1,1-dichloroethene. As all investigative samples were free of these analytes, no action upon the data was necessary.

Zinc was also detected within this sample. However, the zinc datum was qualified as non-detect (U) based upon the method blank sample.

Field Duplicate Samples

Precision was measured by collecting field duplicate samples W-060690-RF-04 and W-060690-RF-05. As both sets of data were within limits of agreement, the precision was acceptable.

Overall Assessment

Silver data were qualified as estimated (UJ) for all samples, while five samples had zinc data qualified as non-detect (U). Remaining data are acceptable to quantitatively assess target analyte concentrations.

cc: Bruce Clegg

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY (RI/FS) WORK PLAN

Ford Motor Company
St. Paul, Minnesota

PRINTED ON

FEB 15 1991

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY (RI/FS) WORK PLAN

Ford Motor Company
St. Paul, Minnesota

August 1990
(Revised February 1991)
Ref. No. 2853

CONESTOGA-ROVERS & ASSOCIATES

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

February 15, 1991

Reference No. 2853

Mr. Jerome Amber
FORD MOTOR COMPANY
Suite 608
15201 Century Drive
Dearborn, Michigan 48120

Dear Mr. Amber:

RE: RI/FS Work Plan
Ford Motor Company
St. Paul, Minnesota

Please find enclose a revised copy of the subject report.

If you should have any questions, please do not hesitate to contact us.

Sincerely,

CONESTOGA-ROVERS, AND ASSOCIATES

Jon L. Christ

Jon L. Christofferson

JLC/kk
Enc.

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LIST OF PLANS

1.0 INTRODUCTION

The Ford Motor Company (Ford), Twin Cities Assembly Plant (Plant) is located in St. Paul, Minnesota, at 966 South Mississippi River Boulevard (Site). The Site complex includes buildings on both sides of Mississippi River Boulevard. Buildings east of Mississippi River Boulevard are located above the river bluff on the adjacent sand plains. The Site location is presented on Figure 1.1.

The Plant was originally used to manufacture glass over 50 years ago. Since then the Plant has been expanded several times and is used to assemble pick-up trucks.

At different times during the Plant's history prior to 1970, paint sludges/wastes were deposited in a relatively small area on Site property, west of Mississippi River Boulevard (Site C). This waste deposit was reported to U.S. EPA by Ford during the Superfund notification process. A hydrogeologic investigation was commissioned by Ford in 1981. Since that investigation was completed, additional earth fill has been placed over part of the waste fill. The area is now used as a parking lot for tractor trailer truck units. Excavated materials from two other sites (Sites A and B) were subsequently moved to Site C. The locations of the fill Sites are presented on Figure 1.2. The three fill sites (A, B and C) were subsequently consolidated by MPCA and listed (Class C) as the Ford Twin Cities Assembly Plant during 1983 - 1984 on the Minnesota Pollution Control Agency (MPCA) Permanent List of Priorities.

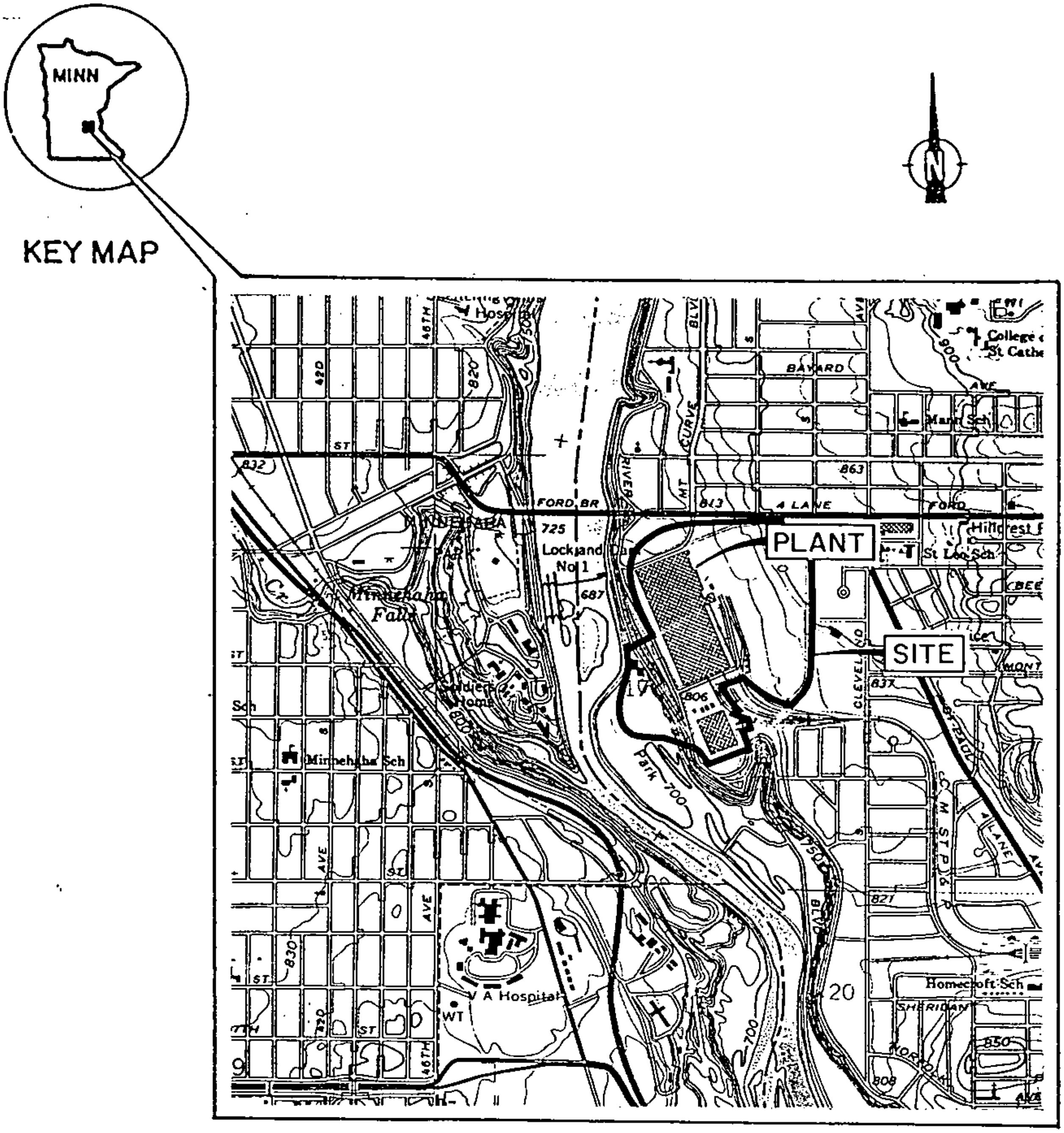
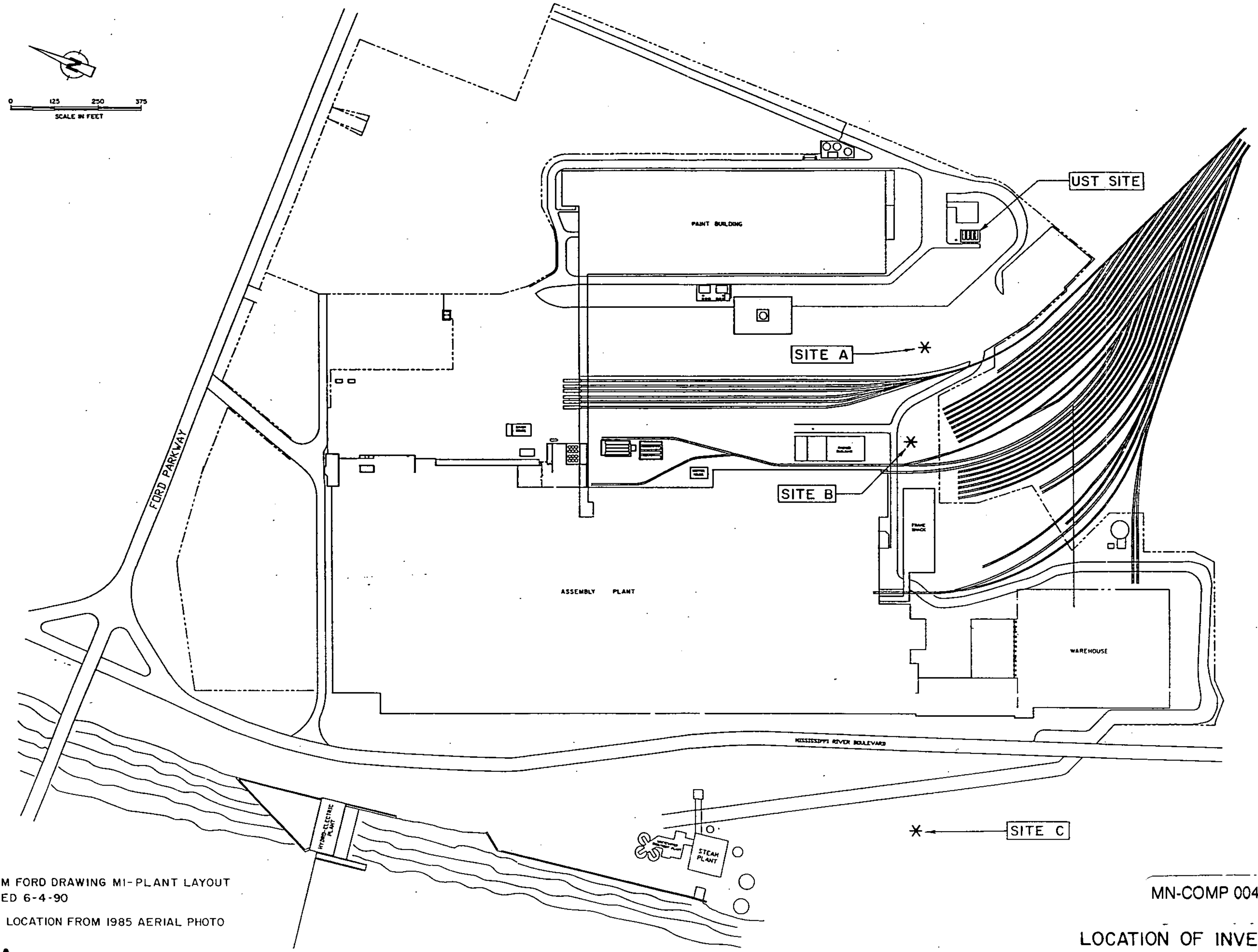


FIGURE 1.1
LOCATION PLAN
Ford Motor Company

CRA

2191-22/09/87-1-D-0



FROM FORD DRAWING MI-PLANT LAYOUT
DATED 6-4-90

* LOCATION FROM 1985 AERIAL PHOTO

CRA

2853-17/08/90-M

MN-COMP 0044575

figure 1.2
LOCATION OF INVESTIGATION AREAS
Ford Motor Company

To address environmental issues that may be associated with past waste handling and disposal practices, and to consolidate information related to past investigations, Ford hired Conestoga-Rovers and Associates (CRA) in 1987 to conduct an assessment of the wastes deposited at the Site. This assessment consisted of a file review, hydrogeologic evaluation, test hole excavation (test pits), stadia survey and waste characterization sampling. From these tasks an assessment and evaluation of the Site conditions was conducted and the results reported to MPCA during the fall of 1988.

Supplemental groundwater and surface water monitoring at Site C occurred during 1989 and 1990 at the request of MPCA.

During 1989, at the request of MPCA, a separate investigation was also conducted at the area designated Site B and subsequently reported to MPCA.

In order to formalize the investigation process, document the extensive work conducted to date and allow for a final decision regarding possible remedial action and/or delisting of the Site from the State's priority list, the MPCA notified Ford during April 1990 of its intention to issue a Request for Response Action (RFRA) for the Site. The RFRA requires Ford to plan and implement a Remedial Investigation and Feasibility Study (RI/FS) at the Site and report the results and recommendations to MPCA. The RFRA was issued on June 26, 1990.

Since the issuance of the RFRA, MPCA requested Ford on August 13, 1990, to incorporate the scope of work of a separate underground storage tank (UST) investigation being conducted at the Site, under the direction of MPCA's Hazardous Waste Division, into the scope of work for the RI/FS.

The UST Site is an underground storage tank facility used for storage of waste (spent) solvents pending shipment off-site for recycling. The USTs received waste regulated by the Resource Conversation and Recovery Act (RCRA). Figure 1.2 presents the location of the UST Site. A work plan outlining a proposed investigation to determine the nature, extent and magnitude of the possible solvent release from the UST Site was presented to MPCA on April 6, 1990. MPCA now requests the UST Site investigation to be made part of the RI/FS scope of work.

This report provides the Work Plan for the RI/FS and is submitted in accordance with the RFRA Section IV B and C of Exhibit A (RI/FS Work Plan Submittal and Contents). The purpose of this report is to:

1. Collect and assemble all existing information and data from work conducted to date at the Site.

2. Provide a list of remedial technologies and treatment alternatives to be evaluated by the RI/FS.

3. Provide a scope of field investigation work for the proposed RI/FS program.

4. Present a plan for project organization.

5. Provide a quality assurance and control plan in the RI/FS.

6. Present a plan for data management and retention of data and records.

7. Provide a summary of tasks to be conducted for a baseline risk assessment.

8. Provide a Site Security and Safety Plan.

9. Provide a plan to organize the flow of public information about the project.

10. Present a schedule for the RI/FS Work Plan tasks.

2.0 BACKGROUND AND SITE HISTORY

2.1 GEOGRAPHIC SETTING

The Site covers an area of approximately 130 acres in the City of St. Paul. It is bordered by the Mississippi River and its gorge to the west, Ford Parkway to the north, Cleveland Avenue to the east and Hampshire Avenue/Mississippi River Boulevard to the south. The Site and plant location are presented on Figure 1.1.

Elevations at the Site range from 690 feet AMSL at the river to 850 feet AMSL on the east side of the property. The main assembly building is at an elevation of 830 feet. The existing topography was developed by a sequence of erosional and depositional events related to the post glacial drainage development of the Mississippi River.

2.2 GENERAL GEOLOGY

Flanking the present river gorge are "terrace features" which consist of level "shoulders" of alluvial sediment which are perched above the present gorge. The Site area exhibits two of these features, one at approximately 830 feet AMSL and one at approximately 850 feet AMSL. These terraces represent alluvial deposits formed during the earliest stages of the Mississippi River's development. Separating this area of alluvial terrace deposits from the river gorge bottom is a vertical bedrock bluff. More recent alluvial deposits fill the gorge. The terrace and gorge alluvial deposits consist of primarily medium to coarse grained sand and gravel.

The bedrock underlying the site, and lining the bluff consists of relatively flat lying limestone, shale and sandstone. Bedrock formations which outcrop on the Site are listed in descending order of age as follows: the Decorah Shale, Platteville Formation (mostly limestone and minor shale), Glenwood Shale and St. Peter Sandstone. The Decorah Shale is described as greenish gray, thin bedded and clay rich. Geologic maps of the Site area, supported by past work performed by CRA, indicate that the shale is partially to mostly eroded away towards the river bluff. Underlying the Decorah Shale is the Platteville Formation which is composed of thin to medium bedded limestone containing minor interbeds of shale. The Platteville is underlain by the Glenwood Shale, a greenish gray, clay rich formation. The St. Peter Formation is a well sorted, medium grained sandstone.

2.3 SITE DISPOSAL HISTORY

The Plant began operation over 50 years ago and was originally used to manufacture glass. Since then the Plant has been expanded several times and is presently used to assemble pick-up trucks.

A file review was conducted by CRA to compile information related to the Plant's pre-1965 waste generation, disposal practices, investigations and activities on or near the Plant facilities. A summary of the file review information was presented in the report "Assessment of Fill Areas", October 1988, CRA. Plant files were reviewed on November 17, 1987. The MPCA files were reviewed on December 4, 1987. The majority of the information and correspondence in the Plant files is dated between and including the years 1980 and 1984. The information in the MPCA files is for the most part duplication of the Ford files with the addition of internal MPCA memos and reports.

Based on previous investigations and the RFRA, three areas at the plant have been identified as former fill sites. The sites have been designated as Site A, Site B and Site C and are shown on Figure 1.2.

During preparation of this work plan, aerial photographs were obtained and studied for the years 1945, 1956, 1958, 1962, 1983 and 1985. These photographs are enclosed under separate cover.

The aerial photograph for 1985 was utilized to summarize the extent of the past disposal at Sites A, B and C as could be determined from the study of the earlier aerial photographs. The areas delineated on the 1985 aerial photographs are based on observation of disturbed soil and vegetation on these earlier photographs and are, therefore, likely to be larger than the area used for actual disposal.

Following are subsections which describe the waste disposal history at Sites A, B and C.

2.3.1 Site A Disposal History

Site A was located at the south end of a former test track east of the assembly plant. Figure 2.1 illustrates the location of Site A. Paint sludges/wastes were deposited in the area from 1943 to 1960. This area was excavated in 1966 during a railroad car loading "tri-level" expansion. Sludge and earthen materials were deposited in the fill area known as Site C.

2.3.2 Site B Disposal History

The Site B is located west of Site A and was used for burning and burial of plant waste during the early Plant operations until 1945. The area was excavated as part of a paved parking lot expansion in 1962. Figure 2.1 illustrates the location of Site B. The excavated materials were placed in the Site C fill area. Based on evaluation of the 1985 aerial photo, from which the maximum area of Site B ground disturbance has been delineated, a portion of the Site B area may now be Soo Line Railroad (Soo Line) property.

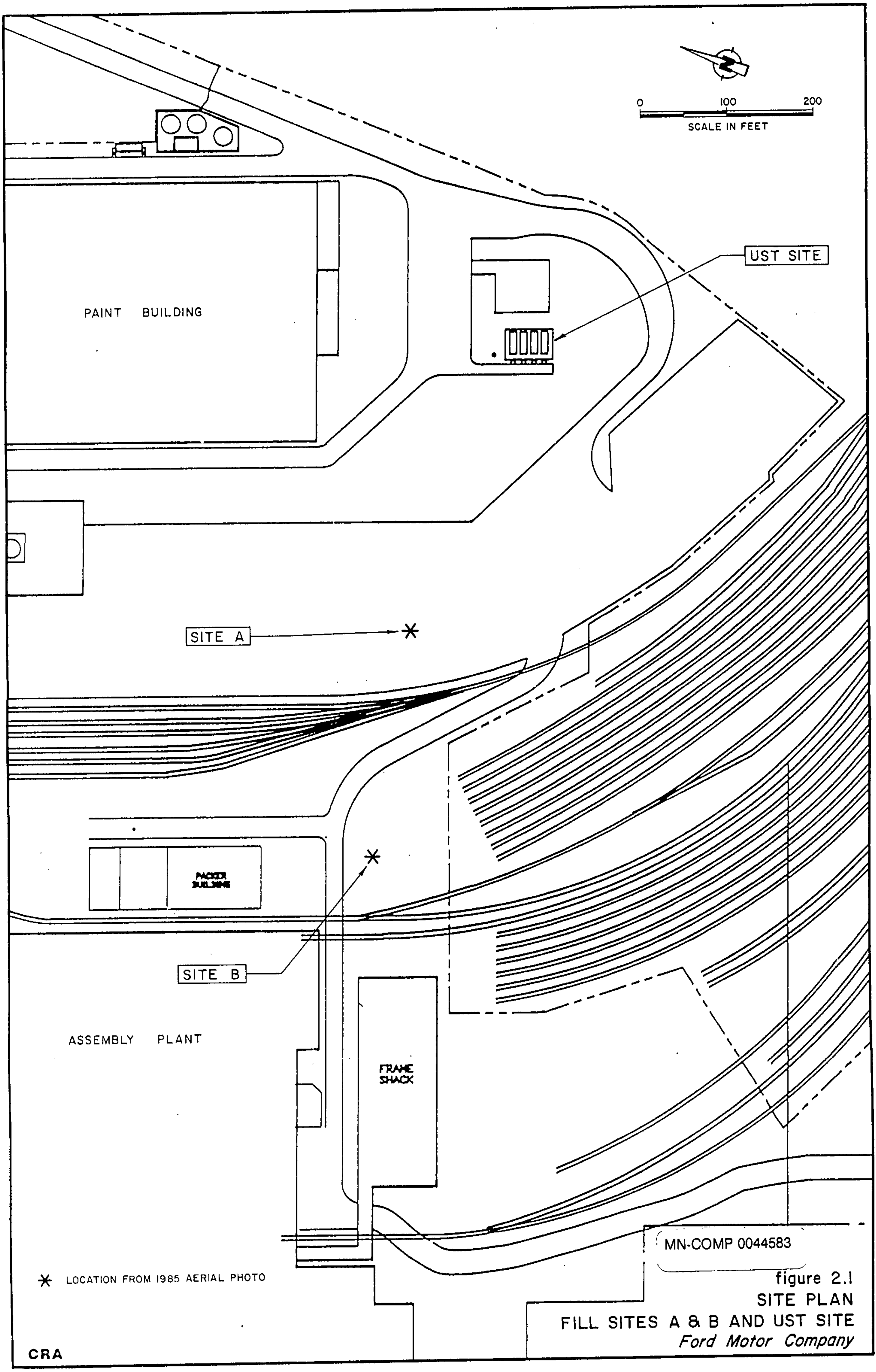


figure 2.1
SITE PLAN
FILL SITES A & B AND UST SITE
Ford Motor Company

2853-17/08/90-M

2.3.3 Site C Disposal History

Site C is approximately 4 acres in size and is located on Ford property west of Mississippi River Boulevard between the Boulevard and the Mississippi River. Figure 2.2 illustrates the Site C fill area. At different times during the Plant's history, construction rubble and paint sludges/wastes were deposited in a relatively small area in Site C. The majority of this material was deposited during the years 1950 through 1965. This practice was discontinued in 1965. During the years 1965 and 1966, construction debris was deposited in large quantities on top of this fill at Site C. The United States Corps of Engineers also deposited additional rubble between Site C and the river during reconstruction of the Lock and Dam No. 1 near the "Ford Bridge" beginning in 1975.

The Site C waste deposit was identified to USEPA by Ford during the Superfund notification process. A hydrogeologic investigation was commissioned by Ford in 1981. Since that investigation was completed, additional clean fill was placed over part of the Site C waste fill. Earth fill and construction rubble, including broken concrete and road excavation rubble from the construction of Mississippi River Boulevard continue to be brought to Site C. A major portion of the top of the fill has been paved with 8 inches of concrete and is now used as a parking lot for tractor-trailer truck units. The remaining top area of Site C is used as a snow dump during winter months for snow removed from local public streets and parking lots.

The file review for Site C indicates that cardboard, wood and scrap metal may also be present in the waste deposit. Batteries, used light

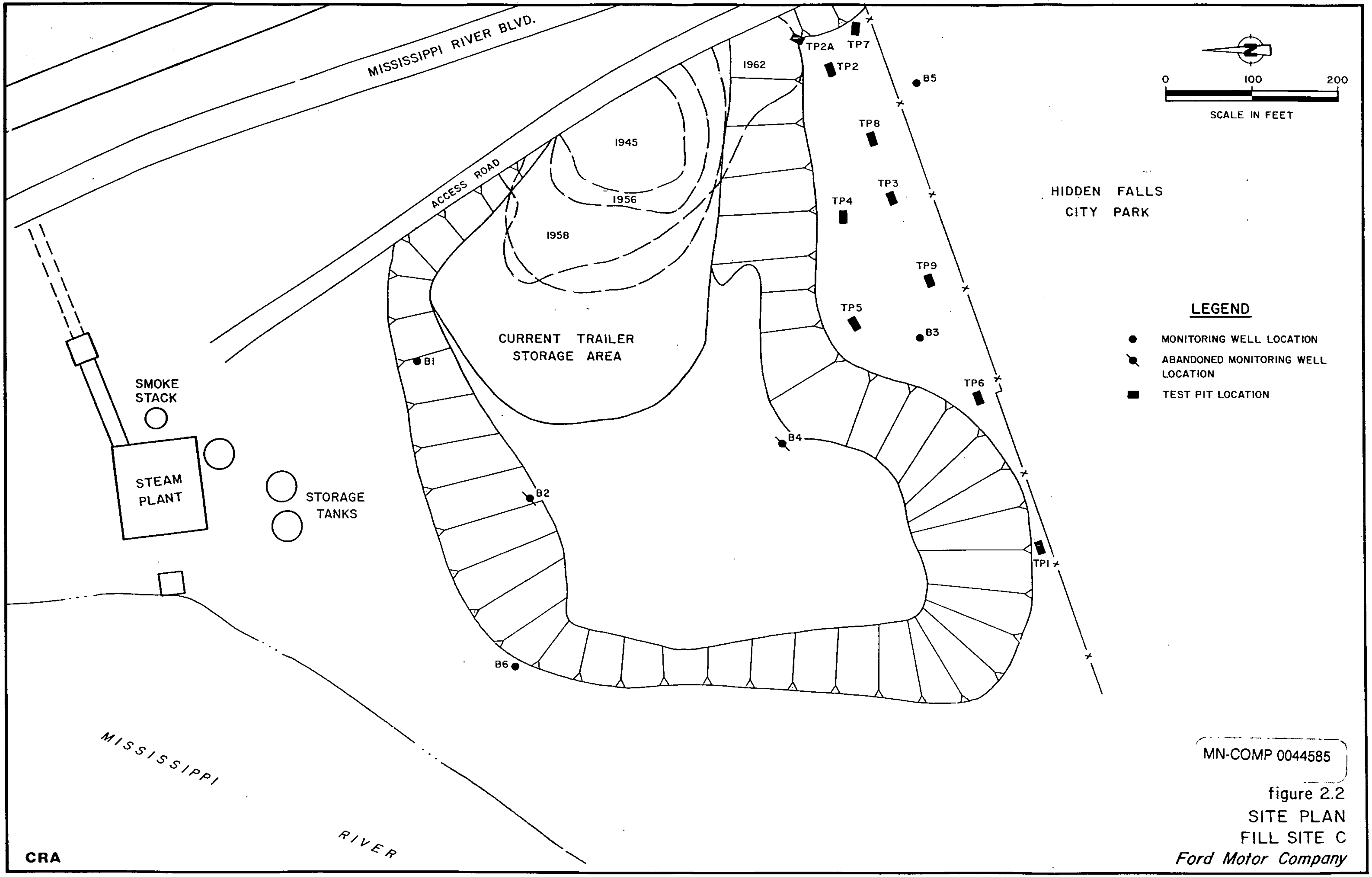


figure 2.2
SITE PLAN
FILL SITE C
Ford Motor Company

2853-11/27/89-M

ballasts and capacitors were specifically excluded from the fill material and were sent to alternate off-site disposal. Undated copies of photographs show, at that time, exposed drums and what appears to be paint sludge at various locations. This area was the subject of a beautification/landscaping program conducted during the spring of 1990 (see Section 2.7, page 27 of 41).

Aerial photographs from the file search were used to prepare a plan illustrating the progression of fill at Site C from the access road westward. The limit of fill in 1945, 1956, 1958 and 1962 is illustrated in Figure 2.2. Filling with paint sludges/waste ceased in 1965. The limit of the paint sludges/wastes is expected to be close to the 1962 limit. Substantial filling with demolition rubble and excavation soil has occurred since 1965. The present limit of fill is also presented on Figure 2.2. The paint/sludges/wastes are buried beneath approximately 30 feet of rubble including large blocks of reinforced concrete. Total fill thickness throughout the area is approximately 60 feet. The fill thickness was estimated by constructing a cross section from topographic survey data and borehole logs.

In addition to the fill areas that are under review by CRA, a smaller waste deposit below the river bluff north of Site C and the steam plant was excavated and removed to a hazardous waste landfill (Wayne Disposal Inc., Bellville, Michigan) in July 1983 during construction of the wastewater treatment plant. Approximately 77 cubic yards were excavated and shipped. All waste observed, as well as visibly contaminated soils, were removed. Analytical results of testing conducted by Ford confirmed that the waste did not exhibit hazardous waste characteristics. This effort was the subject of Ford's Amended Superfund

Notification to USEPA dated August 16, 1983. Further information regarding the waste characterization was also provided to MPCA in a letter dated March 2, 1990, which is provided as Appendix A.

2.4 INVESTIGATIVE WORK COMPLETED TO DATE

Several investigations have been completed since identification of the disposal sites by Ford. These studies include hydrogeological investigations, disposal area assessments, status reports and groundwater monitoring reports. The major studies completed to date are:

1) Final Report, Hydrogeologic Engineering Evaluation, February 1982, STS;
2) Twin Cities Assembly Facility, Groundwater Monitoring Wells Survey, March 1982, Ford;
3) Twin Cities Assembly Facility, Groundwater Monitoring Wells Survey, December 1982, Ford;
4) Assessment of Fill Areas, October 1988, CRA;
5) Project Status, Ford New Site B, November 1989, CRA;
6) Groundwater Monitoring Report and Evaluation, Site C, January 1990, CRA;
7) Supplemental Groundwater Monitoring Report and Evaluation for 1990, Site C, August 1990, CRA.

2.5 SITE A EVALUATION

Site A has been included in previous reports evaluating the Site history and past disposal practices. No environmental field assessment work has been performed at Site A.

2.6 SITE B EVALUATION

The MPCA's interest in Site B was prompted by a citizen's "complaint" dated July 25, 1984 (subject of an MPCA letter dated April 25, 1989). The "complaint" described a location that was related to excavation for construction of a water line during July 1984. Representatives of Ford, CRA and MPCA defined an area of investigation in May 1989. The location of the Site B area is shown on Figure 2.1.

Field work completed by CRA at Site B includes:

6/89	Drilled two boreholes. Screened soil with HNu or OVA
6/89	Four soil samples analyzed for VOCs and metals
8/89	Drilled three boreholes. Screened soil with HNu or OVA
8/89	Installed three monitoring wells (MW1, MW2, MW3)
8/89	Groundwater elevations
8/89	Three soil samples analyzed for VOCs and metals
8/89	Sampled three wells for VOCs and metals

9/89	Groundwater elevations
8/90	Groundwater elevations

All field work was conducted in accordance with the MPCA approved investigation scope of work as described in a June 6, 1989, letter to the MPCA. This letter is contained in Appendix A.

Site B Field Procedures

Initially, two soil borings were proposed. Analytical results of the two initial borings confirmed the presence of VOC. Due to visual appearance and odor in these borings, three additional borings/wells were completed. Locations are presented on Figure 2.3.

All boreholes were advanced using a truck mounted drilling rig advancing 3-1/4 ID hollow stem augers. The augers were steam cleaned between each boring. Soil samples were collected at 2-1/2 foot intervals using a 2 foot long by 2 inch diameter split spoon sampling apparatus. Sampling was conducted in accordance with ASTM methods. Between each sample collection, the split spoons were cleaned using a sequential rinse of methanol, hexane and methanol, followed by a distilled water rinse.

Soil samples were described and classified according to the Unified Soil Classification System. Soil samples were stored in laboratory prepared, 40 ml glass vials and 500 ml glass bottles.

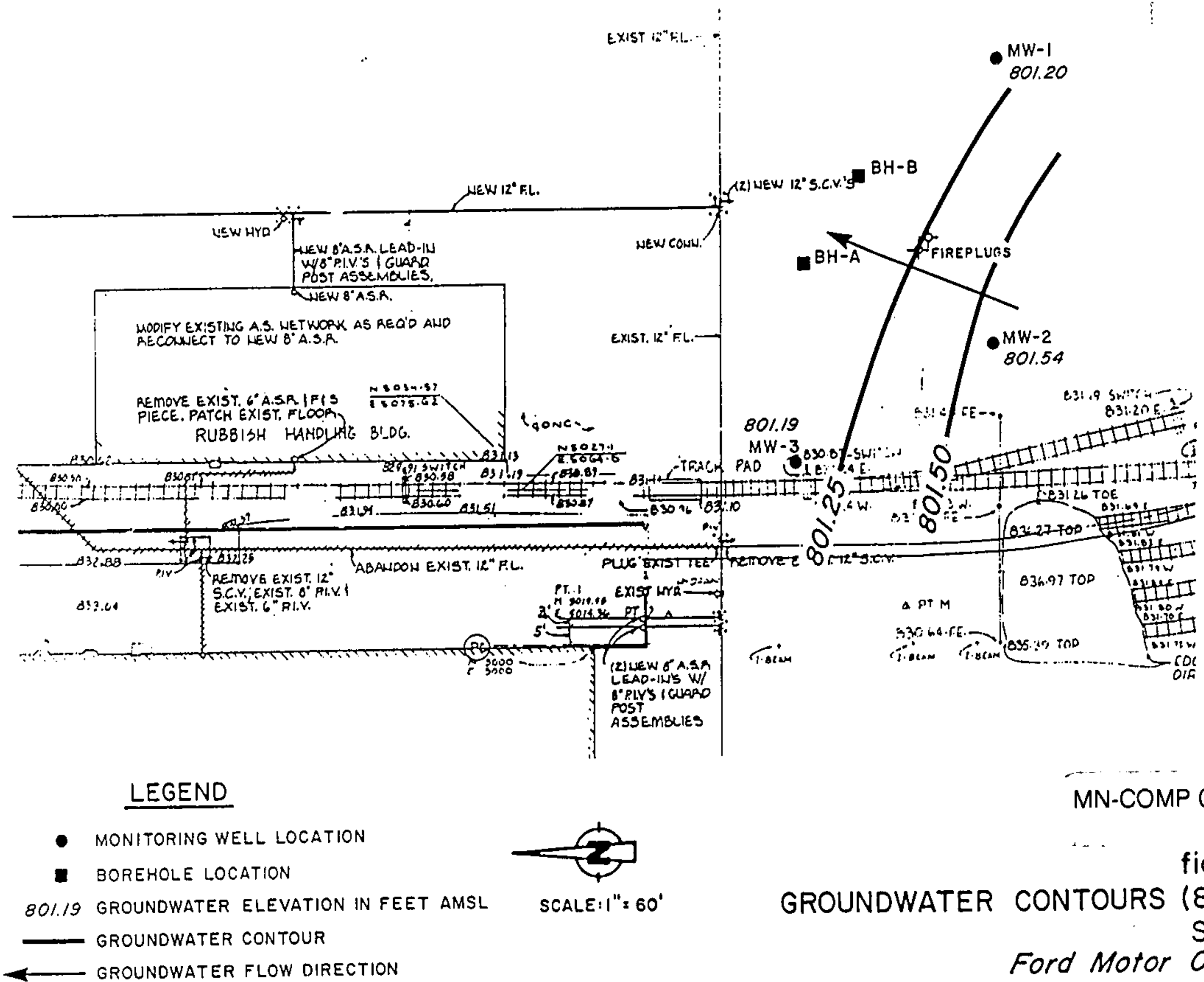


figure 2.3
GROUNDWATER CONTOURS (8-16-89)
SITE "B"
Ford Motor Company

CRA

2853-17/10/89-M

During sampling, both the containerized soils and auger openings were scanned with either an HNu photoionization meter or an OVA flame ionization meter.

From four of the borings, one sample from above the water table was prepared and submitted for chemical analysis. At boring A (BH A) one sample from above and one sample from below the water table was submitted. Samples were sent to Pace Laboratories of Minneapolis, Minnesota (Pace) using chain of custody procedures. Table 2.1 presents a summary of soil samples obtained and indicates those selected and submitted for analysis. A summary of the soil analytical results is presented as Table 2.2.

Monitoring Well Installations

Three monitoring wells were installed to approximately 12 feet below ground surface (BGS). Wells were constructed with:

- 2 foot long by 2 inch diameter stainless steel continuous (#10) slot screens.
- 2 inch diameter low carbon steel riser.
- A sand pack (#30) placed around and 2 feet above the screen.
- A 2 foot bentonite seal.
- Bentonite - cement backfill to the surface.
- Locking protective casing and bumper posts.

TABLE 2.1

SUMMARY OF SOIL SAMPLES
SITE B

Location	Sample Inverval (ft. BGS)	Date	Analysis	OVA/Hnu Reading	Submitted to Lab
BH-A	0.5 - 2.5	6/18/89		BG	
	4.0 - 6.0	6/18/89	VOCs/Metals	40	X
	6.0 - 7.5	6/18/89	VOCs/Metals	40	X
BH-B	0.5 - 2.0	6/18/89		10	
	2.0 - 4.0	6/18/89		40	
	4.0 - 6.0	6/18/89	VOCs/Metals	45	X
	6.0 - 8.0	6/18/89		45	
	8.0 - 10.0	6/18/89	VOCs/Metals	150	X
MW-1	0.0 - 2.0	8/01/89		BG	
	2.0 - 4.0	8/01/89		150	
	4.0 - 6.0	8/01/89	VOCs/Metals	110	X
	6.0 - 8.0	8/01/89		175	
	9.0 - 11.0	8/01/89		180	
	11.0 - 12.0	8/01/89		110	
MW-2	0.0 - 2.0	8/02/89		BG	
	2.0 - 4.0	8/02/89	VOCs/Metals	BG	X
	4.0 - 6.0	8/02/89		BG	
	6.0 - 8.0	8/02/89		BG	
	8.0 - 10.0	8/02/89		200	
	10.0 - 12.0	8/02/89		200	
MW-3	2.0 - 4.0	8/02/89		BG	
	4.0 - 6.0	8/02/89	VOCs/Metals	BG	X
	6.0 - 8.0	8/02/89		BG	
	8.0 - 10.0	8/02/89		BG	
	10.0 - 12.0	8/02/89		BG	

Notes:

1. BG = Back Ground Value
2. VOCs were analyzed using EPA Methods 601 and 602.
3. Metals list includes: As, Ba, Cd, Cr, Cu, Pb, Hg, Se, Ag, Zn, Ni.

TABLE 2.2

SUMMARY OF SOIL ANALYTICAL RESULTS
SITE B

Parameter	MDL	BHA 4-6 ft.	BHA 6-8 ft.	BHB 4-6 ft.	BHB 8-10 ft.	MW1 4-6 ft.	MW2 2-4 ft.	MW3 4-6 ft.
Inorganic Analysis (mg/kg)								
Arsenic	1.3-2.5	21	1.5	9.9	5.6	12	9.0	ND
Barium	5.0	870	39	580	120	380	180	36
Cadmium	0.25	7.5	0.7	56	0.72	3.3	0.70	0.28
Chromium	2.5	51	8.9	490	24	28	32	16
Copper	0.25	100	6.4	75	8.5	32	14	12
Lead	2.5	1,100	62	3,800	16	400	54	7.8
Mercury	0.02	0.19	0.22	0.82	ND	ND	ND	ND
Nickel	1.3	21	10	28	14	22	15	17
Selenium	3.1	ND	ND	8.9	ND	ND	ND	ND
Silver	4.0	ND	ND	ND	ND	ND	ND	ND
Zinc	2.5	770	44	3,500	53	460	73	18
Organic Analysis (µg/kg)(1)								
Ethylbenzene	600(2)	ND	ND	100,000(2)	20,000	ND	ND	ND
Xylenes, Total	600	ND	ND	ND	ND	980	ND	ND

Notes:

MDL = Method Detection Limit
ND = Not detected at or above MDL.
(1) = VOC analysis conducted for EPA 601 and 602 Method Lists, only detected compounds are listed.
(2) = This sample analyzed with MDL of 12,000 µg/kg rather than MDL indicated.

Borehole and monitoring well logs are contained in Appendix B.

Well Development and Sampling

Wells were developed using a bottom filling stainless steel bailer to surge and evacuate groundwater. A minimum of five well volumes were removed. Conductivity, pH and temperature were periodically noted.

Immediately following development, water samples were collected and submitted for chemical analysis to Pace.

The groundwater analytical results are presented as Table 2.3. Table 2.4 presents groundwater elevations and Figures 2.3 and 2.4 show the water table elevation contours for Site B.

Summary of Current Site B Evaluation

Geology

Site B is located approximately 1/4 mile east of the Mississippi River at an elevation of 830 feet AMSL. The river elevation is approximately 690 feet.

TABLE 2.4

GROUNDWATER ELEVATIONS
FORD, SITE B, ST. PAUL, MINNESOTA

Well	Top of Casing Elevation (ft. AMSL)	Groundwater Elevations (ft. AMSL) 8/16/89	Groundwater Elevations (ft. AMSL) 9/13/89
MW1	812.26	801.20	801.17
MW2	813.24	801.54	801.97
MW3	813.22	801.19	801.44

TABLE 2.3

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
SITE B

	MDL	Rinsate Blank	MW-1	MW-2	MW-2 (Dup.)	MW-3
Inorganic Analysis (mg/L)						
Arsenic	0.002	ND	ND	ND	ND	ND
Barium	0.2	ND	0.4	0.9	0.9	0.3
Cadmium	0.0001	ND	0.0003	0.0002	0.0001	0.0003
Chromium	0.001	ND	ND	ND	ND	ND
Copper	0.01	ND	ND	ND	ND	ND
Lead	0.005	ND	ND	ND	ND	ND
Mercury	0.0002	ND	ND	ND	ND	ND
Nickel	0.05	ND	ND	ND	ND	ND
Selenium	0.010	ND	ND	ND	ND	ND
Silver	0.04	ND	ND	ND	ND	ND
Zinc	0.01	ND	0.03	0.06	1.0	0.14
Organic Analysis (ug/L)*						
Methylene Chloride	5.0 - 50	ND	7.7	230	110	ND
1,1-Dichloroethylene	0.3 - 15	0.7	3.1	43	ND	0.4
Benzene	50.0	ND	ND	370	510	ND
Ethyl Benzene	50.0	ND	ND	3,000	64	ND
1,1,1-Trichloroethane	0.5	3.0	ND	ND	ND	ND

Notes:

MDL = Method Detection Limit
ND = Not detected at or above MDL.
* = VOC analysis conducted for EPA 601 and 602 Method Lists, only detected compounds are listed.

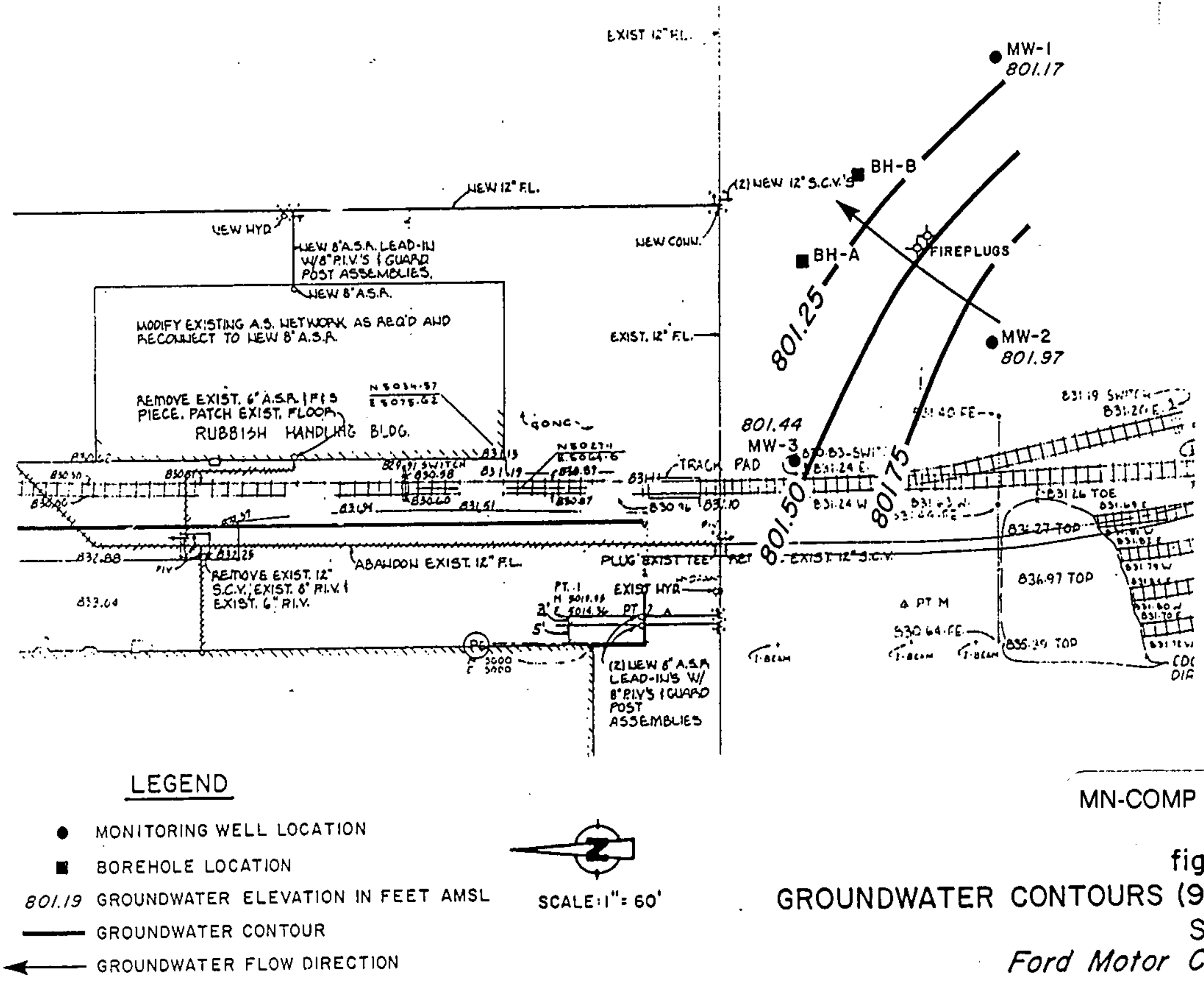


figure 2.4

GROUNDWATER CONTOURS (9-13-89)
SITE "B"
Ford Motor Company

CRA

2853-17/10/89-M

The Site is situated on a level "terrace" feature, a remnant feature of a large post glacial Mississippi River.

Surficial geologic materials on the terrace consist of natural sand, silt and gravel deposited by the post glacial Mississippi river and, where altered by cultural activity, nonnative, assorted fill material is found.

Bedrock exists at or near the ground surface and is exposed in a bluff along the river valley. The bedrock consists of interlayered sandstones, shales and limestones of Ordovician age. The upper four formations are of primary importance with respect to groundwater hydrology and are listed in descending order of age as follows: Decorah Shale, Platteville Formation, Glenwood Shale and the St. Peter Formation.

Five borings were advanced at Site B, four of which intercepted bedrock at approximately 12 feet BGS. The fifth boring was terminated at 7-1/2 feet where auger refusal occurred.

Surficial materials in all boreholes consisted of intermixed poorly sorted sand, silt, clay and non-native fill material.

Bedrock was interpreted to be the upper member of the Platteville formation. The upper Platteville is described as a tan and gray, medium bedded dolomitic limestone containing interbedded grayish green shale.

Hydrogeology

Groundwater was intercepted in all borings at approximately 10 feet BGS. Monitoring wells were installed to a depth of 12 feet BGS, penetrating a zone of saturation approximately 2 feet thick.

Wells were not advanced past 12 feet, the depth at which bedrock was encountered.

The uppermost saturated zone occurs in the unconsolidated fill material lying above the bedrock. Saturation may or may not extend continuously into the underlying Platteville formation.

Groundwater flow is generally towards the north. The average hydraulic gradient is calculated at 0.01. This is considered a shallow gradient. Figures 2.3 and 2.4 show the groundwater flow direction.

Groundwater flow direction in a shallow water table is subject to frequent change primarily attributable to fluctuations during recharge from rain fall events. Flow direction may also be influenced by cultural features (i.e., storm sewers, extensive pavement, drainage tiles, etc.).

Based on these observations, groundwater flow direction at Site B may be subject to frequent change, for there is extensive pavement to the north of the wells and borings. Located to the south is an area that is unpaved, allowing rainfall to infiltrate and recharge the water table. In theory, groundwater would "mound" in the unpaved area and flow towards the north, paved area. After a certain period, flow direction could change as the groundwater system stabilizes, reaching steady state conditions.

Although no boreholes and wells penetrate the Platteville Formation, some conclusions can be reached regarding hydrogeologic characteristics. Regionally, the Platteville, in conjunction with the underlying Glenwood shale, is considered a hydrogeologic confining unit.

CRA's geologist examined bedrock outcroppings of the Decorah shale, Platteville limestone, Glenwood shale and the St. Peter sandstone in the vicinity of the Site for the purpose of examining hydrogeologic characteristics of these formations. Of particular interest was the presence of groundwater seepage emanating from the Platteville formation along the river bluff face. This was observed in several locations and, most notably, several hundred feet south of Site B at Hidden Falls Park. The presence of seeps indicates that groundwater, which may be perched, exists in the Platteville above the Glenwood Shale confining unit. Underlying the Platteville-Glenwood confining unit is the St. Peter sandstone.

HNu/OVA Results

An HNu photoionization device and/or an OVA flame ionization device was used to scan soils for organic vapors in the five boreholes. The results are shown on Table 2.1.

Summarizing the above results, HNu/OVA readings were detected above background levels and below the water table in BH A, BH B and MW1. Readings above background were observed at and below the water table in MW2. No above background readings were detected at MW3.

Soil Chemical Analysis Results

Soil samples were analyzed for halocarbon and aromatic organic compounds (by SW846 Methods 8010/8020) and the inorganic compounds listed on Table 2.2. Table 2.2 presents all inorganic analytical results, however, only detected compounds have been summarized for organics. Based on these inorganic data, cadmium, lead and zinc levels appeared to be present above typical background soils.

Ethylbenzene and total xylene were found above method detection limits (MDLs) in soil taken from boring MW-1. Ethylbenzene was also found above MDLs at BH B.

Groundwater Chemical Analysis Results

Groundwater samples were analyzed for halocarbon and aromatic organic compounds (by EPA Method 601 and 602) and the inorganic compounds listed on Table 2.3. Table 2.3 presents all inorganic analytical results, however, only detected compounds have been summarized for organics. These groundwater results indicate that inorganics were found at levels near MDLs. Results reported for zinc showed poor reproducibility between the sample and duplicate taken for well MW-2.

Levels of VOCs in well MW-3 were not detected above MDL or were found below levels noted in the field rinsate blank (i.e. for 1,1,1-trichloroethene). Detected levels were primarily found in well MW-2 (methylene chloride, 1,1-dichloroethylene, benzene and ethyl benzene) and varied from the sample to the duplicate for this well. Due to the poor reproducibility of VOC results, these data should be qualified as non-quantitative data. However, these data were acceptable for qualitative purposes. Two VOCs (methylene chloride and 1,1-dichloroethylene) were found in well MW-1. Based on the flow direction indicated for the August and September 1989 water levels, well MW-2 is currently the most upgradient of the wells installed.

2.7 SITE C EVALUATION

The majority of the environmental assessment work completed to date at the Plant has related to the investigation of Site C due to the relocation of the materials from Sites A and B. The Site C waste deposit was identified to the USEPA by Ford during the Superfund notification process. The first investigation was commissioned by Ford in 1981. A chronological list of the field work performed at Site C follows:

5/81	Drilled six boreholes, installed four monitoring wells (B1, B2, B3, B4)	STS
1/82	Groundwater elevations	STS
3/82	Sampled four wells for organics and metals	Ford
3/82	Groundwater elevations	Ford
12/82	Installed monitoring well (B5)	STS
12/82	Sampled five wells and three river locations for organics and metals	Ford
12/82	Groundwater elevations	Ford
1/88	Ten test pit excavations, analyzed two leachate samples	CRA
2/88	Stadia survey for mapping	CRA
3/88	Groundwater elevations	CRA
6/89	Sampled three wells and two river locations for organics and metals	CRA
6/89	Groundwater elevations	CRA
6/89	Abandoned two wells (B2, B4)	GME, CRA
8/89	Sampled three wells and two river locations for organics and metals	CRA
8/89	Groundwater elevations	CRA
9/89	Sampled three wells and two river locations for organics and metals	CRA
9/89	Groundwater elevations	CRA
4/90	Installed one well (B6)	GME, CRA
4/90	Sampled three wells and two river locations for organics and metals	CRA
4/90	Groundwater elevations	CRA
6/90	Sampled three wells and two river locations for organics and metals	CRA

6/90	Groundwater elevations	CRA
8/90	Groundwater elevations	CRA

In June of 1989, GME Consultants Inc. upgraded surface protection on wells B1, B3 and B5 by installing locking protective casings, bumper posts and additional riser pipes where necessary. Wells B2 and B4 had been damaged beyond repair by the continual dumping and regrading of rubble. Therefore, wells B2 and B4 were abandoned in accordance with the Minnesota Department of Health (MDH) water well code. The wells were grouted with a neat cement grout and all retrievable material was removed. Well abandonment records and logs are presented in Appendix C.

Following the repairs to wells B1, B3 and B5, a Site survey was completed to establish new top of casing elevations on these wells and to further define the top of fill area.

In April 1990, CRA contracted GME Consultants Inc. to install monitoring well MW-6.

A CME 55 drill rig, using 4-1/4 inch inside diameter, hollow stem augers advanced the well boring. Split spoon samples were collected continuously to the bottom of the boring.

The monitoring well was completed using the following materials:

- 10-foot, 2.0-inch diameter, .10 slot stainless steel screen;
- 40-foot, 2.0-inch, low carbon steel riser;
- #10 silica sand pack;
- bentonite slurry seal;
- bentonite (approximately 3 percent) cement grout;
- 4.0-inch diameter locking protective casing;
- three 4.0-inch steel protective posts.

The monitoring well was installed inside the auger annulus by backing the augers from the boring while simultaneously installing the sand pack. The sand pack was installed from the bottom to approximately 8 feet above the top of the screen. Natural sand and gravel filled the annulus to approximately 26 feet BGS. A bentonite slurry seal approximately 3 feet thick was placed above the sand pack. The remaining auger annulus was backfilled by the tremie grout method using a mixture of bentonite and cement. Surface protection consists of a 4-inch diameter locking protective casing and three steel bumper posts.

The drill rig, augers, well materials and additional associated equipment were decontaminated using a high temperature, hot water steam rinse.

Well MW-6 was developed and stabilized following installation using a 2-inch stainless steel and teflon, bottom filling bailer. A minimum of five standing well volumes was purged. The well was considered stabilized after three consecutive volumes with readings of less than 5 percent variability were purged. In total, 44 well volumes were removed during development.

Monitoring well logs for B1, B3, B5 and MW-6 are contained in Appendix B.

Site C monitoring wells have been sampled on seven occasions. Table 2.5 presents a summary of the detected compounds for all seven sampling rounds. Table 2.6 presents water level elevation data. Water table contours are shown on Figures 2.5 and 2.6.

Groundwater and surface water sampling conducted by CRA was completed according to the approved work plan (provided in Appendix A) and the MPCA guidance manual "Procedures for Groundwater Monitoring; MPCA Guidelines" December 1986. The samples were submitted to Pace Laboratories Inc. for chemical analysis under chain-of-custody procedures.

The surface water samples were taken by the "grab sampling" method. On all five sampling events conducted by CRA, samples were obtained from both upstream and downstream locations. The surface water locations are close to, but may not be exactly the same as those previously sampled by Ford during earlier, 1981 and 1982, monitoring.

TABLE 2.5
GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS
FORD SITE "C"
DETECTED COMPOUNDS

	B1							B2		B3							B4	
	3/82	12/82	6/89	8/89	9/89	4/90	6/90	3/82	12/82	3/82	12/82	6/89	8/89	9/89	4/90	6/90	3/82	12/82
cis-1,2-Dichloroethylene µg/l	NA	NA	ND	ND	ND	ND	ND	NA	NA	NA	NA	ND	ND	ND	ND	ND	NA	NA
1,1-Dichloroethylene µg/l	ND	ND	1.5	ND$^{(R)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride µg/l	ND	ND	ND	ND$^{(R)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane µg/l	ND	ND	ND	ND$^{(R)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane µg/l	ND	ND	ND	14$^{(J)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride µg/l	ND	ND	ND	5.2$^{(J)}$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene µg/l	4	ND	ND	ND$^{(R)}$	2.1	ND	ND	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene µg/l	1	2.1	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	1	ND
Chlorobenzene µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (Total) µg/l	ND	ND	NA	NA	NA	ND	NA	ND	ND	ND	ND	NA	NA	NA	ND	NA	ND	ND
1,2-Dichloroethylene µg/l	ND	ND	ND	ND	ND	ND	ND	15	22.0	ND	ND	ND	ND	ND	ND	ND	ND	6.7
Cadmium mg/l	0.02	0.003	ND	ND	ND	ND	ND	ND	0.003	ND	0.003	0.0002	ND	ND	ND	ND	0.02	0.005
Lead mg/l	0.12	0.005	ND	ND	ND	ND	ND	0.12	0.005	0.05	0.004	ND	ND	ND	ND	ND	0.06	0.006
Zinc mg/l	0.06	ND	ND	ND	ND	ND	ND	0.04	ND	ND	ND	0.03	ND	0.02	ND	ND	0.09	0.06
Copper mg/l	0.03	ND	ND	0.01	ND	ND	ND	0.02	ND	0.01	ND	ND	0.02	ND	0.01$^{(U)}$	ND	0.01	ND
Nickel mg/l	0.07	0.06	ND	ND	ND	ND	ND	0.04	ND	0.02	ND	ND	0.05	ND	ND	ND	0.05	ND
Chromium mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Barium mg/l	NA	NA	ND	ND	ND	ND	0.06	NA	NA	NA	NA	0.3	ND	ND	0.2	0.18	NA	NA

TABLE 2.5
GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS
FORD SITE "C"
DETECTED COMPOUNDS

	B5				B6		Mississippi River Up Stream						Mississippi River Adjacent to Plant	Mississippi River Down Stream					
	12/82	6/89	8/89	9/89	4/90	6/90	12/82	6/89	8/89	9/89	4/90	6/90	12/82	12/82	6/89	8/89	9/89	4/90	6/90
cis-1,2-Dichloroethylene µg/l	NA	ND	ND	ND	ND	5.5	NA	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND
1,1-Dichloroethylene µg/l	ND	ND	0.8$^{(J)}$	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND	1.1$^{(J)}$	ND	ND	ND
Methylene Chloride µg/l	ND	ND	ND	ND	1.4$^{(U)}$	ND	ND	ND	ND	ND	1.3$^{(U)}$	1.0	ND	ND	1.3	ND	ND	ND	ND
Trichlorofluoromethane µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1$^{(J)}$	ND	ND	ND	ND
Dichlorodifluoromethane µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene µg/l	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform µg/l	ND	ND	ND	ND	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene µg/l	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND
Toluene µg/l	ND	ND	ND	ND	ND	ND	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND
Xylene (Total) µg/l	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA	ND	NA
1,2-Dichloroethylene µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND
Cadmium mg/l	ND	0.0004	ND	0.0002	ND	ND	ND	ND	0.0005	ND	ND	ND	0.001	NA	ND	0.0008	ND	ND	ND
Lead mg/l	0.003	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	0.001	ND	ND
Zinc mg/l	ND	0.07	ND	0.26	ND	0.007$^{(U)}$	ND	ND	ND	ND	ND	0.009$^{(U)}$	ND	ND	ND	ND	ND	ND	ND
Copper mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND
Nickel mg/l	ND	0.08	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
Chromium mg/l	ND	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium mg/l	NA	ND	ND	ND	ND	0.073	NA	ND	ND	ND	ND	0.058	NA	NA	ND	ND	ND	ND	0.055

NA - Not analyzed.
ND - Not detected at or above method detection limit.
(J) - Value estimated based on holding time exceedence.
(R) - Value unusable based on holding time exceedence.
(U) - Value qualified as non-detect based on method blank.

TABLE 2.6

FORD SITE C
REVISED* MONITORING WELL ELEVATION DATA

Well #	Top of Casing Elevation	Ground Elevation	Bottom of Screen Elevation	Groundwater Elevations 8/3/90	6/6/90	4/19/90	9/13/89	6/2/89	3/24/88(1)	12/1/82(2)	3/3/82(3)	1/5/82(3)
B1	738.06	735.9	681.62	690.99	690.43	688.30	686.91	689.35	688.24	691.85	688.35	688.62
B3	704.18	702.9	679.68	690.66	690.00	690.38	687.76	689.36	688.50	691.42	688.27	688.65
B5	703.90	703.2	678.50	691.39	690.82	-	689.19	690.45	689.61	691.96	NI	NI
B6	730.85	728.4	681.90	690.95	690.61	687.85	NI	NI	NI	NI	NI	NI
Staff Gauge Lock & Dam #1	-	-	-	691.4	691.5	688.2						

Note:

All elevations are feet above mean sea level (AMSL). **National Geodetic Vertical Datum, 1929 (NGVD)**

*As revised due to well repairs and modifications.

(1) From report "Assessment of Fill Areas, Ford Motor Company, Twin Cities Assembly Plant," CRA, October 1988.

(2) From report "Twin Cities Assembly Facility, Groundwater Monitoring Wells Survey," Ford Motor Company, December 1, 1982.

(3) From report "Twin Cities Assembly Facility, Groundwater Monitoring Wells Survey," Ford Motor Company, March 3, 1982.

NI Not Installed

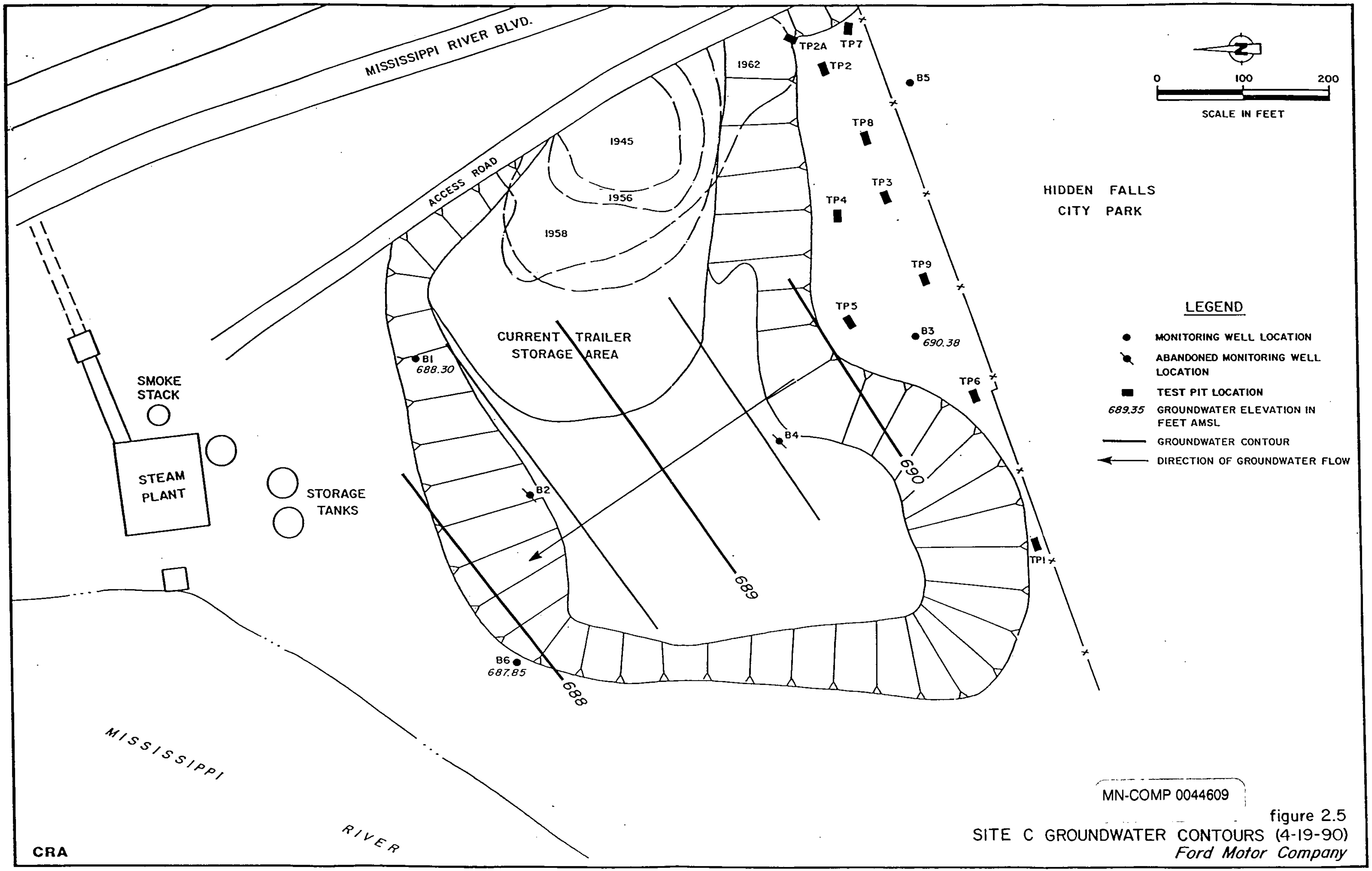


figure 2.5
SITE C GROUNDWATER CONTOURS (4-19-90)
Ford Motor Company

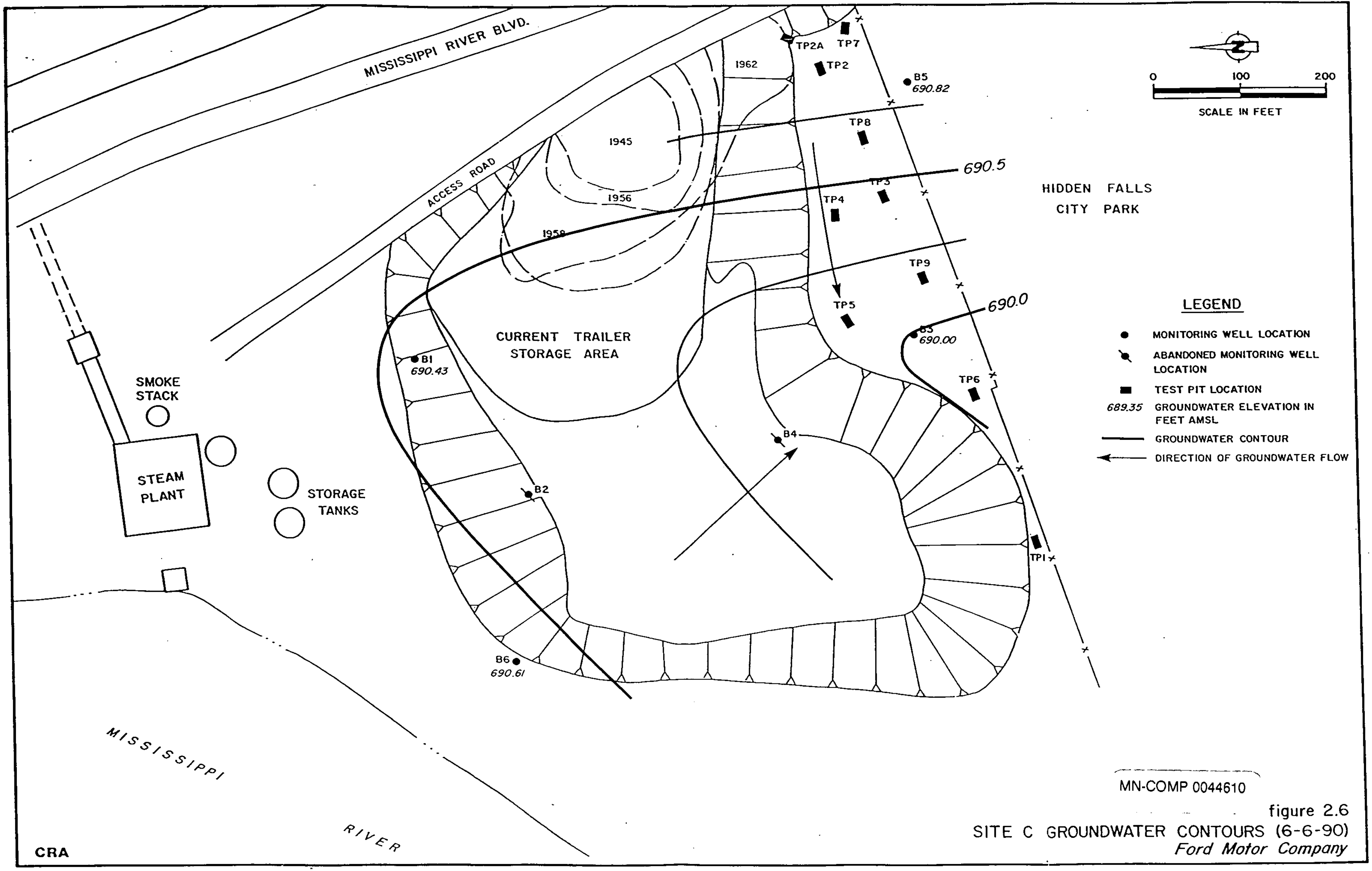


figure 2.6
SITE C GROUNDWATER CONTOURS (6-6-90)
Ford Motor Company

At the time of the June 1989 sampling event, the Site C area was inspected upstream and downstream for the presence of surface "seeps or springs", as suggested by MPCA's letter of April 25, 1989, to Ford. This inspection located no potential sampling locations of this type.

Groundwater Flow Direction

Groundwater flow is predominantly to the west towards the Mississippi River. Seasonal control of the river elevation may affect this flow direction to some degree. Water levels measured by CRA during 1988, also presented on Table 2.6, had indicated a more northwesterly component of flow direction. A similar westerly flow pattern was also provided by data presented by Ford in December 1982 as also indicated on Table 2.6. Early groundwater elevations by Ford do not include well B5, as it was not installed until later in 1982. Only the 1990 data includes the new well B6. Seasonal fluctuations in the river elevation also appear to change the gradients as shown on Figures 2.5 and 2.6.

Figure 2.6 shows a flow direction to the south for the western edge of Site C. This flow direction indicated that the river was recharging this portion of Site C. The Army Corp of Engineers maintains a staff gauge in the lower pool of Lock and Dam #1. The elevations of the river were approximately 3 feet higher during the June 1990 water level round when compared to the river elevation in April. The change in river elevations explains why groundwater flow for June is different than the flow direction for April.

Groundwater elevations are measured in the existing monitoring wells which are screened in the fill and/or river deposits of sand and gravel. Thus, the groundwater flow directions represent a localized condition under Site C.

Site Hydraulic Conductivity

Grain size distribution curves are presented in the 1982 STS report. The grain size distribution can be used to estimate the permeability of the unconsolidated sand and gravel using Hazen's equation. Hazen's equation is an empirical formula that estimates permeability based on grain size distribution. Where:

$K = Ad_{10}^2$

K is the permeability in cm/s,

A is an empirical coefficient equal to 1.0 and

d_{10} is the grain size (in mm) of the 10 percent retained.

Estimated hydraulic conductivity values are presented in Table 2.7. The geometric mean hydraulic conductivity is 2×10^{-2} cm/sec. This is a relatively high hydraulic conductivity consistent with the sand and gravel soils.

Groundwater velocity can be estimated using the equation:

TABLE 2.7

HAZEN'S PERMEABILITY
SITE C

Borehole	Depth (ft. bgs)	d_{10} (mm)	K (cm/sec)
BH1	39.5 - 41	0.08	6×10^{-3}
BH2	19.5 - 21	0.25	6×10^{-2}
BH2	29.5 - 31	0.30	9×10^{-2}
BH2	34.5 - 36	0.075	5×10^{-3}
BH3	19.5 - 21	0.2	4×10^{-2}
BH5	10 - 11.5	0.08	6×10^{-3}
		Average =	2×10^{-2}

$$\bar{v} = \frac{Ki}{n}$$

where: $\bar{v}$ is the average groundwater linear velocity,
K is the hydraulic conductivity (2×10^{-2} cm/sec),
i is the hydraulic gradient (0.002) and
n is the porosity (0.3).

The assumed porosity of 0.3, which is common for this type of sediment. The average hydraulic gradient is 0.002.

By solving the equation, the average linear groundwater velocity is estimated to be 1.3×10^{-4} cm/sec, or 0.4 ft/day.

Analytical Parameters

All water samples were analyzed for halocarbon and aromatic volatile organic compounds (VOC) by EPA methods 601 and 602. In addition to the 601/602 VOC parameters, the MPCA requested that *cis*-1,2-dichloroethylene and ethylacetate also be analyzed. This request was presented in their letter dated April 25, 1989. The following metals were also analyzed: arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc.

The two sampling rounds conducted by Ford in 1982 were analyzed for USEPA volatile priority pollutants plus xylenes, methyl ethyl ketone, methyl isobutyl ketone, cadmium, chromium, lead, nickel, copper and zinc.

Test Pit Investigation

Test pits were excavated at Site C as an investigative tool to define the extent and nature of possible waste disposal.

On December 4, 1987, CRA and its subcontractor mobilized a rubber tired backhoe at Site C along the river. An attempt was made to gain access to the low land areas south of the trailer storage pad. Several attempts were made to reach the bluff, but on each attempt the backhoe got stuck. One test pit (TP1), shown on the Site C Plan, was successfully completed. No evidence of past disposal (i.e. visual or odor) was noted at this test pit location.

On January 19, 1988, a second attempt was made to access this area. A track mounted backhoe was used this time and mobility was not as difficult due to frozen conditions. A total of 10 test pits were excavated to an approximate depth of nine feet below ground surface.

The individual test pit logs are presented in Appendix D. The test pit locations are presented on Figure 2.2 and the Site C Fill Area Site Plan which is provided under separate cover.

Grab samples were obtained from the backhoe bucket as the excavation proceeded. Physical evidence of waste presence (i.e. odor or visual) was noted only at test pits TP3 and TP8. Test pit TP3 exhibited soil with a gray/black color having a paint-like odor and test pit TP8 showed visual evidence of the same gray/black color as TP3, but without the odor. The samples obtained from test pits TP3 and TP8 were the only samples that exhibited odor or color indicating the possible presence of paint sludge/waste. No evidence of waste presence was noted at the other test pits. The steep side slopes and 30 foot thickness of rubble fill over the pre-1965 materials prevented collection of a sample.

The sample from test pit TP8 exhibited a color change at depth, but no odor was noted. Consequently, this sample was analyzed for target metals common to paint sludge/waste. This analysis was conducted using the standard EPA approved Extraction Procedure (EP) toxicity leachate methodology.

The sample from test pit TP3 exhibited a paint sludge/waste-like odor. As the EP toxicity test is not applicable to aromatic compounds, the Toxicity Characteristic Leaching Procedure (TCLP) was selected as the test method. At the time of the investigation this method was typically utilized to :

1. to aid in waste characterization for disposal, –
2. as an accepted EPA method for delisting wastes,

3. in evaluating adherence to applicable EPA land disposal restrictions and
4. in determining the mobility of organics in soil media.

The TCLP method was recently adopted by EPA to replace the EP method.

Table 2.8 provides a summary of the analytical results of detected parameters for leachate analysis from test pits TP3 and TP8.

The sample from TP3 was collected from a sand seam that exhibited a strong paint waste-like odor. The strong paint waste-like odor suggests migration from the adjacent fill material. The flash point of a sample collected from TP3 was reported to be 140°F. The flash point for determining ignitability defined by RCRA regulations of less than 140°F does not apply since the waste is not a liquid.

A sample from TP8 was leached and analyzed for the EP Toxicity metals. All results were well within criteria values as indicated on Table 2.8. Thus, the material would not be considered a hazardous waste under USEPA or MPCA hazardous waste regulations.

Organic results reported above detection methods in the sample leachate for TP3 are presented in Table 2.9. The sample from Test Pit 3

TABLE 2.8

SUMMARY OF DETECTED INORGANIC PARAMETERS AND SAMPLE CHARACTERISTICS FROM TEST PITS - SITE C

	Leachate Criteria	Test Pit 3 (TP3)**	Test Pit 8 (TP8)**
Arsenic (µg/*l*)	5,000	10	ND
Barium (mg/*l*)	100	1.5	0.2
Cadmium (mg/*l*)	1.0	ND	ND
Copper (mg/*l*)	100*	0.02	ND
Lead (mg/*l*)	5.0	0.3	ND
Zinc (mg/*l*)	500*	0.92	0.03
Flash Point (°F)	NA	140	>200
Sulfide, Reactive (mg/kg)	NA	ND	61
pH	NA	7.6	7.9

Notes:

NA - Not Applicable
ND - Not Detected
* - State of Michigan Leachate Criteria Only
** - TP3 sample was analyzed using TCLP, whereas the TP8 sample was analyzed using EPA Toxicity Leachate Procedure

TABLE 2.9

SUMMARY OF DETECTED ORGANIC PARAMETERS (µg/l) FROM TEST PITS - SITE C

	Test Pit 3 (TP3)*
Toluene	180
Ethyl Benzene	85
M-Xylene	2,600
O & P Xylene	3,700

Note:

* - TP3 sample was analyzed using TCLP.

was extracted by the TCLP method. The sample from Test Pit 8 was analyzed for total VOC and all results were reported as below method detection limits. Therefore, no results are tabulated.

Cleanup and Landscaping of the Site C Area

During the spring of 1990, aesthetic beautification and landscaping was completed on a portion of the south face of the Site C fill area. The work was performed after the completion of the above investigation and material characterization and in accordance with the proposed scope of work letter of March 2, 1990. An area was delineated by the landscaping contractor with input from Ford and the MPCA. Brush, several trees, empty drums, drum parts and miscellaneous rubble were cleared from the defined area and used as fill. Approximately 2,000 cubic yards of clay soil plus 500 cubic yards of topsoil was placed over the sloped face and then seeded for aesthetic and erosion control purposes.

Site C Evaluation Summary

Site C is comprised of fill and rubble material deposited over naturally occurring sands and gravels which were deposited by the Mississippi River. Groundwater under Site C flows towards the river and is influenced by the river. The data gathered from the existing monitoring wells represents site conditions in the immediate area under Site C.

Original base grade elevations under the fill pile were on the order of 710 to 720 feet AMSL. Presently, the maximum elevation of the fill area is over 770 feet AMSL, indicating that there is up to 60 feet of fill material present. Near the steam plant access road, paint sludges/waste are present in the lower half of the fill area. Small areas of exposed paint sludges/wastes on the steep bank suggest that the paint sludges/wastes are on the order of 25 feet thick.

A footprint of the area containing paint sludges/wastes can be composited from the 1958 and 1962 limits of fill. Assuming that there is 25 feet of waste and related fill over this area, there is a volume of approximately 30,000 cubic yards of waste material believed to be non-hazardous industrial waste based on the analyses conducted.

The paint sludges/wastes are buried beneath approximately 30 feet of rubble fill including large blocks of reinforced concrete. Exposing the paint sludges/wastes and related material would require removal of a concrete parking lot and excavation of approximately 50,000 cubic yards of fill. Any such excavation would be difficult and costly due to the limited access to the Site, the need to use remote temporary fill storage, the numerous oversize pieces of concrete in the material and disruption to plant operations.

Existing 8 inch concrete pavement covers most of the waste fill and limits infiltration through this material. The low concentration of VOC in groundwater under the Site is not expected to produce a measurable effect in the Mississippi River.

The following summarizes the groundwater and chemical data evaluation for Site C:

- The monitoring well network (wells B1, B3, B5 and B6) at Site C is sufficient to determine that the groundwater flow direction under Site C flows predominantly west towards the Mississippi River.
- Groundwater chemical data gathered from this monitoring represents Site conditions in the immediate area under Site C.
- Chemical data from samples taken at the river indicate that Site C has had no impact on the river.
- Data quality assessments were conducted of the samples collected during the five sampling rounds conducted by CRA (1989/1990). With minor exceptions, the data was found to be acceptable to assess analyte concentrations within groundwater and surface water at the Site.

- Concentrations for the dissolved metals (cadmium, zinc, copper, nickel, chromium and barium) were either below method detection limits or were low and typically acceptable for naturally occurring groundwater.

- The groundwater results from 1989 and 1990 are inconsistent from location to location and are not repeated in successive monitoring events at any one location. These inconsistent results indicate that any VOC release associated with the Site is insignificant. These results are similar in terms of their low levels to those found by Ford during 1982 monitoring at these wells.

- The metals concentrations at all sampling locations are either not detected or at levels well below any concentration of concern.

- Barium was the only analyte found above method detection limits in the river samples taken during 1990 sampling and was found at equal concentrations upstream and downstream of the Site.

- Results for June 1990 sampling for zinc and April 1990 sampling for copper were qualified as non-detect due to the presence of the analyte in the method blank.

- Chemical data from the two rounds of sampling during 1990 on wells B1, B3 and B6 indicate that wells B1 and B3 had no VOCs present during either sampling event.

- Well B6 had methylene chloride detected at 1.4 µg/*l* during the April 1990 sampling. This value was qualified as non-detect due to the presence of this analyte in the method blank.

- Chloroform was detected at well B6 during the April 1990 sampling event at a concentration of 3.9 µg/*l* but was not detected during the June 1990 event. Well B6 was downgradient of the Site during the April sampling event. Well B6 was not downgradient during the June sampling event, however, well B3 was. No VOCs were present in well B3 in either sampling event.

- During the June 1990 sampling, two analytes, *cis*-1,2-dichloroethylene and trichloroetheylnee, were detected at well B6 at concentrations of 5.5 and 0.5 µg/*l*, respectively. However, neither compound was detected during the earlier April 1990 event when B6 was more downgradient of the Site.

- Review of all 1990 sampling data from both rounds indicates no analyte concentration at or near any applicable standards often used for comparison of water quality and purity (e.g. MCLs and RALs). All results for this supplemental 1990 monitoring were found well below RALs and MCLs.

2.8 UST SITE - BACKGROUND

Chronology

Prior to the 1970s, the UST Site was an open area located to the southeast of the former test track. Before the tanks were installed the UST Site was not used for waste handling or activities related to disposal. The location of the waste solvent tanks is shown on Figure 2.1. The more detailed UST Site Plan is enclosed under separate cover.

During the fall of 1984, Ford constructed the UST Site as part of its "Ranger" paint facility expansion, initially to store paints, resin and new solvent brought to the Ford Plant in bulk transport trucks. The double walled, corrosion protected, steel tanks were installed on 24 inch thick concrete pads. However, the UST facility was never used for this purpose and in 1987, Ford decided to utilize the facility to store waste or spent solvent. At that time it was decided that only two (2) of the four (4) tanks (the south two tanks) would be utilized. These tanks are designated as tanks #1 and #2. The fill lines were modified by reversing the check valve system and the installation of quick disconnect fittings for transport truck hook up. Tank #1 was put into use in 1987. Tank #2 was put into use in 1988. Both tanks are operated in conformance with 40 CFR 264, Subpart J.

Geotechnical Information and Construction Plans

Information was located in Ford's files and compiled to review available data for the UST Site area regarding:

- Site geology,
- excavation and filling that has occurred in the Site area,
- the physical construction of the area facilities,
- the location maps and types of utilities present,
- geotechnical soil boring logs,
- topographical maps and Site grading,
- construction drawings for UST Site facility,
- construction drawings for adjacent hazardous waste storage area.

For this purpose the following information was located and utilized.

Drawings Title or Item Description	Drawing #	Date
Partial Site Grading Plan	CE-2	1983 (revised 1985)
Topographical Survey Partial	TS-3	1983
Topographical Survey Partial	TS-4	1983
Solvent Tank Farm Layout	M-50	1983 (revised 1985)

Solvent Tank Farm Cathodic Protection	M-51	1983 (revised 1985)
Solvent Tank Farm Cathodic Protection	M-52	1983 (revised 1985)
Key Plan Sections	M-53	1984 (revised 1985)

This information is enclosed under a separate cover.

A geotechnical investigation was performed for the hazardous waste storage area in 1984. The report and borehole logs for the investigation are provided in Appendix F.

It should be noted that no information was located regarding the propane storage tank area.

Description of System

An illustration of the UST Site facility is presented on the UST Site Plan which is provided under separate cover. Further detail is provided by Ford Plans M-50, M-51, M-52 and CE-2. The facility consists of the following elements:

1. four tanks of double wall construction type, 10,000 gallon capacity each. Tanks are 8' 0" x 26' 7";
2. related fill, vent, vapor recovery and pump out pipe lines, an access pipe/manhole hatch is also provided, as well as related valves and gauges;
3. each tank was also coated with an asphalt-based coating prior to installation;

4. corrosion prevention is provided by cathodic protection on all tanks, lines and associate fittings;
5. check valves on pump out lines;
6. catch basins located at the pump out line access;
7. the size of the drain tile line is 4-inch, perforated pipe, sloped in the direction of sump;
8. vacuum test fittings;
9. tanks sit on a concrete pad of 48 feet x 30 feet and are anchored to the pad;
10. the concrete manhole sump is located at the north end of the drain tile system.

UST Site Geology and Hydrogeology

Geology

The UST Site is located approximately five-eighths of a mile east of the Mississippi River and is situated at an approximate elevation of 850 feet AMSL on a terrace which flanks the present river gorge. The UST Site area exhibits two of these terrace features, one at approximately 850 feet AMSL and one at approximately 830 feet AMSL. The river elevation is approximately 690 feet AMSL. The UST Site's position on the terrace is near the slope (terrace scarp) which separates the 850 foot terrace from the 830 foot terrace.

Boring logs were reviewed that were obtained during the construction of the present hazardous waste storage area located adjacent to the

UST Site. These logs revealed that the terrace alluvium consists of primarily medium to coarse grained sand and gravel. Bedrock was encountered between 4 and 6 feet BGS.

The bedrock at the UST Site consists of weathered Decorah Shale. Geologic maps of the Site area, supported by past work performed by CRA, indicate that the shale is partially to mostly eroded away just to the west of the UST Site. Underlying the Decorah Shale is the Platteville Formation which is underlain by the Glenwood Shale.

Based on a review of the UST construction plans and previously noted boring logs, it appears that the excavation which houses the tank farm is completed several feet into the Decorah shale. The bottom of the excavation lies at approximately 12 feet BGS which in effect has created a "basin" up to 6 feet in depth in the top of the shale unit. Hereafter this excavation will be referred to as the UST tank basin.

Figures 2.7 and 2.8 present a location of cross section and a geologic cross section, respectively, which represent the interrelationships of: the UST Site and tank basin, terrace features, surficial alluvium, Decorah Shale, Platteville Formation and Glenwood Shale.

Hydrogeology

The previously completed borings reveal that groundwater exists below the UST Site within the alluvial sediment, perched above the

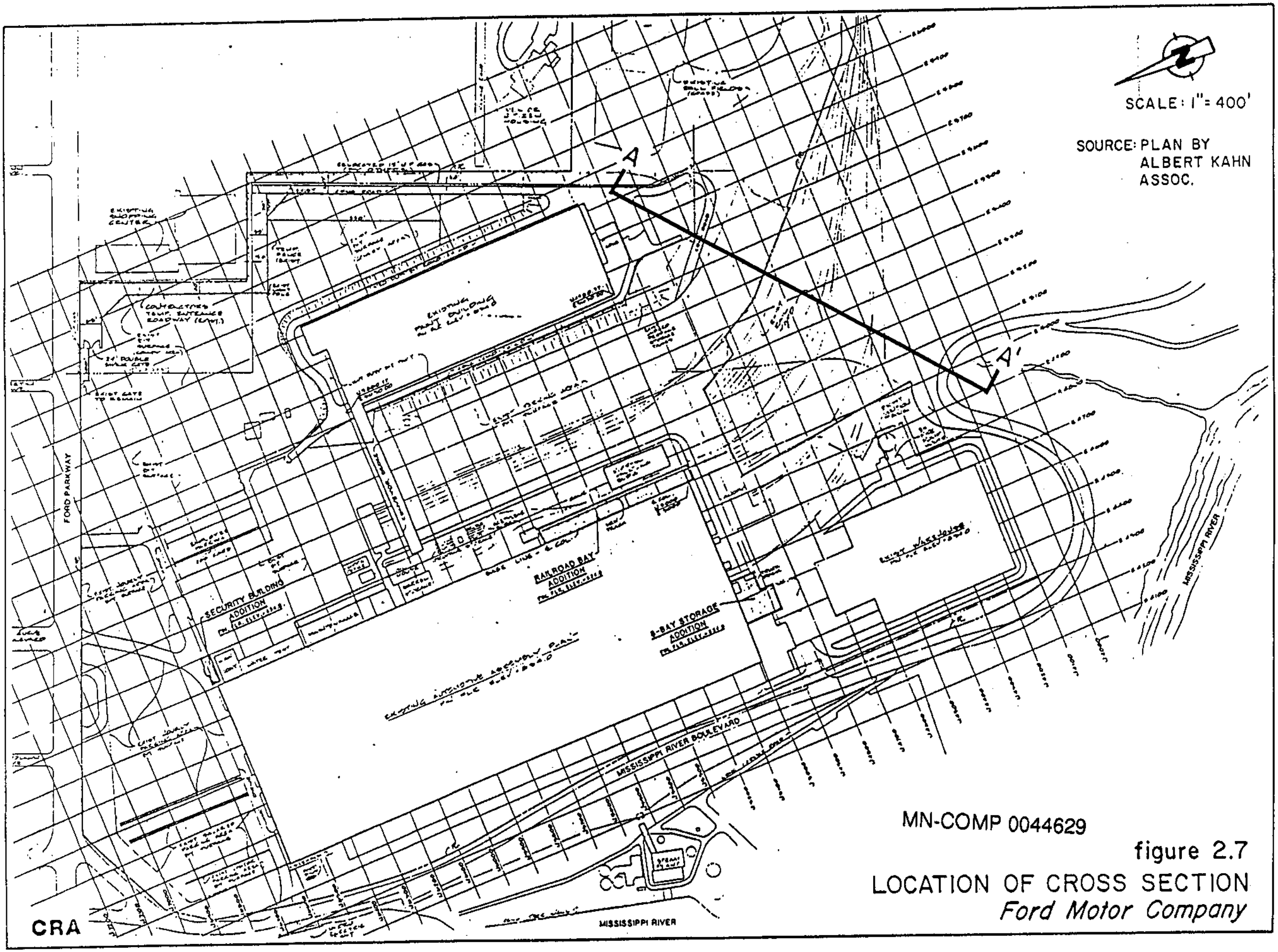
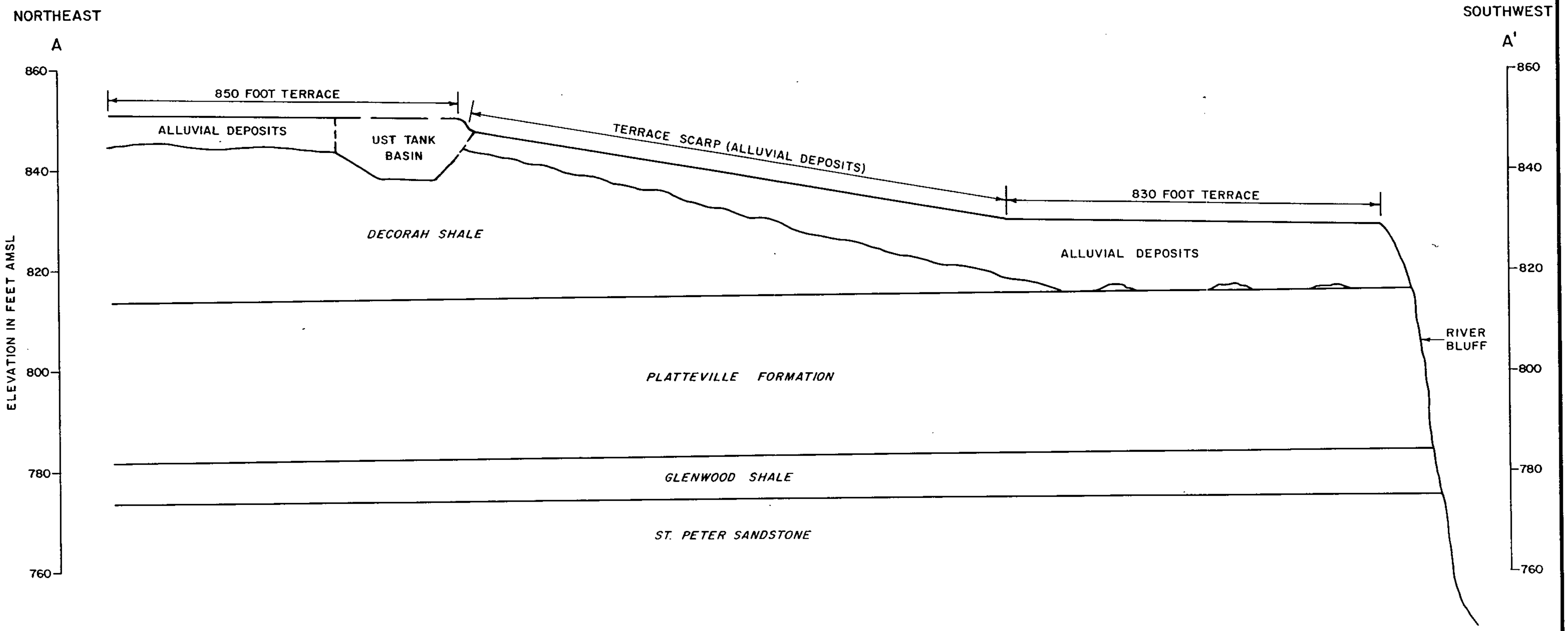


figure 2.7
LOCATION OF CROSS SECTION
Ford Motor Company

2853-30/03/90-M



SOURCES: EXISTING BORING DATA
MINNESOTA GEOLOGIC SURVEY

SCALE: 1"= 20' VER., 1"= 100' HOR.

figure 2.8
GENERALIZED GEOLOGIC CROSS SECTION A-A'
Ford Motor Company

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2853-30/03/90-M

Decorah Shale. The alluvial sand and gravel, in general, will readily transmit groundwater. Hydrogeologic literature describes the Decorah Shale as a confining unit. Hydraulic conductivities within the Decorah are low. The underlying Platteville Formation contains groundwater within its fracture systems. This groundwater discharges at the bluff which lines the Mississippi River gorge.

Of particular importance is the relationship of the groundwater perched above the Decorah shale to the UST Site. Some basic assumptions can be made regarding groundwater flow. It is expected that the perched groundwater will flow horizontally along the Decorah Shale towards the lower terrace feature to the southwest. The volume of groundwater will fluctuate significantly in response to rainfall and recharge.

The UST Site could in itself impose an influence on perched groundwater occurrence. Surface runoff is presently draining into the UST tank basin. This will in effect recharge the aquifer on a very local level. There is presently a tile drainage system which directs the basin's water into a sump. It is hypothesized that groundwater could also flow horizontally, unimpeded, through the tank basin. Additionally, pumping in the sump could effect a drawdown in the shallow groundwater system.

Additional influences on UST Site groundwater characteristics may be affected by storm sewer lines and utility trenching.

Waste Characterization

Solvent Waste Stored in Tanks

Since its initial use, the UST Site has been used only for waste solvent storage. The same types of solvents have always been stored in both the tanks. These spent solvents are primarily generated from auto body painting operations. The following provides a description of materials that when used become part of this waste stream.

Paint

Ford uses a variety of paints in the paint building operations including various colors of top coat paint and clear coat.

Solvent

Ford presently uses a variety of solvents in the painting/manufacturing operations. Some of these solvents are listed RCRA wastes when spent. The major solvent components are:

- xylene,
- toluene,
- methyl isobutyl ketone (MIBK),
- butanol,

- Cellosolve 100 (Aromatic 100), a solvent blend,
- Cellosolve 150 (Aromatic 150), a solvent blend.

The waste solvent material stored at the UST Site has been tested periodically in order to characterize it for waste disposal and recycling. The waste solvent has been characterized as EPA waste number F005 under RCRA regulations. Appendix G provides a sample analysis for a first load of solvent shipped from the tanks. This analysis indicates the following characteristics:

- percent each solvent/organic
  45 percent xylene
  13.5 percent MIBK
  12.5 percent toluene
- waste density: 0.882

Metals analysis was not conducted on the sample.

The two waste streams stored in these tanks are recycled for reuse by Ford. A quantity of approximately 150,000 gallons is typically generated per year.

Soil Samples Taken During Investigative Excavation

On November 6, 1989, Ford excavated an area at the UST Site in an effort to determine whether a release may have occurred in the vicinity of these tanks. This followed an October 26, 1989, meeting with Minnesota Pollution Control Agency (MPCA) at which the possibility of a solvent release was discussed. Following this meeting, Ford hired a contractor to excavate the area near tanks #1 and #2. The MPCA was notified and was present for the work. The excavation proceeded to approximately 4 feet BGS at which point the very top west end of tank #1 was exposed, as was the access pump out and vapor vent piping. At this point, the odor level, apparently solvent vapors, was such that following consultation with the MPCA, Ford discontinued excavating. The hole was left open to the point that had been accomplished and the materials that had been excavated were placed on a plastic tarp and covered for storage until a determination was made as to whether further excavation would occur.

During excavation one sample was taken by Ford for laboratory analysis. This sample was obtained from the area near the top of tank #1. The sample was submitted by Ford to Pace Laboratories Inc. of Golden Valley, Minnesota (Pace), and analyzed for MDH List 465C of Volatile Organic Compounds (VOCs). No total metals analysis was conducted. Results were received by Ford and are provided as Appendix H. The results indicate concentrations above method detection limits for xylenes, ethylbenzene, toluene, methylene chloride and 1,1,2-trichlorotrifluoroethane (in order of concentration found from greatest to least).

Based on the observation of stained ground cover prior to excavation and the proximity to the pump stations used for transport truck tank unloading (see UST Site Plan), it is possible that the presence of solvent materials is likely due to transfer practices from the tank to the transport vehicle. The tanks themselves are not believed to be a source of release as Ford has tested the intersitional zones of tanks #1 and #2 by volume and found no evidence of leakage. Daily recording of tank levels also indicates that no leakage has occurred.

3.0 SUMMARY OF REMEDIATION TECHNOLOGIES

Table 3.1 summarizes technologies which will be considered and identifies the technologies which may be used in the development of remedial alternatives.

Based on information obtained during the RI, determination will be made as to the need for and type of treatability studies to be conducted. The studies will consider appropriate treatment technology for the Site from the list provided on Table 3.1.

TABLE 3.1

SUMMARY OF REMEDIAL ACTION TECHNOLOGIES
FORD RI/FS WORK PLAN

Remedial Action Technology		Comments
A.	*Soil Remediation*	
A.1	- Deed Restriction	Restricts future land use of area affected by contamination.
A.2	- Site Cap or Cover	Reduction of water infiltration, prevents direct contact and exposure of contaminants at the surface.
A.3	- Removal (excavation)	May be cost prohibitive but removes source of contamination.
A.4	- Consolidation	Permits consolidation of Site materials for other treatment options.
A.5	- Disposal in Industrial Waste/ Hazardous Waste (RCRA) Landfill (On-Site or Off-Site)	Secures waste and minimizes future migration of contaminants, may be restricted by Land Disposal Regulations.
A.6	- Soil Treatment	
	- Incineration (On-Site or Off-Site)	Provides destruction of most organic wastes and can be conducted on or off Site. Would require additional handling of decontaminated soil/ash after incineration.
	- Advanced Electric Reactor	Practical successes not demonstrated by the manufacturer.
	- Bioremediation	Some compounds are not easily biodegradable. VOCs would be released to atmosphere.
	- Fixation/Solidification	Limited to fixation of contaminated soil containing inorganics. Could be used to fix residual metals within incinerated soil.
	- Soil Washing	Experimental technology. Difficult to maintain oxygen and nutrient levels in soil.
	- Soil Vapor Extraction (low temperature soil desorption)	Removes volatile organic waste constituents and promotes biodegradation of non-volatiles.
	- Vitrification	Cost prohibitive, not proven technology, will not immobilize VOCs.

TABLE 3.1 (CONT'D)

SUMMARY OF REMEDIAL ACTION TECHNOLOGIES
FORD RI/FS WORK PLAN

	Remedial Action Technology	Comments
B.	*Groundwater Remediation*	
B.1	- Monitoring	Provides determination of ongoing nature, extent and trends.
B.2	- Deed Restriction	Restricts use of groundwater in area of contamination.
B.3	- Cap	Reduction of surface water infiltration potentially reduces long term mass loading to aquifer.
B.4	- Physical Containment	Provides physical barrier to prevent future migration of contaminants.
B.5	- Hydraulic Containment/Collection	
	- Extraction Wells	Collects groundwater and mitigates future migration. Would reduce levels of contamination over time.
	- Extraction Wells with Reinjection	Reinjection not normally allowed in Minnesota.
	- Subsurface Drain	Collects groundwater and prevents future migration. Limited to depths of 40 feet or less.
B.6	Treatment	
	- Biological	Difficult to implement and maintain on-Site. Off-Site treatment at Public Owned Treatment Works (POTW) suitable.
	- Activated Carbon	Effective in treating large array of organic contaminants. Ineffective for some compounds such as acetone. May require pre or post treatment by other technology.
	- Air Stripping	Effective in treating volatile compounds. May require additional polishing by other technology for surface water discharge.
	- Aeration	Effective in removal of volatile compounds. Low maintenance where scaling a concern.

TABLE 3.1 (CONT'D)

SUMMARY OF REMEDIAL ACTION TECHNOLOGIES
FORD RI/FS WORK PLAN

Remedial Action Technology	Comments
- Oxidation	High cost of oxidizing agents when used alone. Not effective in treating VOCs without ultraviolet radiation.
- Ion Exchange	Used to treat inorganic wastewater (i.e. metals).
- Reverse Osmosis	Used to treat inorganic wastes (i.e. metals.).
- Solar Evaporation	Would cause VOC releases to atmosphere. Ineffective when humid.
- Spray Evaporation	Would cause VOC release to atmosphere. Ineffective when humid.
- Discharge to POTW	Would be subject to POTW's operating permit. Site contaminants are readily treated by POTW.
- Ultraviolet Oxidation	Capable of treating most organic compounds. Requires pretreatment for iron removal.
- Biological/Activated Carbon	High cost. Normally applied when high level of organic contaminants present.
B.7 Treatment Groundwater Disposal	
- Reinjection/Recharge	Not normally allowed in Minnesota.
- Discharge to Surface Water	Would require NPDES permit and high efficiency treatment.
- Discharge to POTW	Would be subject to POTW's operating permit.
- Discharge to RCRA Facility	Logistics of transporting treated water not feasible.
B.8 Alternate Water Supply	Not expected to apply as area serviced by city water system.

4.0 SITE INVESTIGATION PLAN

4.1 OBJECTIVES

The goal of this RI/FS is to gather the data necessary to characterize the nature and extent of potential residual contamination resulting from past activities at the Ford Site. The information compiled will be used to:

1) conduct a Baseline Risk Assessment to evaluate potential impact on public health and well being;

2) develop potential remedial alternatives for the Site, if needed;

3) determine what additional data is needed, if any, to fully characterize the site.

The specific tasks to achieve these objectives are:

1) to determine the nature and extent of potential residual soil contamination attributable to past Site activities;

2) to characterize Site geologic conditions;

3) to characterize the Site hydrogeologic conditions including horizontal and vertical groundwater flow directions and velocities in both overburden and bedrock;

4) to determine the nature and extent of groundwater contamination in the Site overburden and bedrock, if any;

5) to determine if local surface water is impacted by past Site activities.

4.2 SITE AREA ORGANIZATION

As discussed previously in Section 2.0 (Site Background Information and Past History), four potential source areas have been identified at the Ford Site. Three of these areas, the UST Site, Site A and Site B are located in the main plant area and encompass the majority of the proposed field activities. The scope of field activities at Site C, located adjacent to the Mississippi River, involves the continued monitoring of chemical and hydrogeologic conditions using the existing monitoring well network. Figure 1.2 shows the locations of these potential source areas.

For organizational purposes, a discussion of the scope of work and field activities to be performed at each potential source area will be divided into three sections; the UST Site, Sites A and B (combined), and Site C. The segregation of these potential source areas into separate study units is based on differences in waste disposal history and hydrogeologic setting as outlined in Section 2 and the potential of differing remedial response actions at each source area site.

The following sections discuss the scope of work and field activities which will be performed at each study area.

4.3 UST SITE INVESTIGATION WORK PLAN

4.3.1 Overview of Scope of Work

Based on: the possible presence of waste solvent in the UST Site drain tile system as discussed in Section 2.8; the presence of solvent materials in the soil above tanks #1 and #2; the possible migration of solvent materials outside the UST tank basin, the following scope of work is proposed to investigate Site conditions involving soil and groundwater in the vicinity of the UST.

- Analysis of solvent waste stream in tanks #1 and #2 for metals and further VOC characterization;
- The use of soil gas sampling to investigate soil gas conditions;
- Sample soils for chemical analyses;
- Removal of the four USTs;
- The installation of three groundwater monitoring wells;

- Water level monitoring;
- Groundwater sampling of the three new wells and the drain tile sump for metals and VOC.

This work is proposed to evaluate:

- groundwater flow direction,
- hydrogeologic properties,
- assess groundwater quality in the vicinity of the UST;
- assess soil conditions in the vicinity of the UST.

Ford will be removing the four USTs as part of a separate project to relocate the waste solvent storage facility and provide modifications prompted by new federal RCRA UST regulations. As part of this relocation project, Ford will be utilizing two of the four USTs at a new installation to be constructed at the location noted on Figure 4.1. To the extent possible, the sump and drain tile system will be left intact at the existing location to allow for their use in the UST site investigation. Table 4.1 summarizes the scope of field and related monitoring/analytical work proposed.

4.3.2 Soil Gas Survey

A soil gas survey will be conducted to determine soil gas organic vapor concentrations that may indicate the presence of VOC in the soil. Soil gas monitoring will be conducted at approximately 12 locations (i.e. final

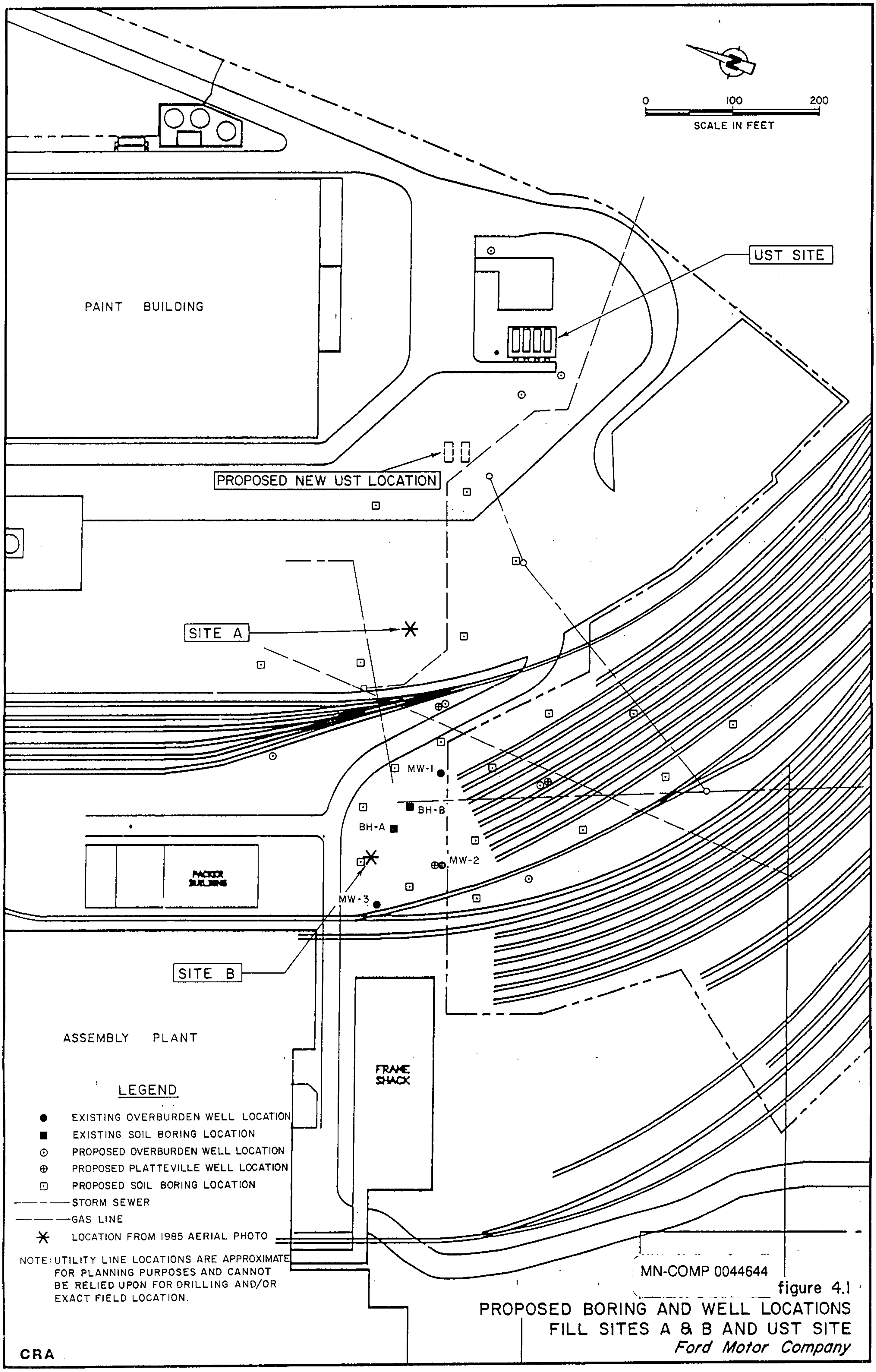

figure 4.1
PROPOSED BORING AND WELL LOCATIONS
FILL SITES A & B AND UST SITE
Ford Motor Company

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TABLE 4.1

SCOPE OF WORK
ANALYTICAL SUMMARY

Site/Location	Matrix	Field Parameters	Analytical Parameters	Number of Investigative Samples[1]	Quality Assurance Samples Trip Blank[2]	Rinsate Blank	Field Duplicate	MS/MSD Sample[3]	Subtotal	Frequency[4]	Total
UST	Soil, Borings	Soil Gas	VOC	3	0	1	1	1	5	1	5
	Groundwater	Conductivity	VOC	3	1	1	1	1	7	2	14
		pH	Metals	3	0	1	1	1	6	2	12
		Temperature									
	Sump	-	VOC	1	1	0	0	0	2	2	4
	Water Discharge	Temperature	VOC	1	1	0	1	1	4	2	8
		pH	Metals	1	0	0	1	1	3	2	6
A and B	Soil, Borings	Soil Gas	VOC	23	0	2	2	2	29	1	29
	Groundwater	Conductivity	VOC	10	1	1	1	1	14	2	28
		pH									
		Temperature									
	Surface Water	pH	VOC	3	1	0	1	1	6	2	12
		Temperature									

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[1] Exact number of investigative samples may vary fro the listed.

[2] Trip blank samples may be consolidated.

[3] Triple normal sample volume will be collected.

[4] Number of sampling events.

quantity of samples will be determined in the field to obtain an adequate definition) within the unsaturated zone around the UST basin perimeter at a depth of approximately four feet using the following procedure:

1. an augered borehole will be drilled to a depth of approximately 3-1/2 feet into the ground at each test location;

2. a steel gas probe will be driven 1/2 foot through the bottom of the borehole such that the perforated portion of the probe is completely below the bottom of the borehole. A temporary bentonite seal will then be placed at the bottom of the borehole and around the probe;

3. a pump will then be used to draw a soil gas sample out of the probe and into a glass vessel. The flexible tubing leading to (i.e. out of) the glass vessel will than be clamped or valved off to trap the gas sample in the vessel;

4. the tygon tubing leading to the air pump will be removed from the pump and connected to the inlet of the HNu probe. The contents of the glass vessel will then be evaluated using an HNu-tpye photoionization detector with 11.7 EV probe calibrated to benzene to determine relative concentrations of gas present;

5. the borehole will then be backfilled with cuttings;

6. as a quality assurance procedure, ambient air (background) readings will be taken prior to and after each sampling location.

Figure 4.1a presents a schematic of the equipment/method to be used for soil gas evaluation. Where feasible, soil gas monitoring will be conducted within the utility line excavations which radiate from the UST area. The hazard of drilling near the utility lines may, however, prohibit this work at these locations.

The proposed monitoring well location for the UST Site (see Sections 4.3.3 through 4.3.4) will also serve as soil gas sampling locations in order to correlate soil gas field data to laboratory analytical data and evaluate the effectiveness of the soil gas sampling.

4.3.3 Soil Borings/Sampling

Three soil borings will be conducted using hollow stem auger methods. These soil borings will then be completed as monitoring wells. Locations are presented on UST Site Plan and Figure 4.1, and may be modified in the field due to accessibility and the presence of utilities. The borehole will be advanced using a minimum 4-1/4 inch I.D. hollow stem auger. Continuous undisturbed soil samples will be taken by split barrel sampling to define the

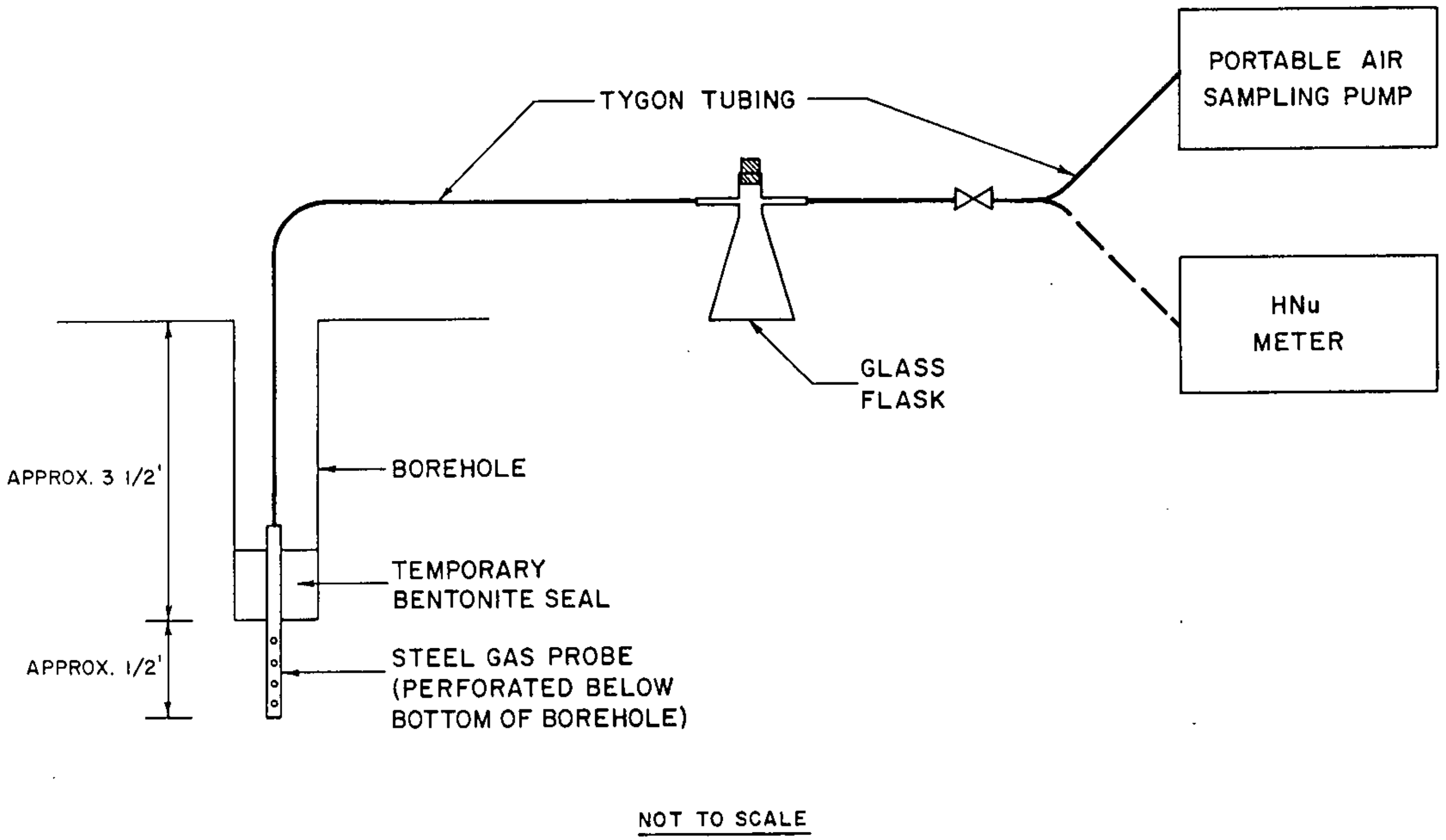

figure 4.1a
SCHEMATIC OF
SOIL GAS EVALUATION
Ford Motor Company

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subsurface soil stratigraphy. All boreholes are expected to be extended a minimum of 2 feet into the water table; the water table is expected to be approximately four to eight feet below grade.

At each monitoring well boring location, continuous undisturbed soil samples will be collected. Sampling will be conducted in accordance with ASTM split barrel sampling methods and EPA SW846 chemical sampling methods. Soil sampling procedures are detailed in Section 6.2.1.

Soil samples will be sent under chain-of-custody procedures and submitted for analysis of VOCs (EPA Method 8010/8020). One sample per boring will be submitted for chemical analysis.

4.3.4 Monitoring Well Installation

Based on Site geologic and hydrogeologic conditions, three monitoring well locations have been selected. The proposed well locations are shown on Figure 4.1 and the UST Site Plan, which is enclosed under separate cover. As described previously, it is expected that groundwater flow direction will be generally towards the southwest. Monitoring wells MWT1 and MWT2 will be placed to intercept groundwater flow downgradient from the UST tank basin. The proposed well MWT3 is located northeast of the UST tank basin for two purposes: to ascertain background groundwater quality and to provide adequate spacing of wells to maximize the evaluation of groundwater flow conditions. These well installations will require a permit from MDH.

The monitoring wells will be constructed according to the procedure provided in Section 6.2.2.

Following installation, the three new wells would be surveyed to the common on-site reference datum (Nation Geodetic Vertical Datum of 1929, NGVD) to establish groundwater elevations.

4.3.5 Groundwater Elevations

Groundwater elevations will be measured to better define the groundwater flow direction under the UST Site. In addition, water levels will be obtained for the drain tile sump and existing monitoring wells placed west of the UST Site as part of the Site B area work. Further information will also be correlated regarding storm water drains in the immediate area to better evaluate their possible influence. Attempt will be made to establish water elevations within these storm sewers should water be present during times of non-precipitation. Storm sewer lines in the area are indicated on Figure 4.1. A minimum of two complete rounds of water levels will be taken and groundwater flow directions will be calculated.

4.3.6 Groundwater Sampling

Two rounds of groundwater samples will be collected from the three new groundwater monitoring wells and the drain tile sump. Prior to sampling, each monitoring well will be developed and stabilized as per Section 6.2 and allowed to set for one week prior to sampling.

The groundwater monitoring wells will be developed using a precleaned[1] stainless steel bailer until a silt-free condition exists, or until a maximum of 10 well volumes has been removed. During development pH, specific conductivity and temperature will be recorded as per Section 6.2.

Wells will be sampled one week after well development. Prior to sample collection, the well will be bailed to remove a minimum of three well volumes, or until the well bails dry. The sample from the sump will be obtained as representative as possible by the use of a "coliwasa" column sample method. Samples will be sent under chain-of-custody procedures and analyzed for the following parameters: VOCs and metals as provided in Section 6.0.

Each sampling round will include one duplicate and one field blank sample as a quality control check.

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[1] Methanol/hexane/methanol followed by distilled water rinse.

4.3.7 Interim Response Action (IRA) Inspection and Sump Sampling Plan

The UST facility will be relocated as earlier noted. This new facility will be operated, maintained and inspected in accordance with applicable UST regulations. Given the more immediate need to address the inspection of the UST Site drain tile and sump, the following IRA is proposed.

4.3.7.1 Pumping Operations

It is proposed that a pump and discharge line be used to pump down the drain tile system. The discharge would be routed to the two filtering basins used for process water recycling/setting with a total capacity of 1.5 million gallons located beneath the paint building. A fiberglass pipeline to the building exists and will be utilized.

Hook up of the line would include use of a pump within the manhole and back flow prevention on the discharge line. A schematic of the discharge/pump out system is presented on the UST Plan.

In addition, diversion of storm water runoff will be evaluated to prohibit runoff from areas adjacent to the UST tank basin from flowing to the basin area.

It is proposed that regardless of removal of the USTs, the flow to the sump should be sampled and analyzed every two months during the

RI to evaluate the water quality. This material is likely to contain the same constituents as the wastewater from paint spray booths. As a result, it is not necessary to evaluate water quality each time pumping is conducted. The sample for analysis will be drained from the discharge line via a sampling port (to be installed). To provide the most representative sample, a composite will be made by taking a sample at the beginning, middle and end of the pumping cycle. This will be done by manually operating the pump and observing the operation during the entire cycle. The collected sample will be analyzed for VOCs and metals as provided in Section 6.0. These pumping operations will be implemented for the period of the RI field work, after which they will be reevaluated. A key factor in this will be whether the sump and drain tile system are still present after the tank removal.

4.3.7.2 Sump Inspection

Assuming the sump and drain tile will be left in place, they will be inspected on a monthly basis and after significant precipitation events. The pumping system will be started to lower the liquid level in the manhole and drain tile system for inspection. The manhole area will then be visually inspected from surface level (without confined space entry) using a strong light. The inspection will help identify:

- sump water levels,
- presence of potential solvent waste in sump water,

- sediment buildup in sump,
- evidence of pipe blockage.

A reference elevation at the lip of the manhole will be established to allow measurement of the water elevation with the manhole sump and the elevation of any sediment build up which may be present.

Inspections of the facility will be conducted on at least a monthly basis during the RI field work. After the RI field work, the frequency of inspection will be reassessed. The results of each inspection will be recorded on an inspection log sheet. Information on the log sheets will include the inspector's name and title, date and time of inspection, item of inspection, observations, the date and whether pumping occurred during inspection.

An inspection log will be kept with the RI/FS project files. Records of inspections will be kept under the terms of the records retention policy provided in Section 7.2.

4.3.8 Reporting

The final UST Site report will be included in the final RI report and present the following information:

1. Background of the Site,
2 Tank contents and history,

3. Results of all sampling and monitoring conducted, including inspection logs completed to date,
4. Site map showing all sampling locations (i.e. borings, monitoring wells, etc.),
5. Technical information on geology and hydrogeology of the Site area,
6. Technical information on surface waters runoff of the area, if any,
7. Building information on structures near the Site area,
8. Information and locations of utilities in the area,
9. Information on any free product or vapors,
10. Interim control measures proposed underway and/or completed,
11. Technical discussion, conclusions and recommendations, and
12. All associated sampling and analytical protocols.

Following completion of the report, the need for additional interim response action will be assessed.

4.4 SITES A AND B INVESTIGATION

Due to the proximity, similar waste disposal history and anticipated similar hydrogeologic setting, Sites A and B will be investigated under simultaneous programs of work.

4.4.1 Overview of Scope of Work

Based on the history of potential waste disposal at Sites A and B and the detection of contaminated soil and groundwater at Site B as outlined in Section 2.0, the following scope of work is proposed to characterize soil and groundwater chemical conditions and hydrogeologic conditions at Sites A and B:

1. installation of boreholes to obtain soil samples for chemical and hydrogeologic analysis;
2. installation of overburden monitoring wells in selected soil boreholes;
3. installation of bedrock monitoring wells, collecting bedrock core;
4. collection of groundwater chemical data from monitoring wells;
5. collection of hydrogeologic data from monitoring wells;
6. collection of chemical data from surface water.

The following subsections detail the field activities associated with the above tasks. Table 4.1 summarizes the scope of field and related monitoring/analytical work proposed. Site A is considered to be entirely on Ford property. The scope of work for the investigation of Site B is separated into two sections, one for work to be performed on Ford property and one for work to be performed on Soo Line property.

Performance of the work proposed for the Soo Line property is contingent on Ford receiving access authorization from Soo Line. Ford will request MPCA assistance if efforts to obtain access are unsuccessful.

4.4.2 Soil Sample Collection

Soil samples will be collected to determine the extent and chemical characteristics of potentially contaminated soils and to obtain data for hydrogeologic interpretation. Samples will be collected for chemical analysis and geological classification continuously from the surface to the top of bedrock, expected to be from 10 to 15 feet BGS. One sample per boring will be submitted for chemical analysis. Details pertaining to the QA, analytical parameters, field protocols and field methods that will be used are described in Section 6.0 (QAPP).

Ford Property

A minimum of 13 boreholes will be advanced at Sites A and B on Ford property. Borehole depths are expected to be from 10 to 15 feet BGS. Figure 4.1 shows the locations of these boreholes. Two of the borings will be completed as monitoring wells.

The objective of this soil sampling program is to delineate the extent of potentially contaminated soils. Borehole locations were chosen based on our review of past work and historical aerial photographs which show areas of disturbance.

The objectives for soil sample locations chosen at Site B were to further delineate the extent of previously encountered contamination in BH A, BH B and MW-1. The proposed borings will be advanced to delineate the areal extent of potential contamination. Soil boring locations chosen at Site A are intended to provide adequate coverage of the disturbed area as shown in the 1985 aerial photograph. Site A is considered to be entirely on Ford property.

Soo Line Property

A minimum of 10 boreholes will be advanced at Site B on Soo Line property. Borehole depths are expected to be from 10 to 15 feet BGS. Figure 4.1 shows the locations of these boreholes. Two of the borings will be completed as monitoring wells

The objective of the Soo Line soil sampling program is to delineate the extent of potentially contaminated soils. Borehole locations were chosen based on our review of past work and historical aerial photographs which show areas of disturbance.

4.4.3 Overburden Monitoring Well Installations

4.4.3.1 Site A Wells

Three overburden monitoring wells will be installed at Site A on Ford property if soil contamination is discovered at Site A. The locations of these potential wells will be based on soil chemistry and geologic data obtained during the soils investigation phase of the Site A area. These monitoring wells will be placed to provide a thorough coverage of the Site A area shallow groundwater to intercept potentially impacted groundwater, if any, associated with contaminated soils.

Overburden monitoring well construction methods and field protocols are detailed in Section 6.2.2.

4.4.3.2 Site B Wells

Overburden monitoring wells will be installed to characterize the chemical and hydrogeologic conditions of the shallow groundwater underlying Site B.

Monitoring well placement will be based on both available data gathered from past studies and additional data gathered during the soils investigation. Figure 4.1 shows the approximate locations of the proposed monitoring wells.

Ford Property - Site B Wells

Based on the chemical and hydrogeologic data available from the existing Site B monitoring wells (MW-1, MW-2 and MW-3), two overburden monitoring well locations, on Ford property, were selected . The objectives of these new well locations is to further delineate the location of potential groundwater contamination which may extend laterally to the east of MW-1 and downgradient to the north of MW-1 and MW-2. Additionally, these wells will provide added data points for hydrogeologic interpretation. These wells will be installed in the soil borings previously noted.

Soo Line Property - Site B Wells

A minimum of two overburden monitoring wells will be installed at Site B on Soo Line property. These wells will be installed in the previously completed borings as earlier noted. These wells are intended to delineate the source of potential groundwater contamination upgradient of MW-1 and MW-2. The locations of these wells and the locations of possible additional wells are contingent on the results of the borehole sampling program.

4.4.4 Bedrock Monitoring Wells

Three bedrock monitoring wells will be installed at Site B to ascertain if groundwater contamination detected at Site B has migrated vertically into the bedrock, determine if a hydraulic connection exists between the overburden and bedrock and determine horizontal and vertical groundwater flow characteristics of the bedrock aquifer. Bedrock monitoring wells will be located adjacent to selected overburden monitoring wells (nested) to provide determination of vertical hydraulic gradients. Two bedrock wells will be installed on Ford property and one bedrock well will be installed on Soo Line property. Figure 4.1 shows the proposed locations of the bedrock monitoring wells.

Bedrock monitoring well locations were chosen based on the observation of impact to the overburden units at Site B. Well placement will maximize interpretation of hydrogeologic characteristics.

The bedrock immediately underlying the Sites A and B area consists of limestone of the Platteville Formation. Based on past field observations and available literature, groundwater is known to occur in fractures of the Platteville Formation. The thickness of the Platteville is estimated at 20 to 25 feet in the Site area.

Underlying the Platteville Formation is the Glenwood Shale which is approximately 4 to 6 feet thick. Literature sources state that this

Formation is composed of clay rich, thin bedded shales which functions as a hydrogeologic confining unit. Underlying the Glenwood Shale is the St. Peter Sandstone.

Based on the above information, the proposed bedrock monitoring wells will be installed with the well screens set in the Platteville Formation. Drill holes will not extend beyond the contact with the Glenwood Shale. It is expected that the Glenwood Shale will provide an effective confining layer preventing vertical groundwater flow into the St. Peter Formation.

Bedrock monitoring wells will be installed to minimize potential cross contamination from the overburden aquifer to the bedrock aquifer. The following outline details the procedures and materials which will be used to install the bedrock monitoring wells:

1. A 10 inch diameter borehole will be advanced through the overburden, two feet into the top of the Platteville Formation;

2. A 6.0 inch diameter steel casing will be installed, sealed and grouted in the 10 inch boring. The casing will be allowed to set an adequate period of time, and then will be checked to ensure an adequate seal has been achieved. This check will be done by placing drilling water in the casing and observing that the water level is maintained;

3. Using wet rotary methods, a core hole will be advanced using an nx sized barrel (approximately 2.0 inch inside diameter) to the top of the Glenwood Shale. All wet rotary methods will be conducted using potable city water.

4. The core hole will be reamed to a diameter of 6.0 inches using a tri-cone rotary bit and wet rotary methods.

5. The drill hole will be flushed clean using potable water.

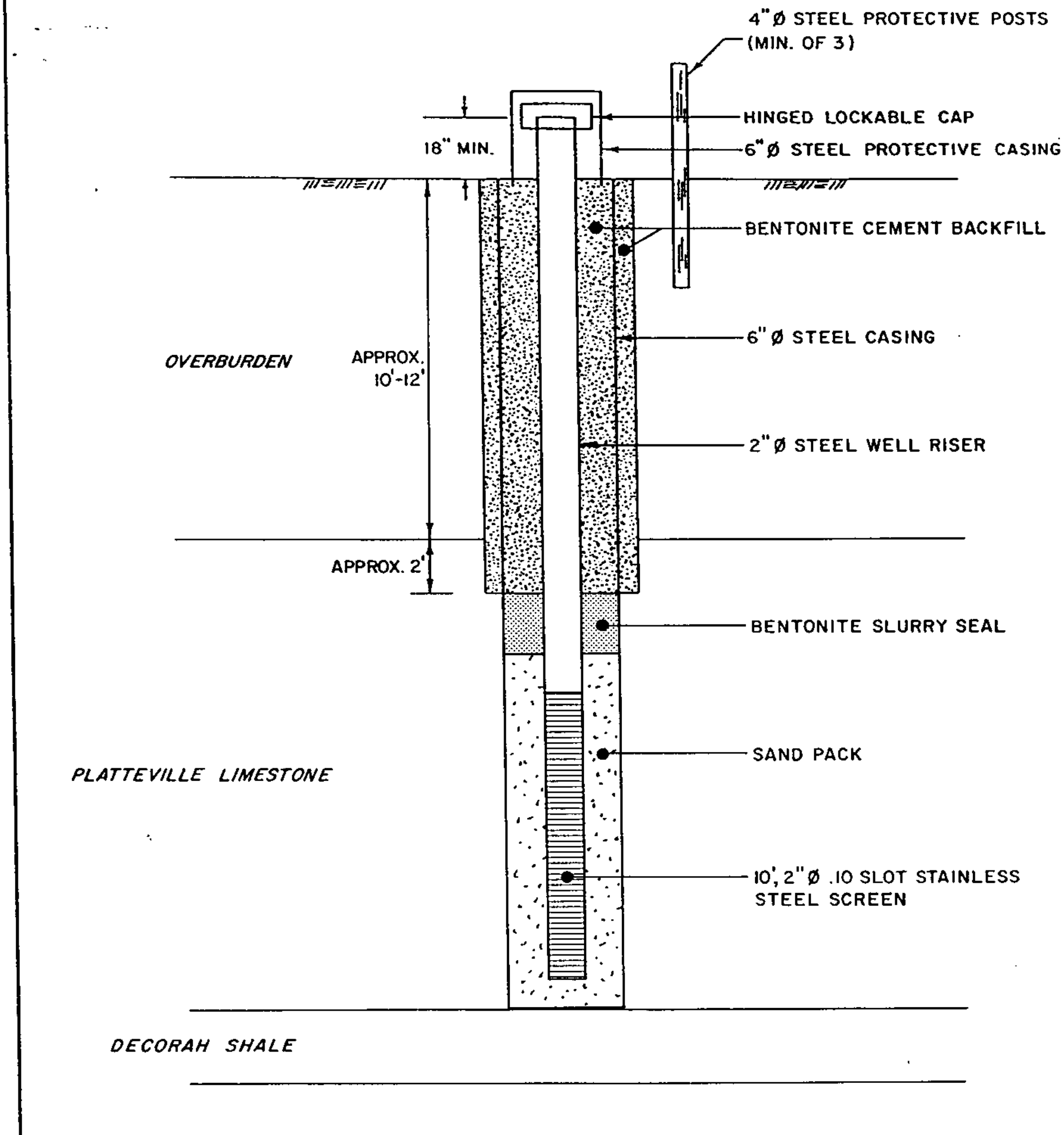
6. A two inch diameter well and surface protection will be installed using the same materials, methods and field protocols as described in Section 6.2.2.

7. All drilling equipment (i.e. rods, augers, drill rig, etc.) will be cleaned in accordance with the procedures outlined in Section 6.2.2.

Figure 4.2 details the bedrock monitoring well installations.

Bedrock monitoring wells will be installed in accordance with the MDH well code using a licensed well contractor.

Rock core will be cataloged and described by CRA's field geologist, paying particular attention to hydrogeologic properties of the bedrock.



NOT TO SCALE

figure 4.2

TYPICAL BEDROCK MONITORING WELL INSTALLATION

Ford Motor Company

CRA

2853-8/02/90-M

All monitoring wells will be developed and stabilized as described in Section 6.2.2.

4.4.5 Groundwater Sampling

Following well development and stabilization, two rounds of groundwater samples will be collected from overburden and bedrock wells. Details pertaining to sampling procedures, analytical parameters, field procedures, sampling protocols, quality assurance and quality control are summarized in Section 6.0 (QAPP).

4.4.6 Hydrogeologic Data Collection

Hydrogeologic data will be collected from selected monitoring wells to provide a basis for determining groundwater flow direction in overburden and bedrock, horizontal and vertical hydraulic gradients, hydraulic conductivities, groundwater flow rates and groundwater recharge and discharge points. Monitoring well reference elevations will be surveyed to the NGVD datum to aid in hydrogeologic characterization.

The following hydrogeologic data collection is proposed:

1. Water Level Elevations: Three rounds of water elevation data will be collected from all wells using an electric water level tape.

2. Single Well Response Tests: Single well response tests will be performed on selected monitoring wells to provide data for interpreting hydraulic conductivity. Rising and falling head tests will be conducted using a "slug" consisting of a solid PVC rod. The slug will be inserted into the monitoring well, resulting in a raising of the water level. Water level change versus time will be recorded using an electric water level tape as the water level column drops back to its static level (falling head test). Should the hydraulic response be too rapid to accurately monitor by electric water level tape, an electronic transducer and data logger will be used. Upon stabilization of the water level to static conditions, the slug will be removed, causing a lowering of the water level. Water level measurements versus time will again be noted as the water rises to its static position (rising head test). Response test data will be interpreted using the method of Papadopulos 1973, with the aid of a computer program, Graphical Well Analysis Package (GWAP).

4.4.7 Surface Water Sampling

Three surface water samples will be collected to aid in evaluating the potential impact of past Site disposal practices on local surface water. These samples will be taken in conjunction with the two proposed groundwater sampling events using the same analytical parameters as discussed in Section 6.0.

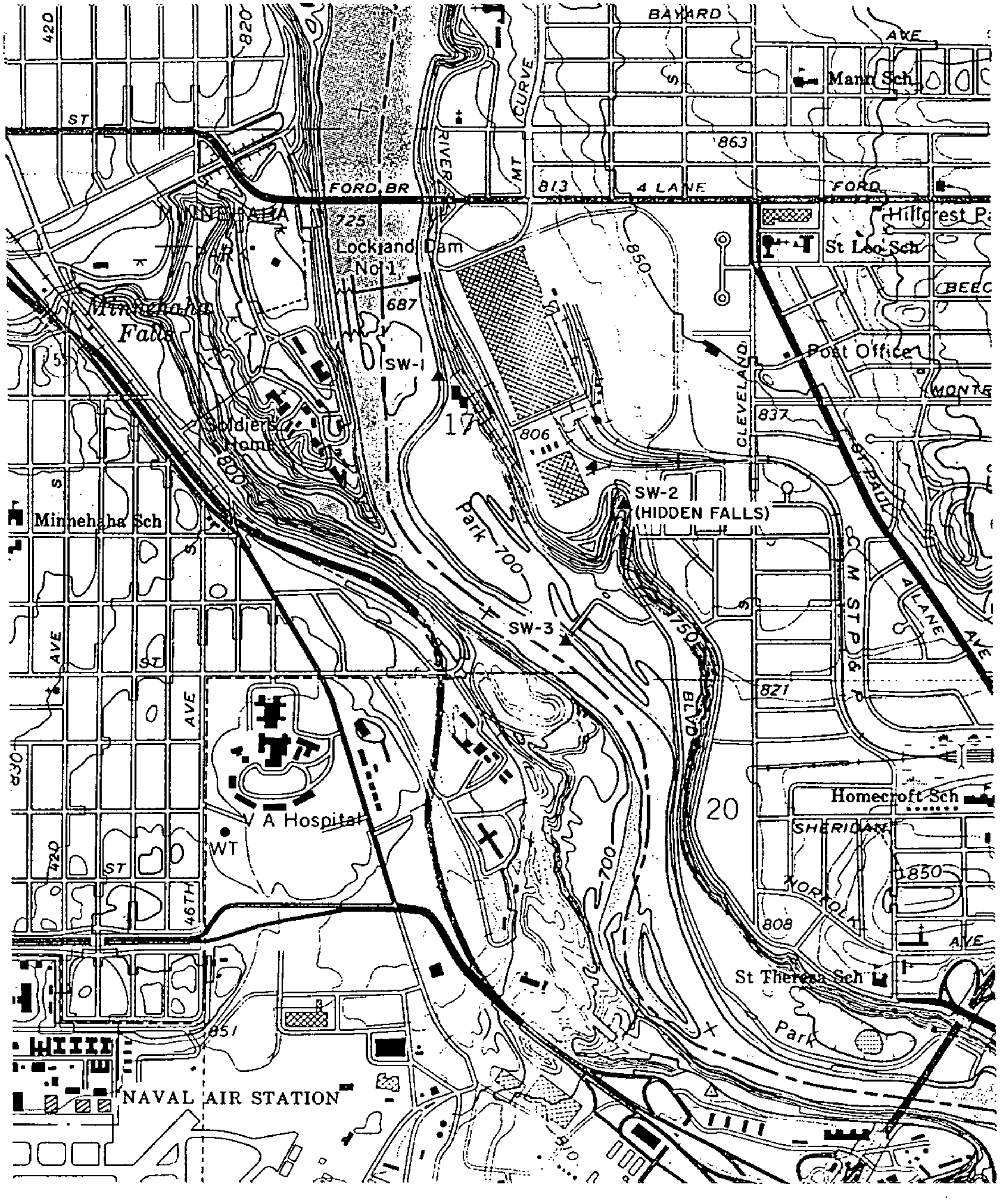
The locations of these sample points is illustrated on Figure 4.3. One surface water sample will be collected from Hidden Falls creek, directly from the storm sewer runoff (SW-2). This location will be used to evaluate if Site groundwater is discharging to the area storm sewer system. Two surface water samples will be collected from the Mississippi River, one located down gradient of the Site (SW-3) and one located up gradient of the Site (SW-1) to provide background chemical characterization.

Surface water sampling procedures, QA and field protocols are discussed in Section 6.0.

4.5 SITE C INVESTIGATION

4.5.1 Overview of Scope of Work

As detailed in Section 2.0, an investigation of Site C has been ongoing for approximately nine years. There are presently four monitoring wells installed at Site C, with a significant amount of chemical and hydrogeologic data collected from these wells, and from surface water. The summary of the evaluation of Site C is provided in Section 2.7.



SW-1 ▲ SURFACE WATER SAMPLE LOCATION

NOT TO SCALE

CRA

figure 4.3
SURFACE WATER
SAMPLE LOCATIONS
Ford Motor Company

2853-20/08/90-M

Based on the work completed to date, no further investigation is proposed for Site C.

5.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Conestoga-Rovers and Associates (CRA), as contractor to Ford, has overall responsibility for all phases of the RI/FS. CRA will perform or supervise all field investigations and, using information compiled from this program, perform a site and risk assessment. In addition, CRA will also develop, screen and evaluate remedial action alternatives. All reports based on RI/FS activities will be produced by CRA.

Pace Laboratories Inc., as analytical subcontractor to CRA, will perform all chemical analyses of samples collected for the RI.

Both firms will provide project management as appropriate to their responsibilities. CRA will provide administrative oversight and QA/QC for all deliverables. All final project deliverables will be issued by CRA.

Figure 5.1 presents the key staff organization for the project. A summary of each of the key person's responsibilities is presented below:

Jerome S. Amber - Technical Project Supervisor, Ford

- General overview of the project to ensure that the objectives are met
- Participation in negotiations with the MPCA
- Managerial guidance to CRA's Corporate Project Manager and Project Coordinator

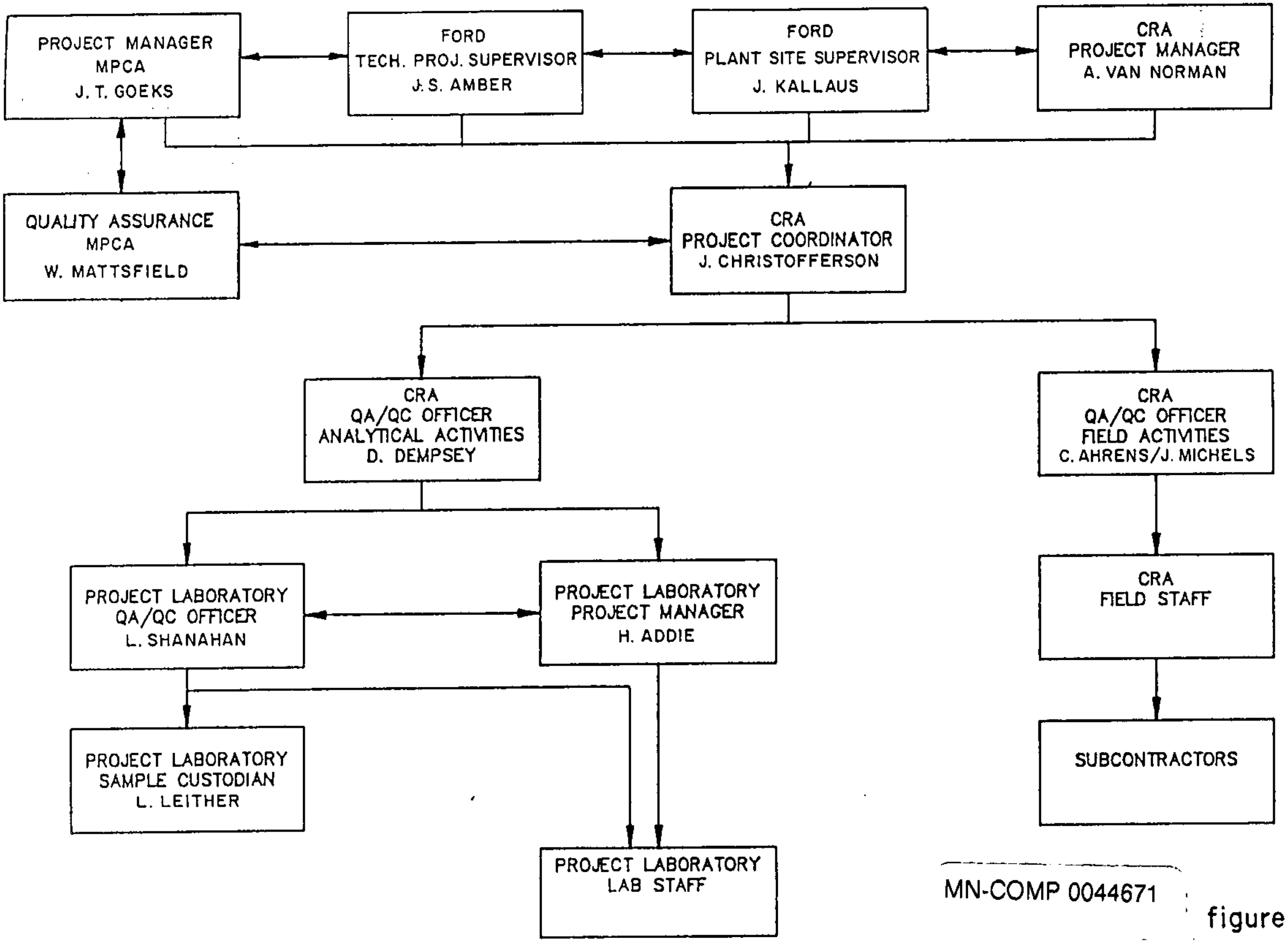


figure 5.1

PROJECT ORGANIZATION
Ford Motor Company

CRA

2853-20/08/90-M

John Kallaus - Ford Site Supervisor, Ford

- Provides coordination with Plant personnel and operations
- Provides access to necessary Plant facilities
- Coordinates activities with Plant security

Alan Van Norman - Project Manager and Principal Engineer, CRA

- Provides overall project management
- Ensures all resources of CRA are available on an as-required basis
- Participation in technical negotiations with the MPCA and attendance at project meetings on an as-required basis
- Managerial and technical guidance to CRA staff
- Preparation and review of RI/FS report
- Approval of the QAPP

Jon Christofferson - Project Coordinator, CRA

- Day-to-day project management
- Managerial and technical guidance to CRA staff
- Participation in technical negotiations with the MPCA
- Preparation and review of RI/FS report
- Project file custodian

Dave Dempsey - Quality Assurance Officer - Analytical Activities, CRA

- Overview of laboratory activities
- Decides laboratory data corrective action
- Analytical data assessment and validation

- Responsible for external performance and system audits
- Review of RI/FS report
- Approval of the QAPP

Chuck Ahrens/Jon Michels - Quality Assurance Officers - Field Activities/Field Supervisors, CRA

- Management of field activities and field QA/QC
- Data assessment
- Preparation and review of RI/FS report
- Technical representation of field activities
- Preparation of SOP for field activities

Helen Addie - Project Manager, Pace

- Ensures all resources of Pace are available on an as-required basis
- Overviews final analytical report
- Oversees all laboratory's activities
- Approval of the QAPP

Bill Scruton - Operations Manager, Pace

- Coordinate laboratory analyses
- Supervise in-house chain-of-custody
- Schedule sample analyses
- Oversee data review
- Oversee preparation of analytical reports
- Approve final analytical reports prior to submission to CRA

Leisa Shanahan - Quality Assurance Officer, Pace - Laboratory Activities

- Overview laboratory quality assurance
- Overview QA/QC documentation
- Conduct detailed data review
- Decide laboratory corrective actions, if required
- Technical representation of laboratory QA procedures
- Approval of the QAPP

Lisa Leither - Sample Custodian, Pace

- Receive and inspect the incoming sample containers
- Record the condition of the incoming sample containers
- Sign appropriate documents
- Verify chain-of-custody and its correctness
- Notify laboratory manager and laboratory supervisor of sample receipt and inspection
- Assign a unique identification number and customer number and enter each into the sample receiving log
- With the help of the laboratory manager, initiate transfer of the samples to appropriate lab sections
- Control and monitor access/storage of samples and extracts

Primary responsibility for project quality rests with CRA's QA Officers. Ultimate responsibility for project quality rests with CRA's Project

Manager. Independent quality assurance will be provided by the Laboratory Project Manager and QA Officer prior to release of all data to CRA.

5.1 MINNESOTA POLLUTION CONTROL AGENCY (MPCA)

The MPCA Project Manager will be responsible for the execution and direct management of all the technical and administrative aspects of this project. The MPCA Project Manager will also be responsible for providing approval of the work plan. J. Todd Goeks is the Project Manager for the MPCA.

The MPCA Quality Assurance Officer will be responsible for MPCA oversight of QA/QC activities and approval of the QAPP. The MPCA Quality Assurance Officer will be Wayne Mattsfield.

6.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

6.1 QUALITY ASSURANCE (QA) OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses and reporting that will provide accurate data. Specific procedures to be used for sampling, chain-of-custody, calibration, laboratory analysis, reporting, quality control, audits, preventive maintenance and corrective actions are presented in other sections of this QAPP.

Data quality objectives (DQO) have been established in accordance with the U.S. EPA guidance document entitled "Data Quality Objectives for Remedial Response Activities", EPA/540/G-87/003, March 1987, to ensure that the database developed during the Site investigation meets the objectives and quality necessary for its intended use, namely risk assessments, determining contaminant distribution and evaluating remedial objectives.

DQO can be classified for measurement data by defining the level of analytical support assigned to each type of measurement data. For activities outlined in Table 4.1, all laboratory analyses will require level III analytical support.

DQO for field screening activities such as the determination of pH, specific conductance, temperature and VOC concentration (HNu) will require level I analytical support.

6.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

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Data quality objectives (DQO) have been established in accordance with the U.S. EPA guidance document entitled "Data Quality Objectives for Remedial Response Activities", EPA/540/G-87/003, March 1987, to ensure that the database developed during the Site investigation meets the objectives and quality necessary for its intended use, namely risk assessments, determining contaminant distribution and evaluating remedial objectives.

DQO can be classified for measurement data by defining the level of analytical support assigned to each type of measurement data. In general, all laboratory analyses will require level III analytical support.

DQO for field screening activities such as the determination of pH, specific conductance, temperature and VOC concentration (HNu) will require level I analytical support.

The use of the analytical support levels defined above will ensure that the overall objectives for the RI/FS will be completed.

6.1.1 Level of QA Effort

To assess the quality of data resulting from the field sampling program, field duplicate samples, rinsate samples, trip blank samples and matrix spike samples will be taken (where appropriate) and submitted to the analytical laboratory.

For all field samples collected, field duplicate samples will be collected at a frequency of 1 per 10 or fewer investigative samples per parameter set for each sample matrix or at least once per day, whichever is more frequent. Matrix spike/matrix spike duplicate (MS/MSD) samples will be analyzed at a minimum frequency of 1 in 20 for each analysis.

Rinsate blank samples will be submitted at a frequency of 1 per 10 or fewer well purging/sampling equipment cleanings or at least once per day of well purging/sampling equipment cleanings. Rinsate blanks shall be collected by routing deionized distilled water through decontaminated sampling equipment. For surface water samples, field blank samples will be collected at a frequency of 1 per 10 samples in place of rinsate samples.

Trip blank samples for VOC analyses (prepared by the laboratory and consisting of organic-free water) will be shipped by the laboratory with each shipment container of aqueous VOC sample vials. Trip blanks samples will be handled in a manner consistent with actual field sample handling and will be shipped back to the laboratory with the daily field samples. The trip blanks will provide a measure of potential cross contamination of samples during shipment and handling. It is noted that trip blanks will not be opened in the field.

The sampling and analysis program (the level of QA effort required for each matrix) is summarized on Table 6.1.

Blank samples will be analyzed to check procedural contamination and/or ambient conditions and/or sample container contamination at the Site that may cause sample contamination.

Upon examination of the results obtained by Pace, if any of the aforementioned blanks contain any analytes, the following procedure will be followed. First, determine if the contamination is real by examining the associated investigative samples and method blanks. If the contamination can be traced to an isolated source, e.g. a highly contaminated sample, the data are to remain unqualified. Otherwise, the data will be examined to determine the extent of contamination and all associated data will be qualified according to the data validation guidelines referenced in Section 6.6.

Field duplicate samples will be analyzed to check for sampling and analytical reproducibility. Field duplicate samples will be collected 1 for every 10 samples per matrix or at least once each day of sampling

TABLE 6.1

SUMMARY OF QA SAMPLES FOR SAMPLES COLLECTED DURING TWIN CITIES ASSEMBLY PLANT RI/FS FORD MOTOR COMPANY

Matrix	Rinsate Sample	Field Duplicate Sample	MS/MSD Sample	Trip Blank Sample
Soil	1 for every 10 samples or at least once per day of sampling activities	1 for every 10 samples or at least once per day of sampling activities	1 for every 20 samples	
Groundwater	1 for every 10 samples or at least once per day of sampling activities	1 for every 10 samples or at least once per day of sampling activities	1 for every 20 samples	1 in every cooler containing aqueous VOC samples
Surface Water[1]	1 for every 10 samples or at least once per day of sampling activities	1 for every 10 samples or at least once per day of sampling activities	1 for every 20 samples	1 in every cooler containing aqueous VOC samples

Note:

1. For surface water, field blank samples will be collected in place of rinsate samples.

activities for each matrix. Comparison of field duplicate samples will be based upon analytes, both non-detected and detected, and relative percent differences (RPD). The parameters which do not meet criteria may only be used for qualitative assessment. Professional judgement shall determine the RPD limits on a sample-to-sample basis.

6.1.2 Sensitivity, Precision and Accuracy of Analysis

The fundamental QA objective with respect to the accuracy, precision and sensitivity of analytical data is to achieve the QC acceptance criteria of each analytical protocol. The sensitivities required for these organic analyses will be at least the targeted detection limits listed on Tables 6.2 and 6.3. These tables present targeted detection limits for all target parameters. It should be noted that these limits are targeted detection limits. Lower method detection limits, if achieved by the laboratory, will be substituted for the targeted detection limits in the final report.

The analytical method precision (based upon relative percent difference) shall be determined from replicate analyses, and will meet criteria presented in Section 6.6.2.2.

TABLE 6.2

PRACTICAL QUANTITATION LIMITS (PQLs) AND METHOD DETECTION LIMITS (MDLs) FOR VOC ANALYSES
TWIN CITIES ASSEMBLY PLAN SITE RI/FS
FORD MOTOR COMPANY[1]

	Water[1]		Soil[2]	
	PQL (µg/l)	MDL (µg/l)	PQL (µg/kg)	MDL (µg/kg)
Bromodichloromethane	1.0	0.2	125	25
Bromoform	2.0	1.0	250	120
Bromomethane	-	1.5	-	190
Carbon Tetrachloride	1.2	0.3	150	38
Chlorobenzene	2.5	1.0	312	120
Chloroethane	5.2	1.0	650	120
2-chloroethyl Vinyl Ether	10	5.0	1,200	620
Chloroform	0.5	0.5	62	62
Chloromethane	2.0	1.0	240	120
Dibromochloromethane	2.0	1.0	240	120
Dibromomethane	-	-	-	0.10
1,2-dichlorobenzene	10	4.0	1,200	500
1,3-dichlorobenzene	10	4.0	1,200	500
1,4-dichlorobenzene	10	4.0	1,200	500
Dichlorodifluoromethane[3]	-	1.5	-	190
1,1-dichloroethane	0.7	0.3	88	25
1,2-dichloroethane	0.3	0.2	38	25
1,1-dichloroethene	1.3	0.3	162	38
trans-1,2-dichloroethene	1.0	0.3	125	38
Methylene Chloride	-	1.0	-	120
1,2-dichloropropane	0.4	0.2	50	25
trans-1,3-dichloropropene	3.4	0.3	425	38
1,1,2,2-tetrachloroethane	2.0	1.0	240	120
Tetrachloroethene	2.0	1.0	240	120
1,1,1-trichloroethane	1.0	0.5	120	62
1,1,2-trichloroethane	2.0	1.0	240	120
Trichloroethene	1.2	0.5	150	62
Trichlorofluoromethane	-	0.4	-	50
Vinyl Chloride	1.8	1.5	225	190
Benzene	2.0	1.0	250	120
Ethyl Benzene	2.0	1.0	250	120
Toluene	2.0	1.0	250	120
Xylenes	-	1.0	-	120
Ethyl Acetate	-	0.01% (solvent scan)	-	0.01% (solvent scan)

Notes:

1. PQLs and MCLs are highly matrix depenent. Therefore, actual PQL and MDLs obtained may be considerably higher, depending on the sample matrix.
2. PQLs and MCLs are based on wet weight of sample.
3. Analyte demonstrated poor trap-and-purge efficiency.

TABLE 6.3

PRACTICAL QUANTITATION LIMITS (PQLs) AND METHOD DETECTION LIMITS (MDLs) FOR TARGET METALS ANALYSES TWIN CITIES ASSEMBLY PLAN SITE RI/FS FORD MOTOR COMPANY[1]

	Water[1]		Soil[2]	
	PQL (µg/l)	MDL (µg/l)	PQL (mg/kg)	MDL (mg/kg)
Arsenic	10	10	2	0.094
Barium	200	6.0	40	0.006
Cadmium	5	0.1	1	0.006
Chromium	10	10	2	0.01
Cobalt	50	16	10	0.016
Copper	25	5.0	5	0.005
Lead	5	1.0	1	0.045
Mercury	0.2	0.2	0.04	0.0002
Nickel	40	21	8	0.021
Selenium	5	3.3	1	0.081
Silver	10	5	2	0.005
Zinc	20	6.0	4	0.006

Notes:

1. PQLs and MDLs are highly matrix depenent. Therefore, actual PQL and MDL obtained may be considerably higher, depending on the sample matrix.
2. PQLs and MDLs are based on wet weight of sample.

Accuracy for the analytical method will be determined by the matrix spike and check sample recoveries. Sections 6.6.2 summarize criteria that each spike recovery must meet.

6.1.3 Completeness, Representativeness and Comparability

It is expected that all analyses conducted in accordance with SW-846 methods will provide data meeting QC acceptance criteria for 80 percent of all samples tested. Any reasons for variances will be documented. The corrective actions taken if the completeness goals are not met are described in Section 6.11 of this work plan.

The sampling networks have been designed to provide data representative of Site conditions. During development of these networks, consideration was given to past disposal practices, existing data from past studies completed for the Site, remedial activities to date and physical setting. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are documented in this work plan. However, it may be necessary to verify similar documentation for previous analytical data to adequately establish comparability. Comparability of laboratory analyses will be ensured by the use of consistent units. Following completion of data collection, the existing database will be evaluated for representativeness.

6.2 FIELD PROTOCOLS

6.2.1 Soil Sample Collection

All soil samples will be obtained in accordance with ASTM D1586-84. The split spoon sampler will be attached to the drill rod and driven into the soil the full depth (24 inches). If the soil is loose, wet or in any way unconsolidated, clean basket retainers will be used to retain the soil in the split spoon. Between each sampling station, the split spoon will be cleaned with Alconox detergent and rinsed with deionized water.

All soil samples collected will be described and classified according to the Unified Soil Classification System. A record of all soil sampling will be recorded on borehole logs which will be maintained by the Site geologist.

Selected soil samples will be prepared in the following manner for chemical analyses.

1. The sampling tool and all other instruments used in extracting the soil samples for chemical analyses will be precleaned using Alconox detergent. A new pair of disposable latex gloves will be used for each sample handled. Disposable gloves will be collected and contained for proper disposal.

2. Each soil sample for chemical analyses will be obtained and prepared in the following manner:

   a. Using a clean cutting tool (stainless steel knife), the soil sample will be extracted from the split spoon, attempting to ensure that a representative sample is collected. For VOC samples, the sample core will be transferred to sample jars without breaking apart the core, if possible. The remaining soil will be placed in the proper sampling bottles as outlined on Table 6.4.

3. Soil samples will be labeled noting the sampling location, depth, time and sampler's initials. A separate hard-cover field book will be maintained to document all soil samples and sampling events.

4. Samples will be placed on ice or cooler packs in laboratory supplied coolers after collection and labeling.

The criteria for selecting soil samples for chemical analysis are as follows:

TABLE 6.4

SOIL AND GROUNDWATER CONTAINER, PRESERVATION, HOLDING TIME PERIODS AND SHIPPING REQUIREMENTS

Analysis	Containers	Preservation	Maximum Holding Times[1]	Volume of Sample	Shipping[2]	Normal Packaging[3]
Water						
VOCs	Two 40 m*l* volatile organic vials	HCl to pH<2 4°C	14 days	Fill completely, no air bubbles	Courier or staff	Bubble Pack
Metals	One 500 m*l* polyethylene	HNO_3 to pH<2 4°C	6 months (except mercury, 28 days)	Fill to shoulder of bottle	Courier or staff	Bubble Pack
Soil						
VOC	1 4 oz. glass jar	4°C	14 days	Fill completely	Courier or staff	Bubble Pack
Metals	1 4 oz. plastic jar	4°C	6 months (except mercury, 28 days)	Fill completely	Courier or staff	Bubble Pack

Notes:

1. The maximum sample holding time is calculated from the date of sample collection.
2. Samples will be picked up by Pace.
3. All samples shall be protected from light.

During sampling, HNu headspace readings will be taken and recorded as an indication of possible VOC presence. Headspace readings will be collected as follows: a portion of the soil sample not already sealed in VOC jars (i.e. the metals sample) will be placed in a glass jar and the mouth of the jar will be sealed with aluminum foil. After a period of 15 to 20 minutes, an HNu photoionization probe will puncture the seal to detect any volatile gases that may be emitting from the soil.

If an HNu reading above site background levels is recorded from the soil sample, the sample will be prepared for possible analysis. A representative sample from each boring will be selected for chemical analysis after the HNu screening is complete. If HNu readings above background are not recorded, the soil sample collected from just above the groundwater table will be submitted for chemical analysis. A minimum of one soil sample per boring location will be submitted for chemical analysis.

6.2.2 Overburden Monitoring Well Installation Protocols

Overburden monitoring wells will be installed using a truck mounted drill rig advancing hollow stem augers with a minimum inside diameter of 4-1/4 inches. Overburden monitoring wells will be 2 inches in diameter. The following well materials will be used:

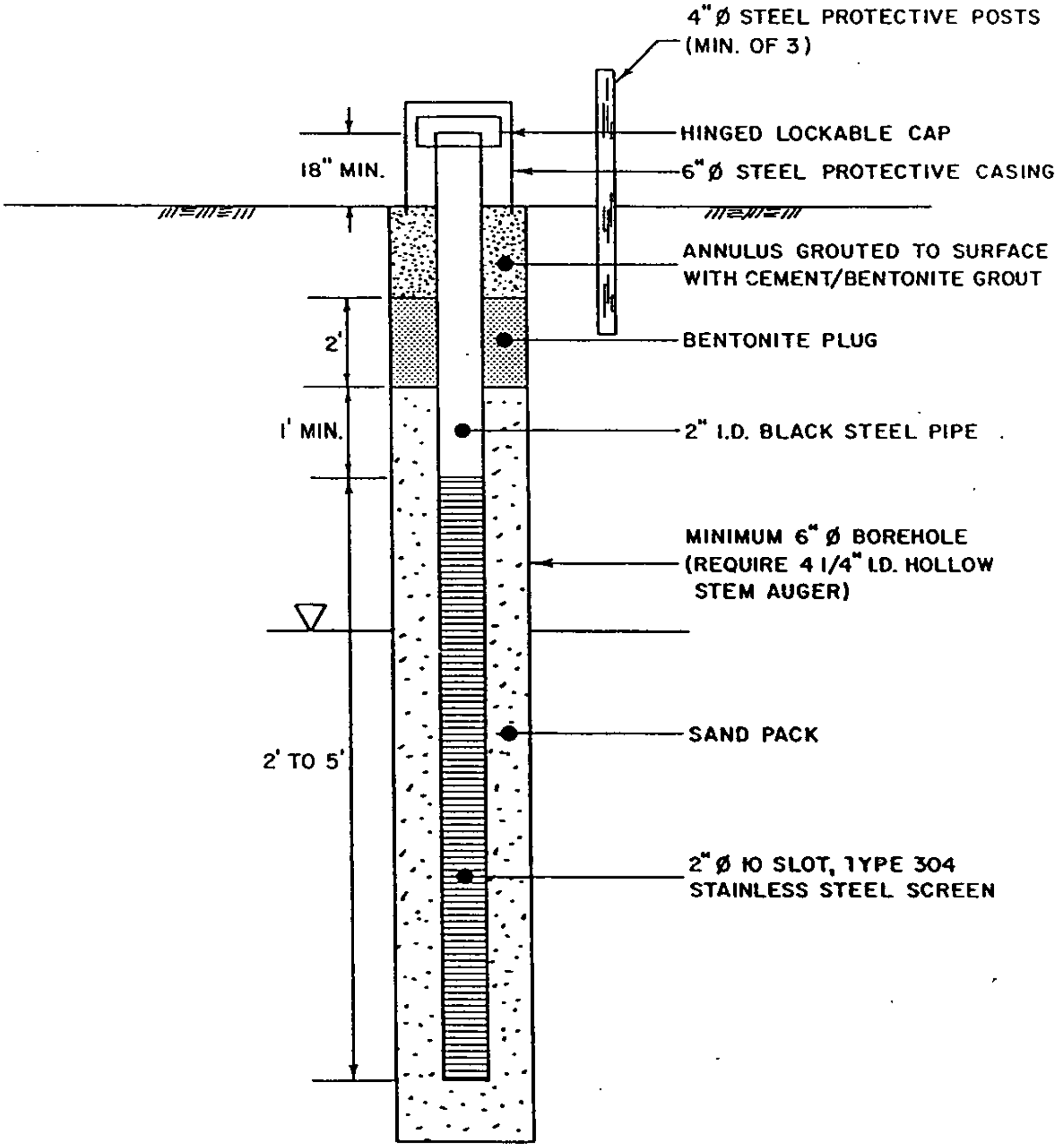
1. 2.0 feet or 5.0 feet of .10 slot stainless steel screen;
2. low carbon steel, flush threaded riser;

3. appropriate sized sand pack material installed a minimum of 1.0 feet above the top of the well screen;
4. a seal consisting of a minimum of 2.0 feet of bentonite slurry
5. bentonite (approximately 3 percent) cement backfill;
6. surface protection consisting of a locking steel protective post and three protective bumper posts.

The decision to use a 2 foot or 5 foot screen will be made in the field based on the depth of the borehole and the depth to the water table. As a provision for the possible presence of light NAPL, wherever possible, the screen will be installed so that the top of the screen is above the water table.

The monitoring well will be installed inside the auger annulus by backing the augers from the boring while simultaneously installing the sand pack. The sand pack will be installed from the bottom of the boring to approximately 1 foot above the top of the screen. A bentonite slurry seal approximately 2 feet thick will be emplaced above the sand pack. The remaining annulus will be backfilled by the tremie grout method using a mixture of bentonite and cement. Surface protection consisting of a 4 inch diameter locking protective casing and three steel posts will be installed.

Figure 6.1 illustrates typical overburden monitoring well construction details.



NOT TO SCALE

figure 6.1

TYPICAL OVERBURDEN MONITORING WELL INSTALLATION

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2853-8/02/90-M

Monitoring Well Installation Protocols

Monitoring wells will comply with the Minnesota Department of Health Water Well Construction Code. The following provides a summary of aspects related to field quality assurance.

To eliminate cross-contamination between successive drilling locations, the installation of all monitoring well will be carried out according to the following protocol:

1. Prior to drilling in the initial and all subsequent boreholes, the drilling rig and all drilling equipment will be cleaned using a high pressure-low volume hot water wash and/or steam cleaned with alconox.

2. All drilling water will be obtained from the site potable water supply.

3. All well screens will be of the precleaned Johnson™ Environmental type. All riser pipe and screens will be "steam cleaned" prior to use.

6.2.3 Monitoring Well Development

Well development will be carried out according to the following protocol:

1. Monitoring wells will be developed by the surge and bail method using a stainless steel bottom filling bailer. Prior to use, the bailer will be "precleaned" off site using the following solvent rinse sequence: methanol, hexane, methanol, air dry, deionized water.

2. Development will continue until sediment-free water is obtained and three successive readings of pH, temperature and conductivity are measured within the following ranges:

   pH - ±0.1 pH unit

   Temperature - ±0.5°C

   Conductivity - ±10 umhos/cm

3. The purged water will be discharged onto the ground surface.

4. Prior to the measurement of water levels, the measuring instrument will be cleaned with distilled water.

5. All cleaning fluids will be collected and contained for proper disposal.

6. Well development and stabilization records will be maintained. This includes recording readings of pH, temperature, conductivity and cumulative volume of water removed during development.

6.2.4 Monitoring Well Sampling

All monitoring wells will be sampled according to the following protocols:

1. New disposable latex gloves will be used when sampling each well. Additional glove changes will be made for each sampling.

2. The sampling will measure and record the depth to water in each well to the nearest 0.01 foot using an electric tape. The bottom three feet of the measuring device will be cleaned by rinsing with deionized water.

3. Prior to sampling, each well will be purged using a precleaned, bottom filling, stainless steel or teflon bailer. A minimum of three times the standing water volume in the well will be removed, or until conductivity and pH readings in the purge water are stable. In the event that a well is purged dry prior to achieving three well volumes, groundwater will be permitted to recover to a level sufficient for sample collection. The time that the well was purged dry will be noted and well recovery will be monitored. Upon recovery, a precleaned bailer will be used for sample collection. Prior to use, each bailer will be cleaned as follows:

   a. Rinse with methanol/hexane/methanol;
   b. Allow to air dry.
   c. Triple rinse with distilled deionized water;

4. All waste groundwater will be discharged to the ground surface.

5. Field measurements of pH and conductivity (using a DspH-3 pH/3 RGE conductivity meter or equivalent) and temperature (using a YSI Model 33 SCT meter or equivalent) will be recorded prior to sample collection. Calibration of field instruments will be conducted as specified in Section 6.4.

6. After the required standing well water has been purged, water samples will be collected using a bottom filling, stainless steel or teflon bailer attached to a nylon rope. New nylon rope will be used for each monitoring well.

7. Containers for sample collection and preservation requirements are determined as required by the analytical parameters. Table 6.4 details the requisite sample containers and preservation techniques for chemical parameters. All sample bottles will be provided by the laboratory and will be prepared consistent with ICHEM 300 Series protocols. The sample bottles will be delivered to the Site in sealed containers.

8. The MS/MSD sample will be taken from a well where samples do not require consideration for turbidity. Samples will be collected from the well as outlined in (5) above, but in triple the normal volume. The analysis request sheets sent to the laboratory will indicate the sample that will undergo MS/MSD analyses.

9. All disposable gloves and nylon ropes will be placed in DOT approved 55-gallon drums and stored on-site. All drummed waste will be disposed of in accordance with State and Federal regulations. All rinsings will be handled as discussed in item (3) above.

10. Samples will be labeled noting the well location, date, time and sampler's initials. A separate, hard-cover bound, field notebook will be maintained describing the sampling history (including: date and time of collection, sample handling and storage, preservation and labeling, field measurements, details pertaining to well purging and characteristics of each sample taken, and weather conditions).

11. Samples will be placed on ice or cooler pack in laboratory supplied coolers after collection and labeling.

6.2.5 Surface Water Sampling

The surface water samples will be collected in accordance with the following protocols:

1. New disposable latex gloves will be used when collecting the sample.

2. The sample will be collected by the grab sample method directly into the precleaned sample containers. The most downstream sample will be collected first and sampling will then progress upstream.

3. Containers for sample collection and preservation requirements will be the same as specified for groundwater samples (see Table 6.4).

4. Samples for MS/MSD analyses will be collected in triple the normal volume. The analysis request sheets sent to the contract laboratory will indicate the sample to undergo MS/MSD analyses.

5. Rinsate samples will not be collected since there will be no sampling tools used for collecting these samples. Therefore, field blank samples will be collected at a frequency of 1 per 10 samples, or at least one per day of sampling activities.

6. Samples will be labeled noting the sampling location, date, time and sampler's initials. A separate hard-cover field book will be maintained to document all samples and sampling events. Weather conditions at the time of sampling will be noted.

7. Samples will be placed on ice or cooler packs in laboratory supplied coolers after collection and labeling.

6.3 SAMPLE CUSTODY AND DOCUMENT CONTROL

This section details the procedures and protocols which must be followed for the transport of samples.

6.3.1 Chain-of-Custody

A chain-of-custody will be maintained to document the transfer of sample containers. Each sample will be properly sealed. Sample container labels will include sample number, place of collection and date and time of collection. Samples will be placed in the shipping cooler immediately after collection.

Each cooler being shipped to Pace will contain a chain-of-custody form. The chain-of-custody form consists of four copies which are distributed to the shipper, the receiving laboratory, the CRA laboratory and the CRA office file. Each sample number of each sample shipped will be recorded on the sheet. The shipper will maintain his copy while the other three copies are enclosed in a waterproof envelope within the cooler with the samples. The container will then be sealed properly for shipment. The laboratory, upon receiving the samples, will complete the three remaining copies. The laboratory will maintain one copy for their records. One copy will be returned to CRA upon receipt of the samples by the laboratory. One copy will be returned to CRA with the data deliverables package.

Upon receipt of the container at the laboratory, the container will be inspected by the designated sample custodian. The condition of the container will be noted on the chain-of-custody record sheet by the sample custodian. The sample custodian will document the date and time of receipt of the container and sign the form.

If damage or discrepancies are noticed, it will be recorded in the remarks column of the record sheet, dated and signed. Any damage or discrepancies will be reported to the laboratory supervisor who will inform the lab manager and QA officer. The lab QA officer will than notify the CRA QA Officer - Analytical Activities.

6.3.2 Sample Documentation in the Laboratory

The sample custodian will assign a unique number to each incoming sample for use in the laboratory. The unique number and customer number will then be entered into the sample receiving log. The laboratory date of receipt will also be noted.

Pace will be responsible for maintaining analytical log books and laboratory data, as well as sample (on hand) inventory for submittal to CRA on an "as required" basis. Samples will be maintained by the laboratory for a period of 30 days following CRA's receipt of the respective sample data under the conditions prescribed by the appropriate U.S. EPA methods for additional analyses, if necessary. Raw laboratory data files will be inventoried and maintained by Pace for a period of five years at which time CRA will advise Pace regarding the need for additional storage.

6.3.3 Storage of Samples

After the sample custodian has prepared the log book, the chain-of-custody will be checked to ensure that all samples are stored in the appropriate locations. All samples will be stored within an access controlled location and will be maintained at 4°C until completion of all analytical work or, as a minimum, for 30 days.

6.3.4 Sample Documentation - CRA

Project files for the entire project will be inventoried and maintained by CRA and will consist of the following:

- Project Plan
- Project Logbooks
- Field Data Records
- Sample Identification Documents
- Chain-of-Custody Records
- Correspondence
- Report Notes, Calculations, etc.

- Data Packages,
- References, Literature
- Miscellaneous - photos, maps, drawings, etc.
- Final Report

The project file materials will be the responsibility of the evidentiary file custodian with respect to maintenance and document removal. Jon Christofferson will be the project file custodian.

6.4 CALIBRATION PROCEDURES AND FREQUENCY

The procedures indicated below will be performed for all samples delivered to Pace for analysis. Specific instructions relevant to a particular type of analysis are given in the pertinent analytical procedures for this project.

All quality control data and records produced from calibration will be retained by the laboratory and will be made available to CRA on an "as required" basis.

The following specific analytical quality control procedures are related to each analytical batch.

Laboratory protocols and QA/QC procedures for Pace are provided in Appendix I.

6.4.1 Instrument Performance

Prior to initiating analysis, it is required to establish that a given instrument meets the specifications required.

6.4.1.1 Organic Analyses

Internal standards retention times must be within two percent of the initial standard. In addition, a laboratory prepared sample is analyzed with each batch of samples. Percent recovery for this sample is required to be within ten percent of actual analyte concentrations. If either criteria is not met, analysis of samples is halted until the problem is corrected.

6.4.2 Calibration

Prior to analysis, laboratory instruments will be calibrated using procedures for VOC and metals analyses specified by Pace (see Appendix I).

6.4.2.1 Calibration of Gas Chromatograph

A five-point calibration curve is prepared by Pace each day analyses are performed. Calibration factors are calculated for each analyte and percent relative standard deviations (%RSD) are calculated. Each %RSD value must be less than 20, otherwise the calibration procedure must be repeated for any analyte that failed this criterion.

A calibration check is conducted after every ten samples. Calibration factors values from this sample must be within 15 percent of the initial calibration factor, based upon the relative percent difference. If this criterion is not met, analysis of samples will stop until the problem is corrected. This may result in generating a new five-point calibration curve.

6.4.2.2 Standard Curves for Inorganic Analysis

Standard curves used in metals analyses will be prepared as follows:

Standard curves derived from data consisting of one reagent blank and a minimum of three concentrations will be prepared for each inorganic analyte. The standard curve will be used with each subsequent analysis, provided the standard curve is verified by using at least one reagent blank and one standard at a level normally encountered or expected in such samples. If the results of the verification are not within ±10 percent of the original curve, a new standard will be prepared and analyzed. If the results of the second verification are not within ±10 percent of the original standard curve, a reference standard will be used to determine if the discrepancy is with the standard or with the instrument. New standards will also be prepared on a quarterly basis at a minimum. All data used in drawing or describing the curve will be so indicated on the curve or its description. A record will be made of the verification.

6.4.2.3 Field Instrument Calibration

Calibrating field instruments will be done prior to the collecting each water sample if well purging data indicate a change (>±10 percent) in pH and/or conductivity from the last location sampled. However, calibration will be conducted at least daily during groundwater sampling. The field equipment will be maintained, calibrated and operated in a manner consistent with the manufacturer's guidelines and U.S. EPA standard methods. Since the majority of field measurements will be limited to pH, conductivity, temperature and depth (water level) the following procedures will be conducted, at a minimum:

1) pH
    - Calibrate daily against two buffer solutions within a pH of 2 of the anticipated water pH.

A) Calibration of pH Meter

The pH meter will be calibrated with commercially obtained pH 7, 4 and 10 buffer solutions. The pH calibration will be temperature compensated and will be performed immediately before initiating a sampling event. Calibration checks will be performed with every sample collected. In the event that the result fails to be within 0.1 pH units, the meter must be recalibrated and all samples after the last calibration must be remeasured.

Calibration will be performed in accordance with the following procedure:

1) Rinse the probe in deionized water;
2) Insert probe in a fresh pH 7 buffer solution;
3) Slide battery compartment cover back to the first stop, exposing the adjustment potentiometers;
4) Adjust the "CAL" potentiometer such that the display reads 7.00;
5) Remove the probe; rinse in deionized water;
6) Insert probe in a fresh pH 4 or pH 10 buffer solution;
7) Adjust the slope potentiometer until the correct pH is displayed; and
8) Remove probe; rinse in deionized water.

2) Conductivity

- Check once per sampling event against a standard solution of potassium chloride and deionized water.

B) Calibration of the Specific Conductivity Meter

The specific conductivity meter is factory calibrated, but the calibration should be checked periodically and the probe thoroughly rinsed between samples. Calibrating the specific conductivity meter will be performed as follows:

1) Rinse probe in deionized water;
2) Wipe probe and allow to dry the conductivity displayed should be zero in air;
3) Adjust the zero potentiometer if necessary;
4) Immerse the probe in a solution of known conductivity;
5) Adjust the "SPAN" potentiometer such that the correct conductivity is displayed; and
6) Rinse probes thoroughly with deionized water and allow to dry.

3) HNu

HNu calibration checks will be done daily in the field prior to the commencement of field activities.

C) Calibration Checks of the HNu

Calibration checks will be performed in accordance with the following procedures:

1) Connect the analyzer to the regulator and cylinder with a short piece (butt connection) of tubing. The calibration gas in the cylinder consists of a mixture of isobutylene and zero air. Isobutylene is non-toxic and safety to use in confined areas. There are no listed exposure levels at any concentration.

   It is important that the tubing be clean since contaminated tubing will affect the calibration reading. Do not use cylinder below about 30 psig as a reading below that level can deviate up to ten percent from the rated value.

   Safely discard the disposable cylinder when empty. Do not refill this cylinder.

2) With the SPAN setting and the function switch at the same positions as listed in the Application Data Sheet or Calibration Report, open the valve on the cylinder until a steady reading is obtained.

3) If the reading is the same as the recorded data, the analyzer calibration for the original species of interest is still correct.

4) If the reading has changed, adjust the SPAN setting until the reading is the same.

5) Shut off the cylinder as soon as the reading is established.

6) Record and maintain this new SPAN setting.

6.5 ANALYTICAL PROCEDURES

This section presents the analytical methods which will be employed by Pace to complete all required analyses.

6.5.1 Overview

All soil, surface water and groundwater samples collected for chemical analyses will be analyzed using SW-846 methods. The methods for performing these analyses are presented on Table 6.5. The analyses of VOC and metals will be performed in a manner consistent with these analytical methods.

TABLE 6.5

ANALYTICAL METHODS FOR ANALYSIS OF SOIL AND AQUEOUS SAMPLES[1]

Matrix	Analysis	Extraction	Method
Soil	VOC	5030	8010/8020
	Metals		6000/7000 Series
Water	VOC	5030	8010/8020
	Metals		6000/7000 Series

Note:

1. All methods are from "Test Methods for Evaluating Solid Waste", SW-846, third edition, September 1988.

6.5.2 Identification

Identification of all target analytes will be accomplished with an authentic standard of the analyte. When authentic standards are not available identification will be considered tentative.

For gas chromatographic determinations of specific analytes, the relative retention time of the unknown will be compared with that of an authentic standard. Since a true identification using GC is not possible, an analytical run for compound confirmation will be performed using a column of a dissimilar phase, according to the specifications in the methods. Peaks must elute within daily retention time windows established for each indicator parameter to be declared a tentative or confirmed identification. Retention time windows are determined via a standard a study defined in each method. Results of the study are to be filed in the laboratory and available for inspection during a QC audit.

6.5.3 Quantification

The procedures for quantification of analytes are discussed in the appropriate specific analytical methods.

6.5.4 Practical Quantitation Limits (PQLs)

The data used to conduct the RI/FS will have PQL detection limits that are consistent with the appropriate analytical methods. The PQLs for chemical analyses were previously presented on Tables 6.2 and 6.3. Specific detection limits are highly matrix dependent. The PQLs listed in these tables are provided for guidance and may not always be technically achievable.

6.6 DATA REDUCTION, VALIDATION ASSESSMENT AND REPORTING

Pace will perform analytical data reduction and validation in-house under the direction of the laboratory QA officer. The laboratory QA officer will be responsible for assessing data quality and advising of any data which were related "preliminary" or "unacceptable" or other qualifications. Figure 6.2 illustrates the analytical data flow through the laboratory. Data reduction, validation and reporting by the laboratory will be conducted as detailed in the following. It should be noted, however, that "sign-off" will be required following completion of each step.

- Raw data produced and checked by the responsible analyst is turned over for independent review by another analyst.

- Area Supervisor reviews that data for attainment of quality control criteria presented in the referenced analytical methods.

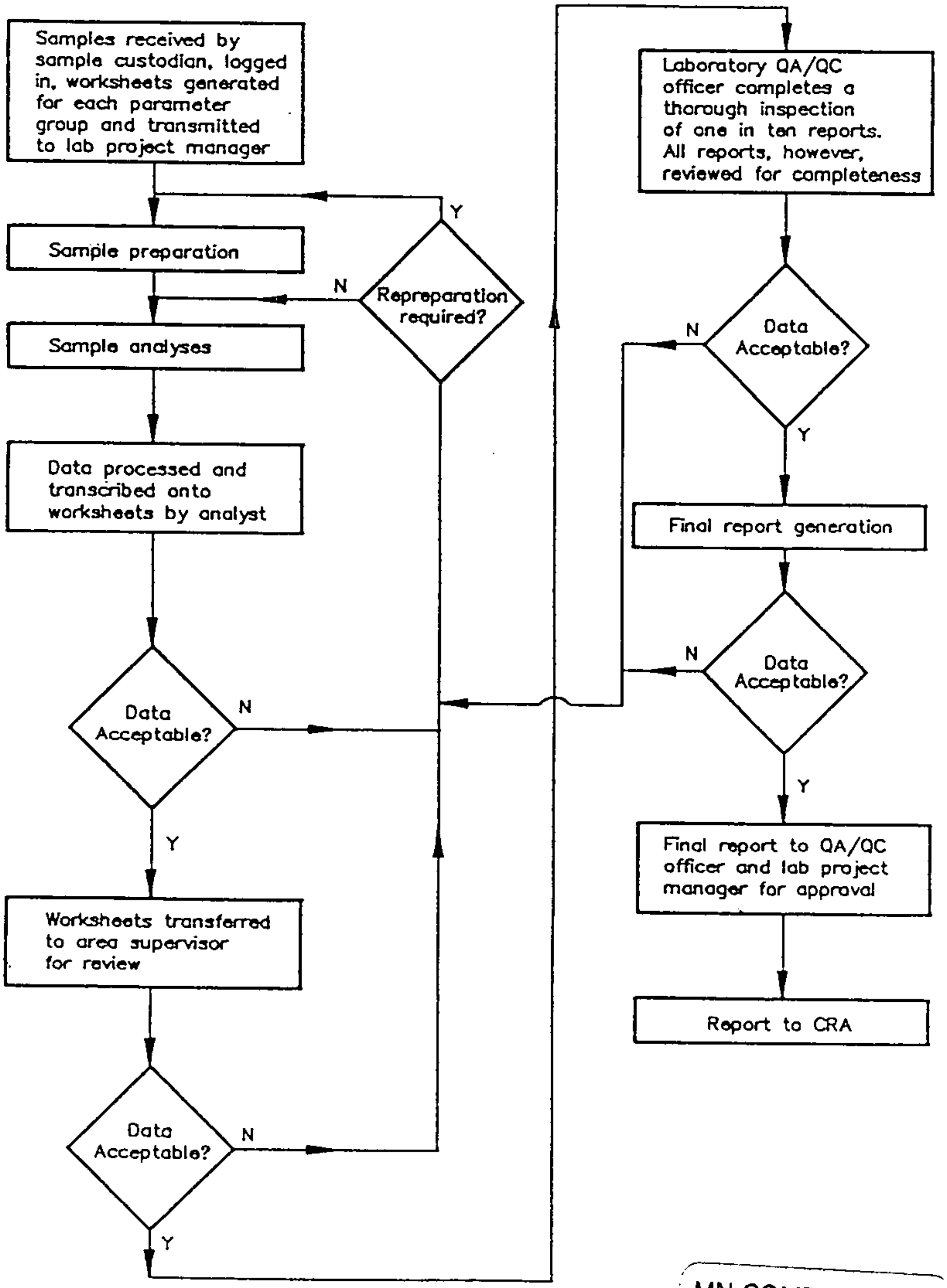

figure 6.2
ANALYTICAL DATA FLOW
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- Laboratory Operations Manager reviews that data and a report will be generated and sent to the laboratory quality assurance officer.

- Laboratory Quality Assurance Officer will complete a thorough inspection of all reports.

- Area Supervisor and QA officer will decide whether any sample reanalysis is required.

- Upon acceptance of the preliminary reports by the QA officer, final reports will be generated and signed by the laboratory manager.

The data package shall consist of the following:

- detailed case narrative,
- summary of analysis dates,
- method blank sample data,
- surrogate compound recoveries,
- MS/MSD recoveries,
- check sample recoveries,
- executed chain-of-custody forms.

CRA's QA Officer - Analytical Activities will conduct an evaluation of data reduction and reporting by the laboratory. These evaluations will consider the finished data sheets, rinsate data, field duplicate data, and recovery data for surrogate and matrix spikes. The material will be checked for legibility, completeness, correctness, and the presence of requisite dates, initials and signatures. The results of these checks will be assessed and reported to the project managers noting any discrepancies and their effect upon the acceptability of the data. All information garnered from QA/QC checks will be discussed in the final RI/FS Report.

Validation of the analytical data will be performed by the CRA QA Officer - Analytical Activities. Validation will be consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988, and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses", July 1, 1988. Assessment of analytical and field data will include checks for data consistency by looking for comparability of duplicate analyses, potential sample contamination as indicated by results of blank sample analyses, laboratory QA procedures, adherence to accuracy and precision criteria, transmittal errors, and anomalously high or low parameter values. The results of data validations will be reported to the project managers, noting any discrepancies and their effect upon acceptability of the data.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified and appended to the report. Where data have been reduced or summarized, the method of reduction will be documented in the report. In addition, field data will be audited for anomalously high or low values that may appear to be inconsistent with other data.

6.7 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

6.7.1 Field QC

Quality control procedures for field measurements will be limited to checking the reproducibility of the measurement in the field by obtaining multiple readings and by calibrating the instruments (where appropriate).

Quality control of field sampling will involve collecting field duplicates and rinsate blanks in accordance with the applicable procedures.

6.7.2 Laboratory QC

Specific procedures related to internal laboratory QC samples (namely, matrix spikes, surrogate spikes, blanks, check samples and matrix spike duplicates) are detailed in the following subsections.

6.7.2.1 Method Blank

A method blank will be analyzed by the laboratory at a frequency of one per twenty analyses or, in the event that an analytical round consists of less than twenty samples, one reagent blank will be analyzed. The reagent blank, an aliquot of analyte-free water or solvent, will be carried through the entire analytical procedure.

6.7.2.2 Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

A MS/MSD sample will be analyzed at a minimum frequency of 1 in 20 for each method per matrix. Table 6.6 presents a summary of the compounds and acceptable criteria. Percent spike recoveries will be used to evaluate analytical accuracy while percent relative standard deviation or percent difference between the spike and matrix spike duplicate will be used to assess analytical precision.

6.7.2.3 Surrogate Compounds

Surrogate compounds are used in all VOC analyses. Every blank, standard and environmental sample, including MS/MSD samples, will be spiked with surrogate compounds prior to purging volatiles.

Surrogate compounds will be spiked into samples according to the appropriate analytical methods. Percent recoveries will fall within the control limits set by procedures specific in the method for analytes falling within the detection limits without dilution. Diluting samples to bring the analyte

TABLE 6.6

PERCENT RECOVERIES AND PRECISION CRITERIA FOR MS/MSD ANALYSES

Analysis	Parameter	% Recovery[1] Water	Soil
VOC	Trichloroethene	35-146 (20)	35-146 (50)
	Chlorobenzene	38-150 (20)	38-150 (50)
	Benzene	39-150 (20)	39-150 (50)
	1,1-dichloroethene	28-167 (20)	28-167 (50)
Metals		75-125 (20)	75-125 (50)

Note:

1. Values in parentheses are maximum RPD limits.

concentration into the linear range of calibration may dilute the surrogates below the quantification limit; assessment of analytical quality in these cases will be based on the quality control embodied in the check and MS/MSD samples.

Table 6.7 presents a summary of the surrogate recovery control limits as stated within the analytical methods.

6.7.2.4 Check Samples

As prepared by Pace, each analytical batch will contain a check sample. The check sample will consist of an analyte-free water spiked with MS compounds. Check samples will be carried through all procedures, including extractions, by Pace. Percent recoveries for check samples will be within ten percent of actual analyte concentrations.

6.8 PERFORMANCE, SYSTEM AUDITS AND FREQUENCY

For the purpose of external evaluation, performance evaluation check samples from the U.S. EPA and various state agencies are analyzed periodically by Pace.

Internally, the evaluation of data from these samples is done on a continuing basis over the duration of a given project.

TABLE 6.7

PERCENT RECOVERIES FOR VOC SURROGATE COMPOUND

	% Recovery	
Compound	Water	Soil
α,α,α-trifluorotoluene	80-120	-

The CRA QA Officer - Analytical Activities may carry out performance and/or systems audits to insure that data of known and defensible quality are consistently produced during a program.

System audits are qualitative evaluations of all components of field and laboratory quality control measurement systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before all systems are operational, during the program, or after the completion of the program. Such audits typically involve a comparison of the activities given in the QA/QC plan described herein, with activities actually scheduled or performed. A special type of system audit is the data management audit. This audit addresses only data collection and management activities.

The performance audit is a quantitative evaluation of the measurement system used for a monitoring program. It requires testing the measurement systems with samples of known composition or behavior to evaluate precision and accuracy. A performance/system audit may be carried out by or under the auspices of the MPCA, without the knowledge of the analyst during each sampling event for this program. The scheduling of performance evaluation (PE) audits will be at the discretion of the MPCA.

In addition, one external QA audit may be conducted by CRA prior to analysis of any investigatory samples. It should be noted, however, that any additional external QA audits will only be performed if deemed necessary by either the PRP or CRA project managers or the CRA QA officers. The project laboratory may also undergo PE audit(s) by the MPCA, if so requested.

6.9 PREVENTIVE MAINTENANCE

All analytical instruments to be used in this project will be serviced by Pace personnel at regularly scheduled intervals in accordance with the manufacturer's recommendations. Instruments may also be serviced at other times due to failure. Requisite servicing beyond the abilities of Pace personnel will be performed by the equipment manufacturer or their designated representative.

Daily checks of each instrument will be by the analyst who has been assigned responsibility for that instrument. This will include changing GC inlet liners, checking operation of data systems, checking for leaks, etc. Manufacturer's recommended procedures will be followed in every case.

The HNu, pH and conductivity meters will be calibrated in the field as described in Section 6.3.2.3. In addition, the following preventive maintenance measures will be taken in the field:

HNu	- The HNu meter is sent annually to the manufacturer for recalibration and cleaning.

pH, Conductivity	- Keep probes clean and free of dirt by rinsing with deionized water.
	- Keep deionized water around probes to prevent dehydration.
Water Level Tape	- Clean probe and lower three feet of tape with pesticide grade isopropanol and deionized water to prevent hard water and iron build up.

6.10 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

6.10.1 QA Measurement Quality Indicators

6.10.1.1 Precision

Precision will be assessed by comparing the analytical results between MS/MSD analyses and/or duplicate sample analyses.

6.10.1.2 Accuracy

Accuracy will be assessed by comparing a set of analytical results to the accepted or "true" values that would be expected. In general, surrogate compound recoveries, MS/MSD analyses and check sample recoveries will be used to assess accuracy.

6.10.1.3 Outliers

Procedures discussed previously will be followed for documenting deviations. In the event a result deviates significantly from established control limits, this deviation will be noted and its effect on the quality of the remaining data assessed and documented.

6.11 CORRECTIVE ACTION

The need for corrective action may be identified by system or performance audits or by standard QC procedures. The essential steps in the corrective action system will be:

- Checking the predetermined limits for data acceptability beyond which corrective action is required;

- Identifying and defining problems;
- Assigning responsibility for investigating the problem;
- Investigating and determining the cause of the problem;
- Determining corrective action to eliminate the problem (this may include reanalyses of resampling and analyses);
- Assigning and accepting responsibility for implementing the corrective action;
- Implementing the corrective action and evaluating the effectiveness;
- Verifying that the corrective action has eliminated the problem; and
- Documenting the corrective action taken.

For each measurement system, the CRA QA Officer - Analytical Activities will be responsible for initiating the corrective action and the laboratory supervisor will be responsible for implementing the corrective action. The corrective action taken will depend upon the QA/QC criteria that did not meet the necessary criteria, and may range form qualifying the data to resampling at the Site.

6.12 QUALITY ASSURANCE REPORT TO MANAGEMENT

Management will receive reports on the performance of the measurement system and the data quality following each sampling round and at the conclusion of the report.

Minimally, these reports will include:

- Assessment of measurement and quality indicators, i.e. data accuracy, precision and completeness;
- Results of system audits; and
- QA problems and recommended solutions.

The CRA QA Officer - Analytical Activities will be responsible within the organizational structure for preparing these periodic reports. The final report for the project will also include a separate QA section which will summarize data quality information contained in the periodic QA/QC reports to management, and details and overall data assessment and validation in accordance with the data quality objectives outlined in this QAPP.

7.0 DATA MANAGEMENT AND DOCUMENTATION

7.1 DATA MANAGEMENT PLAN

Sampling and analytical records will be generated in accordance with the quality assurance plan presented in Section 6. Data generated will be validated prior to inclusion into the database. D-Base and Lotus™ software will be used as appropriate for computer compilation, tabulation and assessment of data records.

Project reports will be submitted according to the schedule provided in Section 11.

DATA RECORD

Each data record entered into the database will include the following information:

1. sample location,
2. the date the sample was taken,
3. analyzed parameter,
4. field measurement raw data,
5. laboratory performing the analysis,
6. analytical method and
7. result of analysis (i.e. concentration).

TABULAR DISPLAYS

Data may be tabulated in the following ways:

1. unsorted (raw) data,
2. summary of data of detected parameters and
3. sorting of data according to location, aquifer or constituent monitored.

GRAPHICAL DISPLAYS

Data may be displayed graphically in the following ways:

1. display of line graphs of concentration versus time for selected sampling locations noted in the data evaluation,
2. displays of the geographical extent of the contamination by use of isopleth maps as noted in the data evaluation and where otherwise appropriate, and
3. graphical displays of hydrogeologic data and interpretation as found appropriate.

7.2 DATA AND DOCUMENT AVAILABILITY AND RETENTION

Ford will allow MPCA staff and/or its authorized representatives to inspect and copy all sampling, testing, monitoring or other data transmitted to or generated by Ford pertaining to work undertaken under the RFRA program of work. Ford will allow duplicate/split samples to be collected by MPCA and/or its authorized representatives of any samples collected by Ford pursuant to the work plan. Ford will maintain a central depository of the data, reports and other documents prepared pursuant the work plan. All data, reports and other documents will be preserved by Ford until Ford receives written approval from the MPCA to allow otherwise.

8.0 RISK ASSESSMENT

A baseline risk assessment will be conducted for the Site. The risk assessment will provide an evaluation of the actual and potential threat to human health, welfare and the environment posed by the possible threatened releases of hazardous substances, pollutants or contaminants in the absence of any remedial action. The objectives of a baseline risk assessment shall be attained by identifying and characterizing the following:

1. An evaluation of the results of the Site investigation showing the actual and potential concentrations of hazardous substances, pollutants or contaminants present in relevant media (e.g. air, soil, groundwater, surface water, sediment and biota) at the conclusion of the RI and projected in the future. The evaluation is expected to focus on VOCs and metals at the Site.

2. Identification of the hazardous and toxicological properties and relevant human health and environmental standards criteria for the hazardous substances, pollutants or contaminants found in the Site investigation.

3. Environmental fate and transport mechanisms within specific environmental media such as physical, chemical and biological degradation processes and hydrogeological conditions.

4. Potential human and environmental receptors.

5. Potential exposure pathways and extent of actual or expected exposure.

6. Extent of expected impact or threat, and the likelihood of such impact or threat occurring (i.e. risk characterization).

7. Level(s) of uncertainty associated with the above items.

The risk assessment will be prepared using the U.S. EPA document "Risk Assessment and Guidance for Superfund", Interim Final, Volume 1 (December 1989) and Volume 2 (March 1989).

9.0 SITE SECURITY AND SAFETY PLAN

9.1 SITE SECURITY

Current Site operations do not allow for public access to operating facilities. The following Site security control measures are in place:

1. The Ford Plant has its own 24-hour per day plant security guards.
2. The investigation sites, Site A, Site B and the UST area, are enclosed within the Plant's security fence. The fence is steel chain link 8 feet high.
3. The Site is watched by video cameras strategic location above the various Plant areas and all investigation sites.
4. The Site C area also is controlled by fencing and is watched by video camera.
5. All monitoring wells at the Site are completed with locking protective riser pipes and bumper posts as per the MDH Water Well Code.
6. All areas are patrolled by Ford security.
7. All Site and Plant visitors must sign in with Plant security before entering the Site. Visitors will be issued passes once access is approved.

9.2 HEALTH AND SAFETY PLAN

Appendix J provides the health and safety plan for the Site operations, maintenance and monitoring activities covered by this RI. This plan is consistent with the requirement of:

1. OSHA requirement 29 CFR Part 1910.120, Hazardous Waste Operations and Emergency Response; Interim Final Rule, Federal Register, December 19, 1986.
2. OSHA requirements 29 CFR part 1910 (General Industry Standards) and 1926 (Construction Industry Standards).
3. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSGH/OSHA/USCG/EPA, DHHS (NIOSH) Publication Number 85-115, October 1985.

10.0 COMMUNITY RELATIONS PLAN

GENERAL

The overall goal of the Community Relations Plan (CRP) is to plan for an organized dissemination of information to the public regarding investigation, activities and results upon request. The Ford CRP therefore includes opportunities for comments and input by citizen, community and other groups.

Elements of the Community Relations Plan are:

1. Establishment of a communication process in conjunction with the MPCA project manager and MPCA's public information office.

2. Ford Plant Employee Relations personnel will be available for communication with persons who have expressed interest (interested persons) to receive as well as provide information.

3. Reliable information will be made available to interested persons who have requested to review the information.

COMMUNITY RELATIONS

The Ford Community Relations Plan Coordinator for this project will be Edward Lloyd - Employee Relations Manager.

The MPCA Coordinator will be J. Todd Goeks.

These Coordinators will keep up to date on all aspects of progress on the RI/FS.

Questions regarding the RI/FS that originate from the public should be first directed to the MPCA Coordinator.

In order to accomplish the CRP goals, Ford will conduct the following:

a. Create and maintain a mailing list of interested parties. Among the persons who shall be included on this list are the MPCA Public Information Officer assigned to this Site, the Mayor of the City of St. Paul, City Council Member Bob Long (representing the City Council of the City of St. Paul), the Chairperson of the St. Paul Parks and Recreation Board, the State Senator and State Representative whose districts include the Site, and any citizen or environmental groups that have expressed an interest.

b. Provide written monthly progress reports to the MPCA as specified in Part II.C. (page R-3) of the RFRA. These progress reports will note, as appropriate in addition to all monthly activities, the status of:

- the Remedial Investigation,
- the Feasibility Study,
- the Record of Decision, and
- any interim remedy or response activity.

REPORTS AND DOCUMENTS

All project reports, progress reports, sampling results and documents will be made available to the MPCA by Ford according to the project schedule. Citizens groups and interested persons can make requests to review the content of these documents by contacting MPCA.

PUBLIC COMMENT

Copies of the project RI/FS report will be available through normal public access for review and comment at the MPCA St. Paul offices. Public comments made through the MPCA will be considered in the preparation of final reports, thus ensuring public input on final results.

PUBLIC INFORMATION

Information from the public should be transferred through the Coordinators to CRA for consideration in the RI/FS. Similarly, information provided by CRA should be through the Coordinators to the public as requested.

11.0 REPORTING AND PROJECT SCHEDULE

11.1 MONTHLY SUMMARY/PROGRESS REPORT

A monthly summary/progress report noting activities conducted under the work plan and the RFRA will be prepared.

The report will provide information on the preceding month and be submitted by the 15th day of the following month.

11.2 RI FINAL REPORT

An RI Final Report will be prepared presenting the results and evaluation of data and information obtained by implementation of this work plan and in accordance with the procedures provided in this work plan.

The RI Final Report will provide a screening of possible remedial alternatives as presented in Section 3.0 of this work plan. It is proposed that this report be submitted according to the schedule presented in Section 11.3.

11.3 RI/FS SCHEDULE

Ford has provided notice of intent to comply with the RFRA and has retained a consultant. Portions of the work related to the RI have been ongoing prior to this work plan submittal.

Submittal of this RI/FS Work Plan is scheduled for August 31, 1990. Based on the RFRA, the following schedule for remaining RI Work Plan tasks is anticipated:

Implement Site Security and Safety Plan	Within 10 days of MPCA written approval of RI/FS Work Plan.
Conduct RI Work Contained in RI/FS Work Plan	Begin within 2 weeks of MPCA written approval of RI/FS Work Plan.
Submit RI Final Report	Within 150 days of MPCA written approval of RI/FS Work Plan. This differs from RFRA schedule, however, is necessary given the time needed to complete work plan tasks and prepare report after approval of work plan. Should the work plan not be approved by

	September 30, 1990, weather delays may also occur and should be anticipated in project scheduling.
Submit Treatability Studies and Feasibility Study - Detailed Analysis Report (DAR)	Within 60 days of MPCA written approval of RI Final Report.

APPENDIX A

SCOPE OF WORK LETTERS
CRA TO MPCA
FORD SITES B AND C

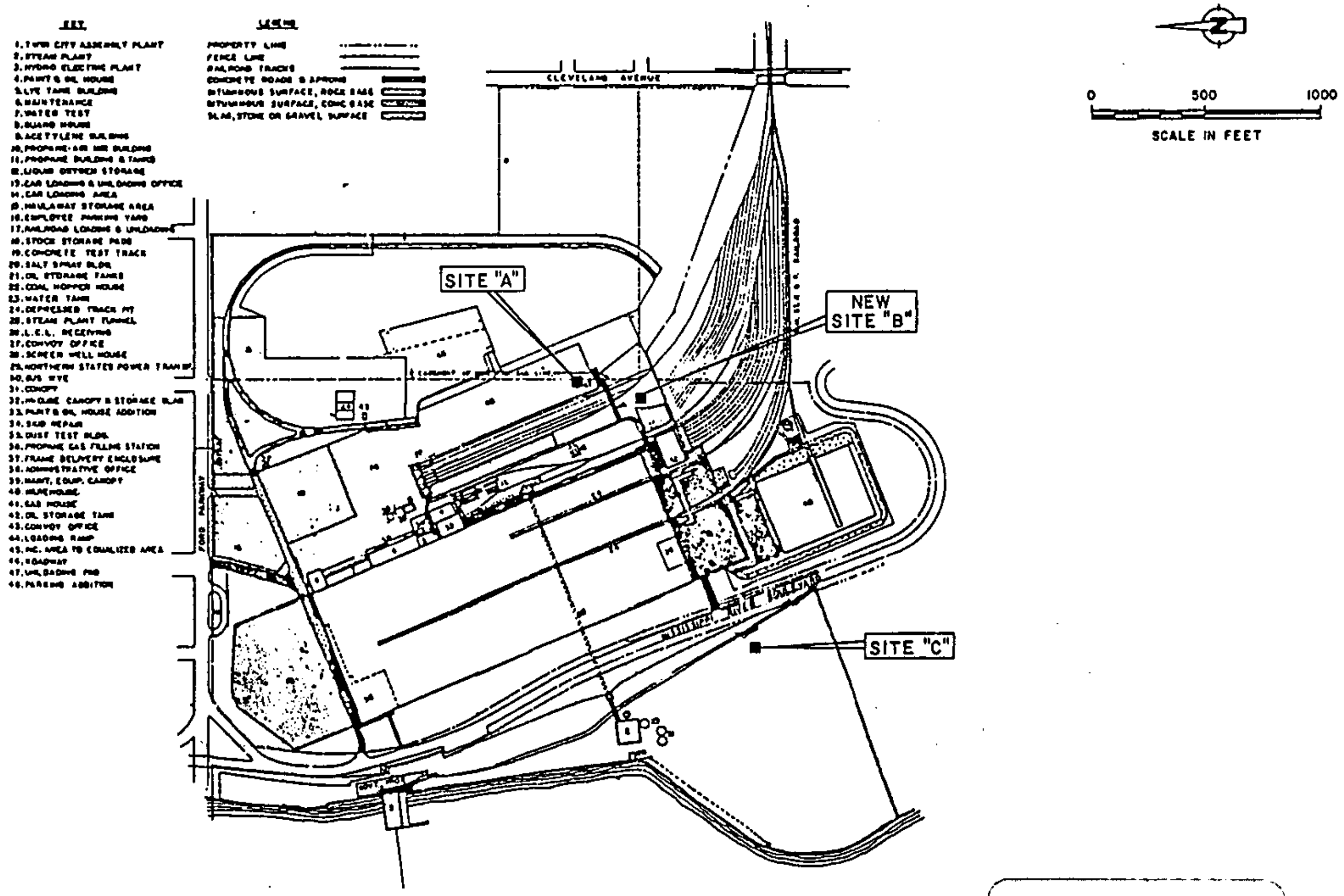
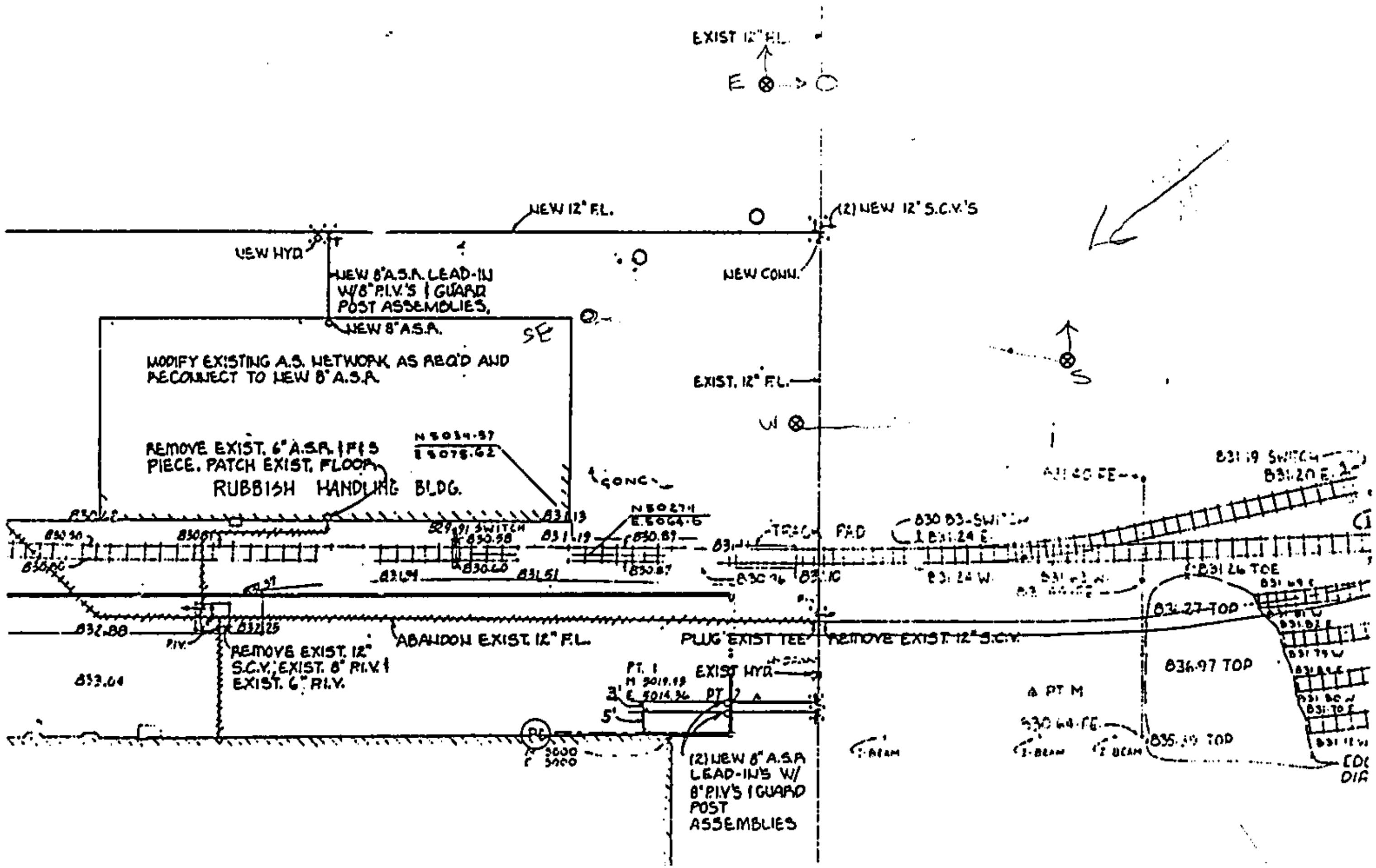


figure 1
LOCATION OF FILL SITES
Ford Motor Company

CRA

2191-21/10/88-N



LEGEND

○ PROPOSED BORING LOCATION

⊗ PROPOSED WELL/BORING LOCATION

SCALE: 1" = 60'

MN-COMP 0044743

figure 2

SITE PLAN
NEW SITE "B"
Ford Motor Company

CRA

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

March 2, 1990

Reference No. 2853

Mr. Todd Goeks
Site Response Section
MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, Minnesota 55155

Dear Mr. Goeks:

RE: Ford Motor Company
Twin Cities Assembly Plant
St. Paul, Minnesota

On behalf of Ford Motor Company (Ford) we are submitting the following information as a result of discussions that occurred at our recent January 31 meeting.

1. A Work Plan for supplemental monitoring at Site C (the fill area near the river) is enclosed to provide a summary of groundwater and surface water monitoring to be conducted by Ford. This monitoring would include the installation of one additional well with two subsequent rounds of monitoring.

2. Waste characterization information is enclosed to complete your files regarding the paint sludge material excavated during the wastewater treatment plant construction in July 1983. These copies of documents located in Ford's files include:

   - a copy of the laboratory report dated July 7, 1983, for analysis of the excavated material for EP Toxicity. By applying knowledge of the material and processes used, Ford determined that the waste was also non-reactive,non-corrosive and non-ignitable;

   - a copy of the manifests for the three shipments of the excavated material made on July 14 and 27, 1983. We understand from Ford that the waste was shipped and disposed of as a hazardous waste (Waste Classification Number D008) despite the fact that the material was found to be "non-EP Toxic" for lead;

   - a copy of a map that accompanied Ford's Amended Superfund Notification to U.S. EPA dated August 16, 1983, indicating the approximate area of excavation.

3. A portion of the south face of the Site C fill area is proposed for landscaping and aesthetic cleanup to remove empty drums and drum parts. Tasks related to this effort will be:

   - the landscaping contractor will be contracted by Ford and receive its primary directions from Ford;

- Conestoga-Rovers and Associates (CRA) will assist in delineating the work area and will provide input to Ford on the area appropriate for further aesthetic cleanup and landscaping;

- Once the work area has been delineated, MPCA will be advised prior to work proceeding. As discussed at our meeting, MPCA will provide notification and coordination with other regulatory agencies;

- work will then proceed as weather permits. It is expected that work could begin as early as May 1, 1990;

- after brush and several trees have been cleared from the defined area, approximately 500 cubic yards of soil will be placed over the sloped face and then seeded for aesthetic and erosion control purposes.

Should you have any questions regarding this information, please contact Mr. Jerome Amber of Ford at telephone number (313) 322-4646 or me at CRA's local office, telephone number 639-0913.

Yours Very Truly,

CONESTOGA-ROVERS AND ASSOCIATES

Jon L. Christofferson

JLC/kk
Enc.
cc: J. Kallaus, Ford
J. Gibson, Ford
D. Rueh, Ford
J. Amber, Ford
A. Van Norman, CRA

ATTACHMENT 1
WORK PLAN
SUPPLEMENTAL GROUNDWATER MONITORING
SITE C
FORD TWIN CITIES ASSEMBLY PLANT
ST. PAUL, MINNESOTA

Task 1 - Installation of Additional Monitoring Well

- Install additional Monitoring Well B6 (see attached Figure 1 for proposed location).
- Well to be installed in accordance with Minnesota Department of Health Water Well Code. Well construction detail provided as attached Figure 2. To be two feet above the 100 year flood plain elevation of 707 feet AMSL (based on Army Corps of Engineers 100 year flood elevation for Lock and Dam #1 tail water) top of well casing would have to be at a minimum elevation of 709 AMSL. Because this may not be implementable, a variance to the Well Code and/or further discussions with MPCA may be required.

  Installation of Well B6 would be scheduled to be completed by March 30, 1990.
- Develop well prior to sampling.

Task 2 - Groundwater and Surface Water Sampling

- Water level round prior to sampling.
- Sample groundwater wells B1, B3 and B6.
- Sample surface location upstream and downstream of site utilized during 1989 monitoring.
- Each monitoring round to include on blank and one duplicate sample.
- Samples will be analyzed for Halocarbon and Aromatic Organic Compounds by EPA Method 601 and 602 plus cis-1,2-dichloroethylene and ethylacetate. Analysis will also be conducted for the following metals: Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, Zinc and Nickel. Groundwater samples will be field filtered prior to metals analysis. Surface water samples will not be filtered prior to analysis. Metals analysis for Barium, Cadmium, Chromium, Copper, Lead, Silver, Zinc and Nickel will be conducted using Inductively Coupled Plasma (ICP) analysis EPA Method 6010. Analysis for Arsenic, Selenium and Mercury will be conducted using EPA Atomic Absorption methods.
- Sampling rounds will be tentatively scheduled for early April and early June.

Task 3 - Data Monitoring Report

Following completion of the two rounds of sampling and receipt of analytical results, a report summarizing all data and results will be submitted to MPCA. The report will be scheduled for submittal by July 17, 1990.

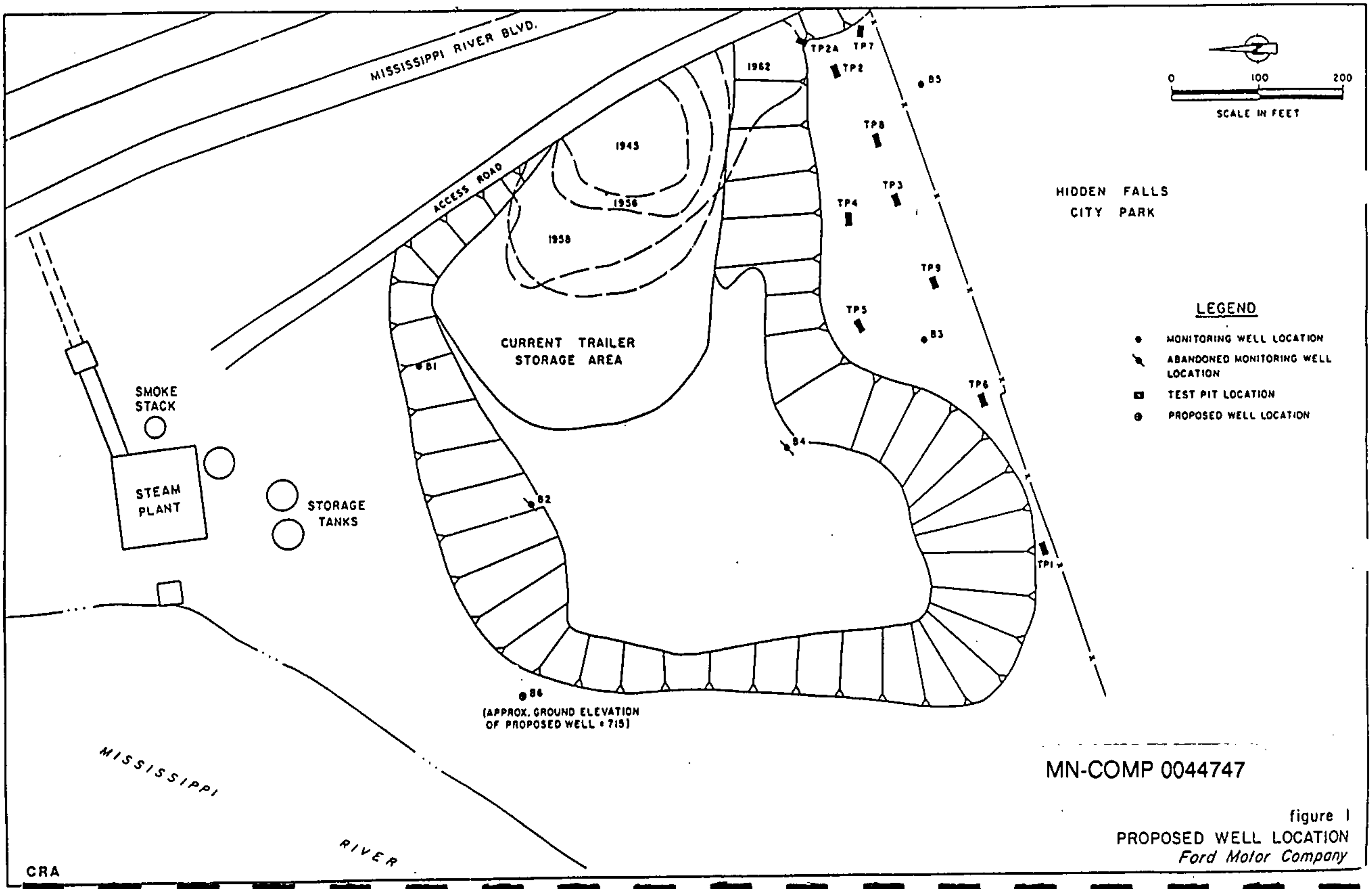
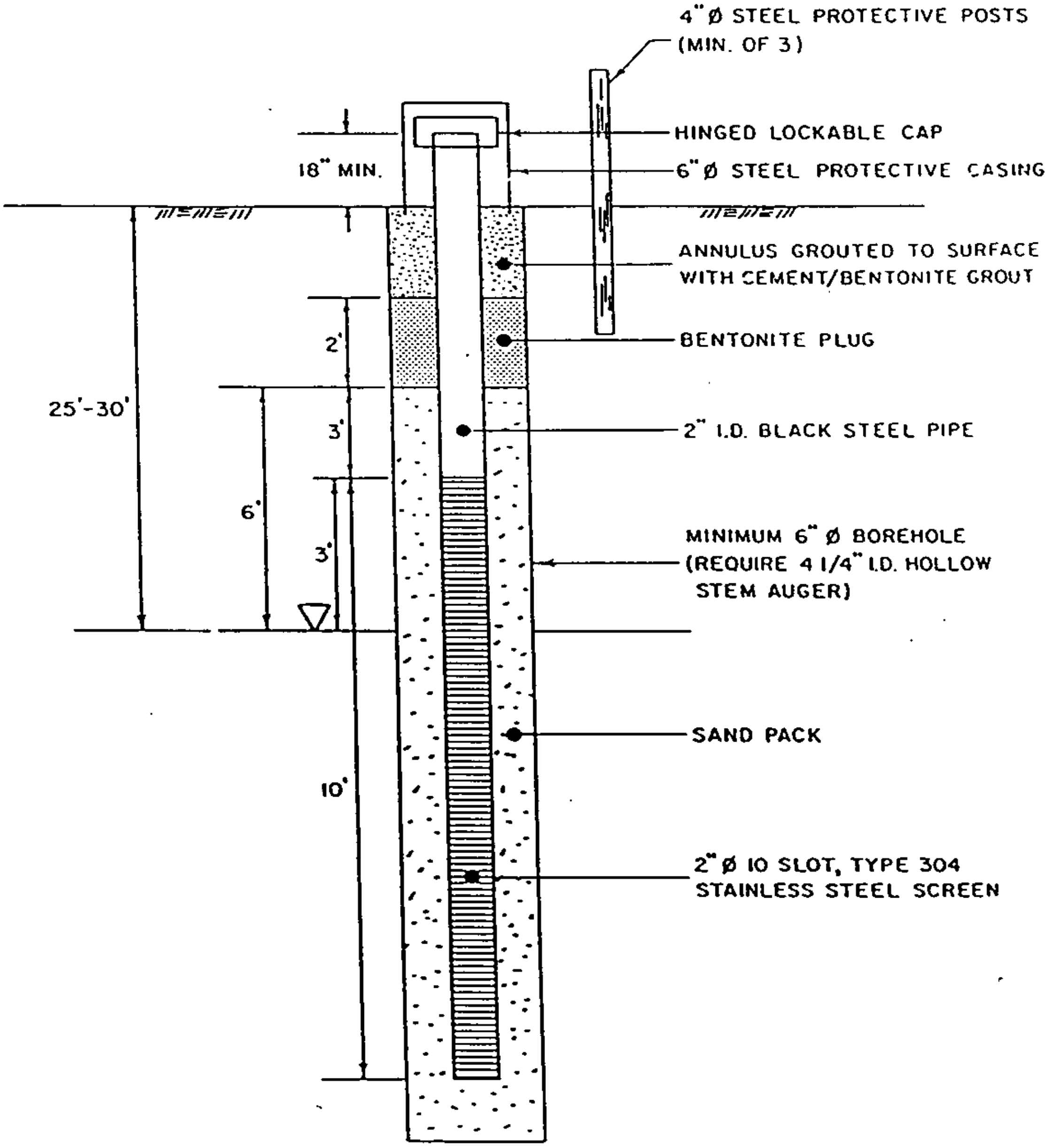


figure 1
PROPOSED WELL LOCATION
Ford Motor Company



NOT TO SCALE

figure 2

TYPICAL MONITORING WELL INSTALLATION

Ford Motor Company

CRA

2853-8/02/90-M

ENVIRONMENTAL RESEARCH GROUP, INC.

erg

135 State Street P.O. Box 70006 St. Paul, Minnesota 55107 (612) 293-9268

FEB 19 90

JULY 7, 1983

FORD MOTOR
ATTN: DAVE CLOUTIER
966 S. MISSISSIPPI RIVER BLVD.
SAINT PAUL, MN 55116

SAMPLE RECEIVED: 6/15/83

LAB REPORT NO. 9429

PURCHASE ORDER NO.
15 P083 167007

ANALYSIS	PAINT SLUDGE	UNITS
E.P. TOXICITY		
1. BARIUM	0.27	MG/L
2. CHROMIUM	0.0043	MG/L
3. MERCURY	<0.0002	MG/L
4. SILVER	0.0029	MG/L
5. ARSENIC	0.006	MG/L
6. CADMIUM	0.014	MG/L
7. LEAD	2.1	MG/L
8. SELENIUM	<0.001	MG/L

WILLIAM R. KRUEGER, BRANCH MANAGER

STATE OF MICHIGAN

WASTE DISPOSAL MANIFEST

☑ Act 64 Waste (HAZARDOUS) ☐ Act 136 Waste ☐ Other

MI 0221753

IDENTIFICATION

Generator's Name
FORD MOTOR CO

Site Address
966 SO. MISSISSIPPI RIVER BLVD
ST PAUL MINN 55116

Phone Number
(612) 696-0699

Generator's Site EPA I.D. Number
MND006287773

Primary Transporter's Name
INLAND WATERS POLLUTION CONTROL

Transporter's Address
4544 WEBSTER
ECORSE MICH 48229

Phone Number
(313) 383-6310

Transporter's EPA I.D. Number
MID000820365

Treatment, Storage or Disposal Facility
WAYNE DISPOSAL

Facility Address
49350 N. SERVICE DR.
BELLEVILLE MICH 48195

Phone Number
(313) 697-7830

Facility Site EPA I.D. Number
MID048090633

If more than one Transporter is to be utilized, give the Name and EPA I.D. Number of each:

GENERATOR COMPLETES / **WASTE INFORMATION**

LOT NO.	U.S. D.O.T. Shipping Name (or common name if there is no D.O.T. shipping name).	D.O.T. Hazard Class	U.N./N.A. No.	Haz. Class Code	Container No.	Container Type	Form Solid	Form Liquid	Form Gas	Form Sludge	Total Weight or Volume	Units	Hazard or Liqu Wast Numb
1.	WASTE HAZARDOUS SOLID N.O.S.	ORM-E	NA 9189	1,5		DUMP TRUCK	X				000026	YDS	D(
2.													
3.													
4.													
5.													
6.													

COMMENTS

Include Safety precautions and special handling instructions.
EXCAVATED WASTE ,PAINT SLUDGE AND SOIL. THIS WASTE IS NON EP TOXIC ,NON REACTIVE ,NON CORROSIVE AND NON IGNITABLE

GENERATOR CERTIFICATION: I certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and U.S. EPA. I further certify that the information contained on the manifest is factual. I understand that the failure to accurately report all information requested by the manifest constitutes a violation of 1979 PA64 and/or 1969 PA136. I further understand that this manifest may be used in administrative and court proceedings.

Generator Signature
① George H Hall

Date Shi MO. DA
02 24 8

TRANSPORTER COMPLETES

HAULER'S CERTIFICATION: I certify acceptance of the above identified wastes for transportation I further certify that I shall deliver the hazardous wastes, together with this manifest, only to the destination specified by the generator on this manifest. I understand that this manifest can be used in administrative and court proceedings.

Transporter Vehicle I.D. No. No. 1 H 30442

Subsequent Transporter Vehicle I.D. No's

Transporter Signature
②

Date(s) Recei

Subsequent transporter(s) signature(s)
③

If the shipment cannot be delivered, describe the reasons for non-delivery.

TSDF COMPLETES

TSDF CERTIFICATION: I certify receipt at this facility of the above identified wastes and that this facility is licensed to accept those wastes. I also certify that the wastes were accompanied by a manifest properly certified by both the generator and hauler and that this facility is the destination indicated on the manifest. ~~I understand that this manifest can be used in administrative and court proceedings.~~

TSDF Signature
④

Facility Site EPA I.D. Number
MID048090633

☑ Accepted
☐ Rejected

Date Receiv
02 18

Was a Surcharge Assessed? ☐ Yes ☐ No

Describe any significant discrepancies between manifest and shipment. 1182640

ALL SPILLS MUST BE REPORTED TO THE MICHIGAN POLLUTION EMERGENCY ALERTING SYSTEM, IN MICHIGAN AT 800—292-4700 OR OUT-OF-STATE AT 517—373-7660 AND THE NATIONAL RESPONSE CENTE

WASTE DISPOSAL MANIFEST

☒ Act 64 Waste (HAZARDOUS) ☐ Act 136 Waste ☐ Other MI U225449

GENERATOR COMPLETES

IDENTIFICATION

Generator's Name
FORD MOTOR CO

Site Address 966 S MISSISSIPPI RIVER BLVD
ST PAUL MINN 55116

Phone Number
(612) 696-0699

Generator's Site EPA I.D. Number
MND006207773

Primary Transporter's Name
INLAND WATERS POLLUTION CONTROL

Transporters Address
4544 WEBSTER
ECORSE MICH 48229

Phone Number
(313) 383-6310

Transporter's EPA I.D. Number
MID000820365

Treatment, Storage or Disposal Facility
WAYNE DISPOSAL

Facility Address 49350 N. SERVICE DR.
BELLEVILLE MICH 48195

Phone Number
(313) 697-7830

Facility (Site) EPA I.D. Number
MID048090633

If more than one Transporter is to be utilized, give the Name and EPA I.D. Number of each:

WASTE INFORMATION

LOT NO.	U.S. D.O.T. Shipping Name (or common name if there is no D.O.T. shipping name).	D.O.T. Hazard Class	U.N./N.A. No.	Haz. Class Code	Container No.	Container Type	Form Solid	Form Liquid	Form Gas	Form Sludge	Total Weight or Volume	Units	Hazar or Ll Wa Num
1.	WASTE HAZARDOUS SOLID N.O.S.	ORM-E	NA9189	1 5		stl box	x				20	YDS	D
2.													
3.													
4.													
5.													
6.													

COMMENTS

Include Safety precautions and special handling instructions.

EXCAVATED WASTE ,PAINT SLUDGE AND SOIL ,THIS WASTE IS NON TOXIC,NON REACTIVE,NON CORROSIVE AND NON IGNITABLE

GENERATOR CERTIFICATION: I certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and U.S. EPA. I further certify that the information contained on the manifest is factual. I understand that the failure to accurately report all information requested by the manifest constitutes a violation of 1979 PA64 and/or 1969 PA136. I further understand that this manifest may be used in administrative and court proceedings.

Generator Signature
MN-COMP 0044751
① George H Hall

Date MO.
07 27

HAULER'S COMPLETES

HAULER'S CERTIFICATION: I certify acceptance of the above identified wastes for transportation. I further certify that I shall deliver the hazardous wastes, together with this manifest, only to the destination specified by the generator on this manifest. I understand that this manifest can be used in administrative and court proceedings.

Transporter Vehicle I.D. No. No. 1 666

Subsequent Transporter Vehicle I.D. No's

Transporter Signature
②

Date(s) Rec
07 27

Subsequent transporter(s) signature(s)
③

If the shipment cannot be delivered, describe the reasons for non-delivery.

TSDF COMPLETES

TSDF CERTIFICATION: I certify receipt at this facility of the above identified wastes and that this facility is licensed to accept those wastes. I also certify that the wastes were accompanied by a manifest properly certified by both the generator and hauler and that this facility is the destination indicated on the manifest. ~~I understand that this manifest can be used in administrative and court proceedings.~~

TSDF Signature
④

Facility Site EPA I.D. Number
MID048090633

☑ Accepted
☐ Rejected

Date Rece
07 28

Describe any significant discrepancies between manifest and shipment.
#826987

Was a Surcharge Assessed? ☐ Yes ☒ No

[redacted] ALL SPILLS MUST BE REPORTED TO THE MICHIGAN POLLUTION EMERG[redacted] ALE[redacted] SYS[redacted]N MIC[redacted]N AT [redacted]92-47[redacted]OUT-[redacted]ATE A[redacted]-373-[redacted]ND TH[redacted]ATIONA[redacted]ESPONS[redacted]CEN

WASTE DISPOSAL MANIFEST

☒ Act 64 Waste (HAZARDOUS) ☐ Act 136 Waste ☐ Other MI 0221794

IDENTIFICATION

Generator's Name
FORD MOTOR CO

Site Address 966 S. MISSISSIPPI RIVER BLVD
ST PAUL MINN 55116

Phone Number
(612) 696-0639

Generator's Site EPA I.D. Number
MND006607773

Primary Transporter's Name
INLAND WATER POLLUTION CONTROL

Transporters Address 4544 WEBSTER
ECORSE MICH 48229

Phone Number
(313) 383-6310

Transporter's EPA I.D. Number
MID000820366

Treatment, Storage or Disposal Facility
WAYNE DISPOSAL

Facility Address 49350 N. SERVICE DR.
BELLEVILLE MICH 48195

Phone Number
(313) 697-7830

Facility Site EPA I.D. Number
MID048090633

If more than one Transporter is to be utilized, give the Name and EPA I.D. Number of each:

GENERATOR COMPLETES — WASTE INFORMATION

LOT NO.	U.S. D.O.T. Shipping Name (or common name if there is no D.O.T. shipping name).	D.O.T. Hazard Class	U.N./N.A. No.	Haz. Class Code	Container		Form				Total Weight or Volume	Units	Haze or L W Nu
					No.	Type	Solid	Liquid	Gas	Sludge			
1.	WASTE HAZARDOUS SOLID N.O.S.	ORM-E	NA9189	15		stl box.	x				000015	YDS	
2.													
3													
4.													
5.													
6.													

COMMENTS

Include Safety precautions and special handling instructions.

EXCAVATED WASTE ,PAINT SLUDGE AND SOIL. THIS WASTE IS NON TOXIC ,NON REACTIVE ,NON CORROSIVE AND NON IGNITABLE.

GENERATOR CERTIFICATION: I certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and U.S. EPA. I further certify that the information contained on the manifest is factual. I understand that the failure to accurately report all information requested by the manifest constitutes a violation of 1979 PA64 and/or 1969 PA136. I further understand that this manifest may be used in administrative and court proceedings.

Generator Signature
MN-COMP 0044752
① George H Hall

Date Shi MO
0727

TRANSPORTER COMPLETES

HAULER'S CERTIFICATION: I certify acceptance of the above identified wastes for transportation. I further certify that I shall deliver the hazardous wastes, together with this manifest, only to the destination specified by the generator on this manifest. I understand that this manifest can be used in administrative and court proceedings.

Transporter Vehicle I.D. No. No. 1 830193

Subsequent Transporter Vehicle I.D. No's

Transporter Signature
② Chas Simpson

Date(s) Re
0727

Subsequent transporter(s) signature(s)
③

If the shipment cannot be delivered, describe the reasons for non-delivery.

TSDF COMPLETES

TSDF CERTIFICATION: I certify receipt at this facility of the above identified wastes and that this facility is licensed to accept those wastes. I also certify that the wastes were accompanied by a manifest properly certified by both the generator and hauler and that this facility is the destination indicated on the manifest. I ~~understand that this manifest can be used in administrative and court proceedings.~~

TSDF Signature
④

Facility Site EPA I.D. Number
MID048090633

☒ Accepted
☐ Rejected

Date Rec
0728

Was a Surcharge Assessed? ☐ Yes ☒ No

Describe any significant discrepancies between manifest and shipment. H826986

ALL SPILLS MUST BE REPORTED TO THE MICHIGAN POLLUTION EMERGENCY ALERTING SYSTEM, IN MICHIGAN AT 800—292-4706 OR OUT-OF STATE AT 517—373-7660 AND THE NATIONAL RESPONSE CE

APPENDIX B

BORING AND WELL-LOGS

FORD MOTOR COMPANY

LOG OF BORING NO. B-1

OWNER
Ford Motor Company

SITE
Twin Cities Assembly Plant

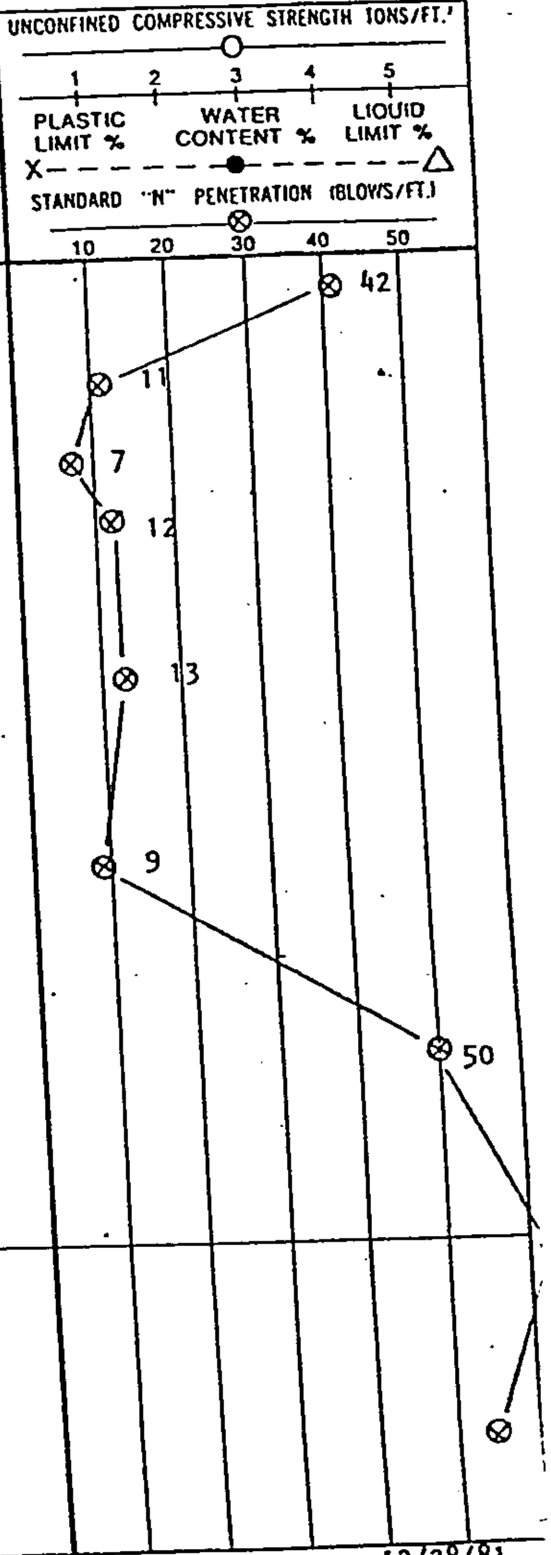
ARCHITECT-ENGINEER

PROJECT NAME
Ford Hydrogeologic Study

SURFACE ELEVATION 729.52

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
	1	SS			Fill; sand, gravel, silt, Decorah shale and clay, with fragments of slag, glass, firebrick, etc. - moist	
	2	SS				
5.0	3	SS				
	4	SS				
10.0	5	SS				
15.0	6	SS				
20.0	7	SS				
25.0	8	SS			River deposits Thinly interbedded grayish brown sandy silts and very fine sands - (SM-ML) - moist	
30.0	9	SS				

Continued



MN-COMP 0044754

WATER LEVEL OBSERVATIONS		
W.L.	42.0' W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

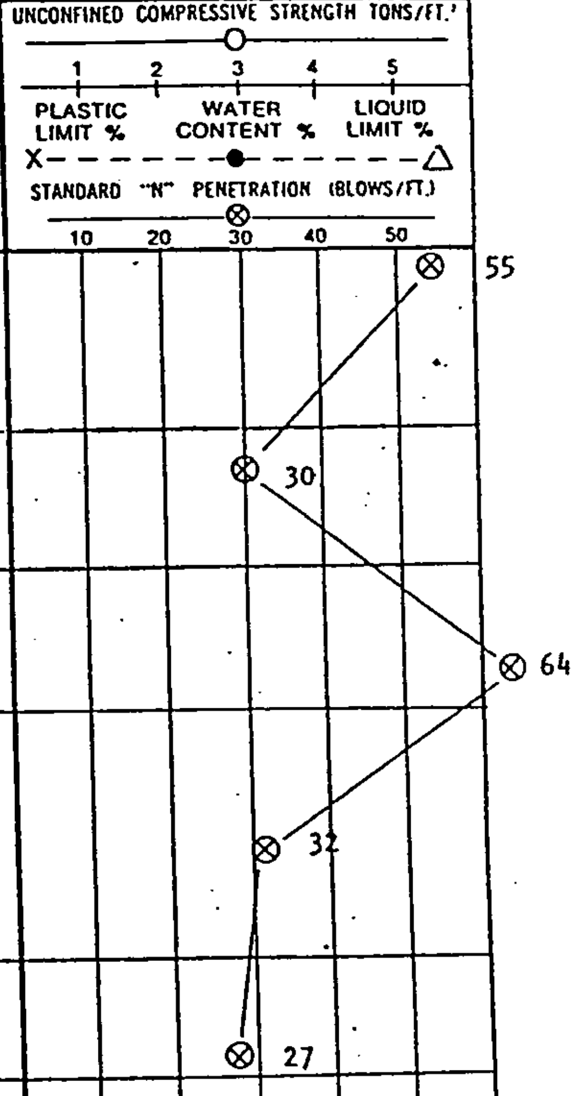
BORING STARTED	12/28/81
BORING COMPLETED	12/31/81
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. B-1

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT. 3
30.0	9	SS			River deposits Thinly interbedded grayish brown sandy silts and very fine sands - (SM-ML) - moist	
35.0	10	SS			Light brown very fine sand with little gravel, little silt - (SM)	
40.0	11	SS			Grayish brown fine to coarse sand and gravel with little silt - (GM-SM) - moist to wet	
45.0	12	SS			Light brown gravel, little sand, little silt - (GM) - saturated	
50.0 51.0	13	SS			Light brown very fine sand, some silt, little gravel - (SM) - sat.	
					End of boring at 51.0 feet. 2" PVC well installed	



MN-COMP 0044755

WATER LEVEL OBSERVATIONS		
W.L.	42.0' W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED	12/28/81		
BORING COMPLETED	12/31/81		
RIG	CME-45	FOREMAN	RM
DRAWN	DW	APPROVED	RJK
JOB #	92776	SHEET	2 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. 2

OWNER: Ford Motor Company

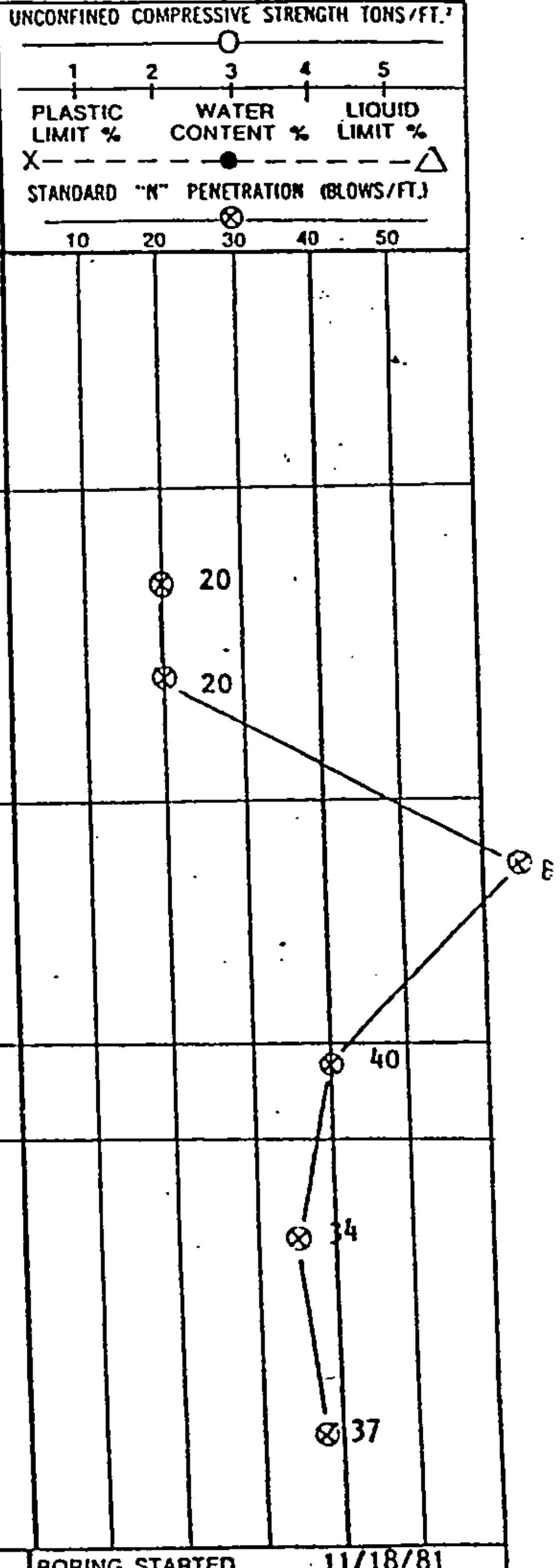
ARCHITECT-ENGINEER:

SITE: Twin Cities Assembly Plant

PROJECT NAME: Ford Hydrogeologic Study

SURFACE ELEVATION ↴ 715.77'

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL
			Boulders, cobble and concrete block from 0'-6.0' Removed with backhoe
5.0			
	1	SS	Fill, dark brown gravel, slag, sand and clay, moist
10.0			
	2	SS	
15.0			
	3	SS	Dark brown fine to coarse sand, trace silt - (SP), moist
20.0			
	4	SS	Light brown, very fine to medium sand, trace silt - (SP), wet
25.0			Light brown fine to coarse sand with some gravel, trace silt - (SW-SP), wet to saturated
	5	SS	
30.0			
	6	SS	
			Continued



WATER LEVEL OBSERVATIONS		
W.L.	29.5' W.S.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED	11/18/81
BORING COMPLETED	11/18/81
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. 2

OWNER
Ford Motor Company

SITE
Twin Cities Assembly Plant

ARCHITECT-ENGINEER

PROJECT NAME
Ford Hydrogeologic Study

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT. 3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5 PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △ STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50
30.0					(SW-SP)		⊗ 37
35.0	7	SS			Brown, fine to coarse sand with little gravel, extremely dense - (SW), saturated		⊗ 2
40.0							
44.5					End of boring at 44.5 feet. 2 " PVC well installed		

MN-COMP 0044757

WATER LEVEL OBSERVATIONS		
W.L.	29.5' W.S.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/18/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 2 of 2

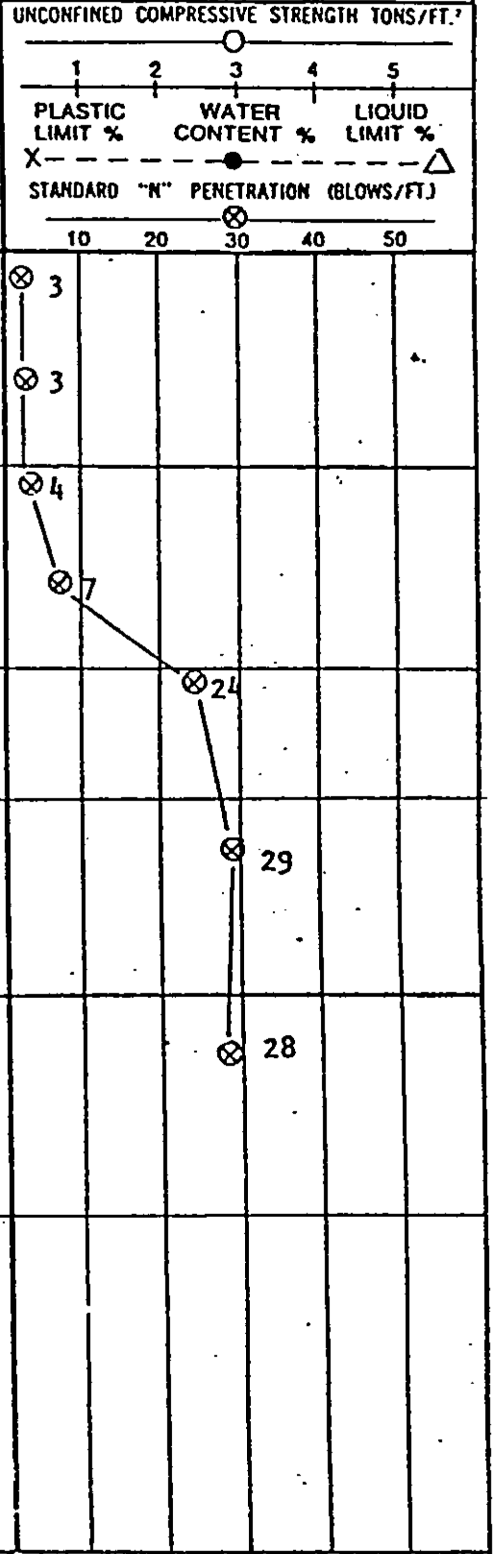
The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. 3

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

SURFACE ELEVATION 701.99

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	STANDARD "N" PENETRATION (BLOWS/FT.)
	1	SS	Dark brown very fine sand, trace to some silt, trace to some organic - (SM-OL), moist		3
	2	SS			3
5.0	3	SS	Light brown, very fine sand, trace silt - (SP), moist		4
	4	SS			7
10.0	5	SS	Brown fine to medium sand, trace to little gravel - trace silt - (SP)- moist to wet		24
15.0	6	SS	Brown medium to coarse sand, with some gravel, trace silt - shell fragments - (SW) - saturated		29
20.0	7	SS	Gray fine to coarse sand, trace silt, some gravel and cobble - (SW) - saturated		28
25.0			End of boring at 24.5 ft. 2" PVC well installed		



WATER LEVEL OBSERVATIONS		
W.L.	14.0' W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/17/81	
BORING COMPLETED 11/17/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 1

The stratification lines represent the approximate boundary

LOG OF BORING NO. 4

OWNER
Ford Motor Company

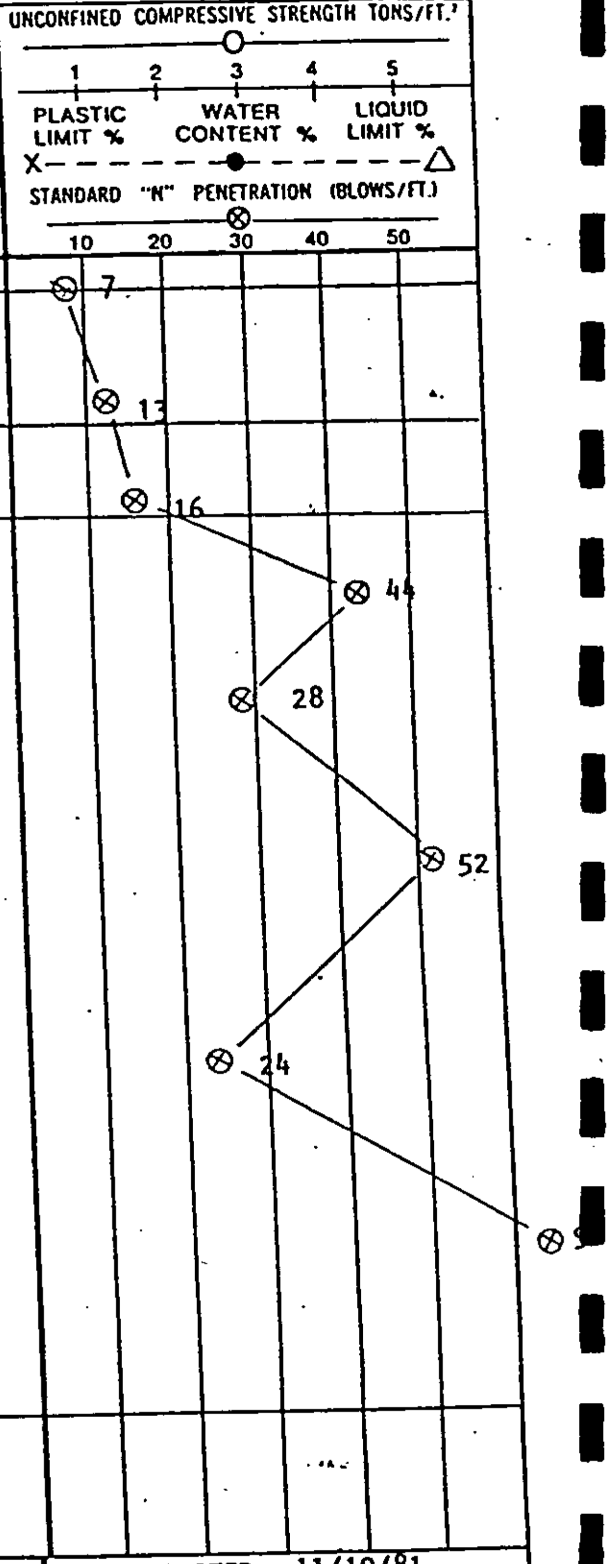
ARCHITECT-ENGINEER

SITE
Twin Cities Assembly Plant

PROJECT NAME
Ford Hydrogeologic Study

SURFACE ELEVATION → 705.47'

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					Brown clay with some very fine *	
	1	SS			Brown very fine sand, trace silt (SP) Lenses of black organic silt (OL) - moist	
	2	SS				
5.0					Black fill - fine to medium sand with graveland slag, moist	
	3	SS				
	4	SS				
10.0						
	5	SS				
15.0	6	SS			Brown fine to coarse sand with some gravel, trace silt - (SW-SP) - wet to saturated	
20.0	7	SS				
25.0	8	SS				
30.0					End of boring at 29.5 ft. 2" PVC well installed *sand (CL)- moist	



WATER LEVEL OBSERVATIONS
W.L. 19.5' W.S.
W.L. B.C.R. A.C.R.
W.L.

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/19/81
BORING COMPLETED 11/19/81
RIG CME-45
FOREMAN RM
DRAWN DW
APPROVED RJK
JOB # 92776
SHEET 1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. 5

OWNER: Ford Motor Company

ARCHITECT-ENGINEER:

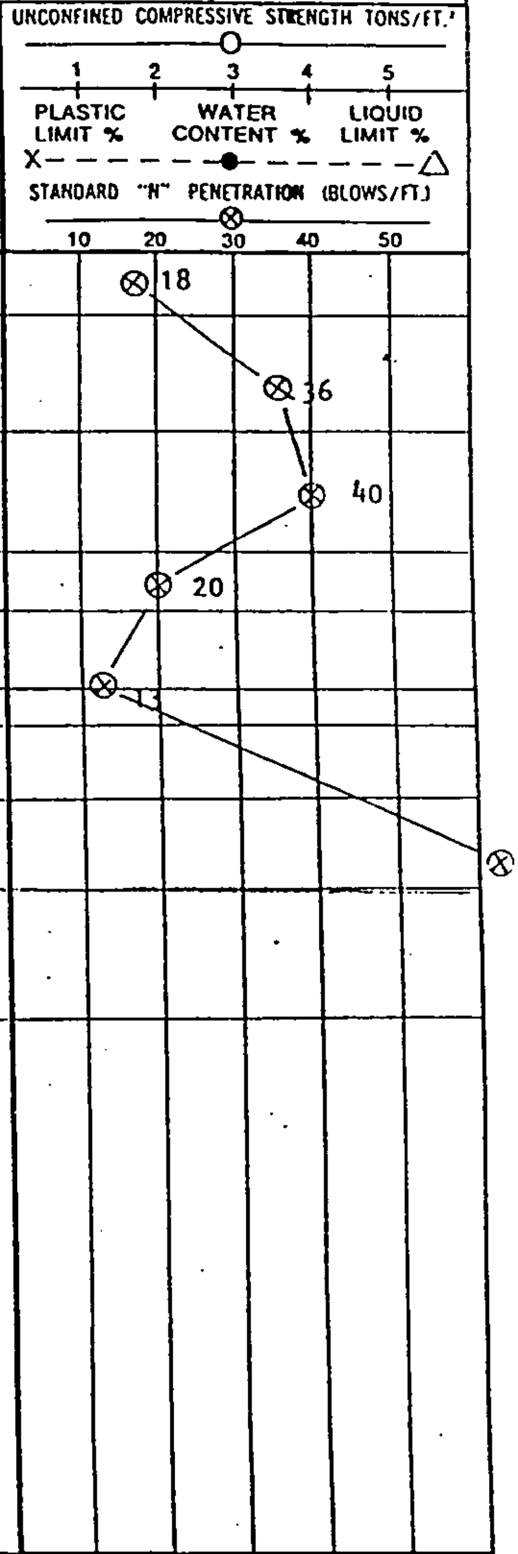
SITE: Twin Cities Assembly Plant

PROJECT NAME: Ford Hydrogeologic Study

SURFACE ELEVATION ↴ 701.5'

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
	1	SS			Dark brown topsoil, organic silt with some coarse sand and gravel - *	
	2	SS			Brown medium to coarse sand, trace silt, some gravel - (SP) - moist	
5.0	3	SS			Gravel and cobble, some fine sand, trace silt - (GP), moist	
	4	SS			Dark brown very fine sand, trace to little silt - (SM-SP) - moist	
10.0	5	SS			Dark brown silt with trace to little very fine sand, horizontal seams and lenses of black silt - ((ML) - moist	
					Gray very fine to fine sand, with trace to little silt - (SP-SM) SOLVENT ODOR, moist	
					Black fine sand with some silt (SM) Strong Solvent Odor - wet to sat.	
15.0	6	SS			Gray gravel and cobble, little sand and little clay - (GC) - saturated	
	7	SS			Light brown gravel and cobble, trace sand and trace clay (GW-GC) - saturated	
20.0					End of boring at 19.5 feet. Boring grouted from bottom to ground surface.	

*(OL-GM)



MN-COMP 0044760

WATER LEVEL OBSERVATIONS		
W.L.	14.0' W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED	11-20-81
BORING COMPLETED	11-20-81
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 1

The stratification lines represent the approximate boundary

LOG OF BORING NO. B-6

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

SURFACE ELEVATION ↴ 759.93'

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △

STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3	STANDARD "N" PENETRATION (BLOWS/FT.)
	1	SS					6
	2	SS					21
5.0	3	RB					
10.0					Fill; rubble, cobble, gravel, sand and green shale (Decorah) clay - moist		
15.0							
20.0							
25.0					Boulder (Limestone)		
					White Sandstone St. Peter Formation		
30.0					Continued		

WATER LEVEL OBSERVATIONS

W.L.	Dry	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/24/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB # 92776	SHEET 1 of 2

The stratification lines represent the approximate boundary

LOG OF BORING NO. B-6

OWNER Ford Motor Company	ARCHITECT-ENGINEER
SITE Twin Cities Assembly Plant	PROJECT NAME Ford Hydrogeologic Study

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT. 3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² ○ 1 2 3 4 5 PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △ STANDARD "N" PENETRATION (BLOWS/FT.) ⊗ 10 20 30 40 50
30.0							
	3	RB			White Sandstone St. Peter Formation		
35.0					End of boring at 34.8 feet. Boring grouted from bottom to ground surface		

WATER LEVEL OBSERVATIONS		
W.L.	Dry	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

BORING STARTED 11/18/81	
BORING COMPLETED 11/24/81	
RIG CME-45	FOREMAN RM
DRAWN DW	APPROVED RJK
JOB #92776	SHEET 2 of 2

The stratification lines represent the approximate boundary ... and the transition may be gradual.

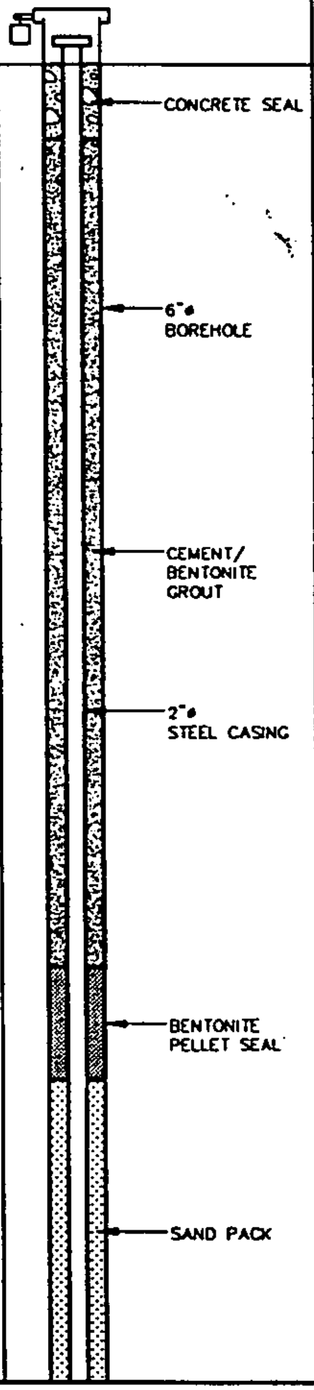
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-06)

PROJECT NAME: FORD SITE C
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: MW-6 (Page 1 of 2)
DATE COMPLETED: APRIL 10, 1990
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

MONITOR INSTALLATION



DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	ML(SILT)FILL, 10-40% clay, green, dry				
2.5					
	ML(SILT)FILL, brick, red-brown, dry				
5.0			1SS	X	28
			2SS	X	25
7.5					
	GC(GRAVEL)FILL, coarse, dry	-8.0			
			3SS	X	22
10.0	CL(CLAY)FILL, 10-30% silt, 10-30% sand and coarse gravel, well graded No recovery	-10.0			
			4SS	X	40
12.5					
			5SS	/	100
15.0			6SS	X	40
			7SS	X	17
17.5					
			8SS	X	23
20.0					
			9SS	X	41
22.5					
			10SS	X	8
25.0			11SS	X	19
	SW(SAND), 20-50% gravel, brown, dry, ALLUVIUM and GC(GRAVEL), 20-50% sand	-26.0			
			12SS	X	15
27.5					
			13SS	X	18
30.0					
32.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

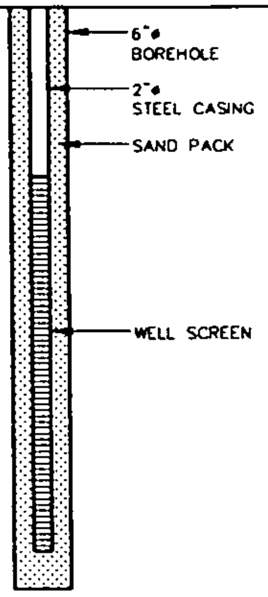
(L-06)

PROJECT NAME: FORD SITE C
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: MW-6 (Page 2 of 2)
DATE COMPLETED: APRIL 10, 1990
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
35.0			14SS	☒	14
37.5		▼			
40.0			15SS	☒	18
42.5	No recovery		16SS	⧄	25
45.0			AC	☒	
47.5	END OF HOLE @ 48.0 FT. BGS	-48.0			
50.0					
52.5					
55.0					
57.5					
60.0					
62.5					
65.0					

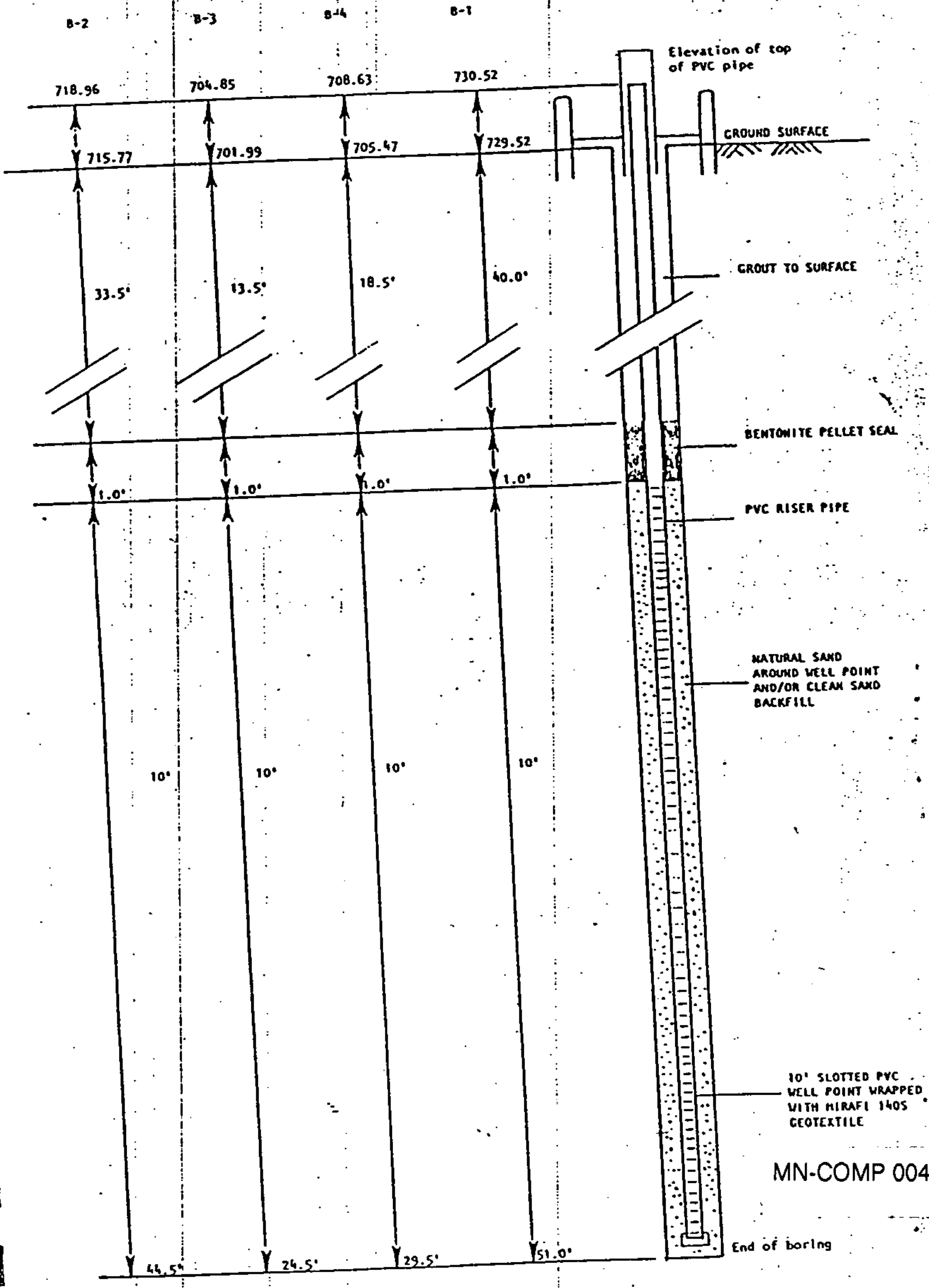
MONITOR INSTALLATION



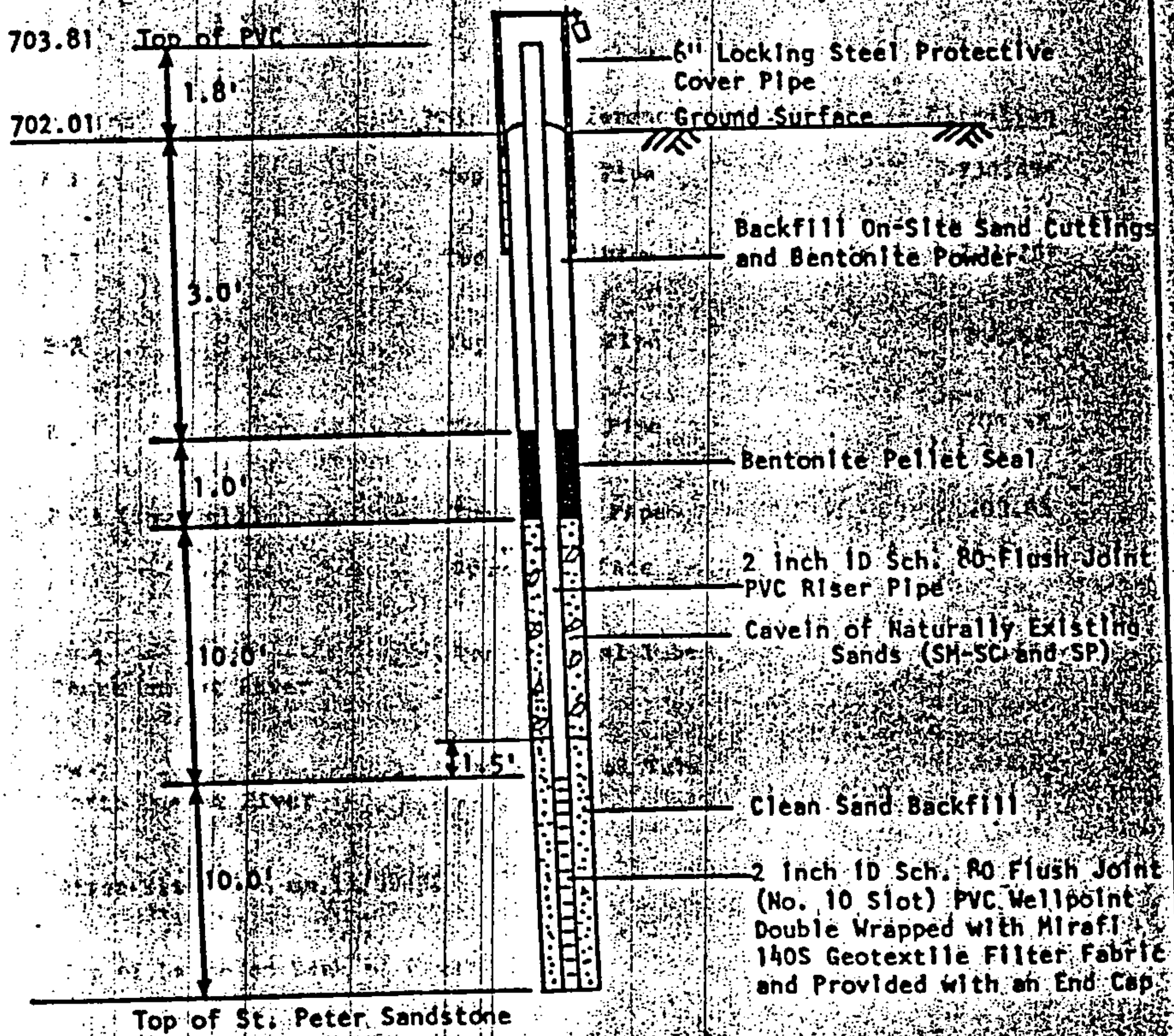
SCREEN DETAILS:
Screened Interval:
37.0 to 47.0' BGS
Length -10.0'
Diameter -2.0"
Slot # 10
Material -Stainless Steel
Sand pack interval:
27.0 to 48.0' BGS
Material -Natural

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼



MONITORING WELL CONSTRUCTION DIAGRAM
FORD MOTOR COMPANY
Twin Cities Assembly Plant
STS Job No. 92776



CONSTRUCTION DIAGRAM

No Scale

ORD MOTOR COMPANY
nitoring Well B-5A
nstalled 11/30/82

SOIL TESTING SERVICES
OF MINNESOTA, INC.
2405 ANNAPOLIS LANE
MINNEAPOLIS, MINN. 55441

HAG		92776-B	12/13/82

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

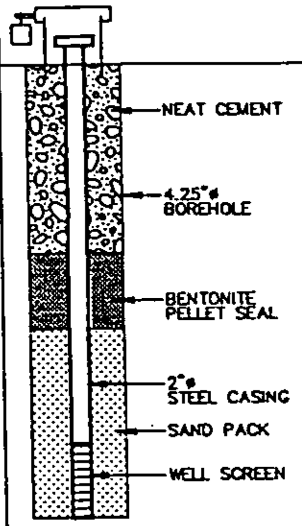
(L-1)

PROJECT NAME: FORD SITE B
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: MW-1
DATE COMPLETED: AUGUST 1, 1989
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top of Riser)	812.26			
	GROUND SURFACE	809.9			
	ML-CL(SILT/CLAY)FILL, trace grayvel, dark gray dry		1SS	☒	5
2.5	ML(SILT), some clay, trace sand, bluish gray moist, product odor		2SS	☒	6
		805.9			
5.0	SP(SAND), medium grained, gray, moist, product odor		3SS	☒	5
		803.9			
7.5	CL-ML(CLAY/SILT), some gravel, black organic material, gray, wet to saturated		4SS	☒	7
10.0			5SS	☒	24
		798.4	6SS	☒	70
12.5	BEDROCK (Ordovician Platteville Formation): buff, sandy limestone	797.9			
	END OF HOLE @ 12 FT. BGS NOTES: 1. HNu = 150 ppm 2. HNu over auger = 300; HNu off split-spoon = 110ppm 3. HNu = 180 ppm				
15.0					
17.5					
20.0					
22.5					
25.0					
27.5					
30.0					
32.5					

MONITOR INSTALLATION



SCREEN DETAILS:
Screened Interval:
10.0' to 12.0' BGS
Length - 2.0'
Diameter - 2.0"
Slot # 10
Material - Stainless Steel
Sand pack interval:
7.0' to 12.0' BGS
Material - #30 Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

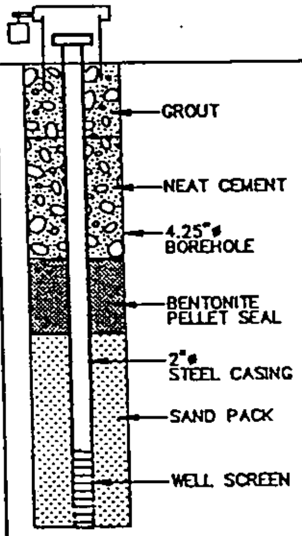
GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

(L-2)

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: FORD SITE B
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: MW-2
DATE COMPLETED: AUGUST 2, 1989
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	'N' VALUE
	REFERENCE POINT (Top of Riser) GROUND SURFACE	813.24 810.4				
	SW-ML(SAND/SILT)FILL, some gravel, gray, dry			1SS	☒	5
2.5				2SS	☒	7
5.0				3SS	☒	6
				4SS	☒	11
7.5	OL-CL(SILT/CLAY), gravelly, gray and black, wet, product odor	802.4		5SS	☒	15
10.0				6SS	☒	70
12.5	BEDROCK (Ordovician Platteville Formation): buff, sandy limestone END OF HOLE @ 12 FT. BGS NOTES: 2SS HNu = 200 ppm 3SS HNu = 200 ppm	798.4	SCREEN DETAILS: Screened Interval: 10.0' to 12.0' BGS Length -2.0' Diameter -2" Slot # 10 Material - Stainless Steel Sand pack interval: 7.0' to 12.0' BGS Material - #30 Sand			
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

(L-3)

PROJECT NAME: FORD SITE B

PROJECT NO.: 2853

CLIENT: FORD

LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: MW-3

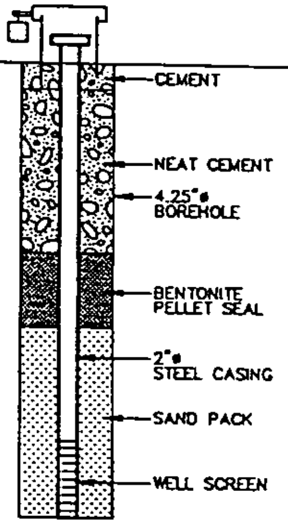
DATE COMPLETED: AUGUST 2, 1989

DRILLING METHOD: HSA

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top of Riser) GROUND SURFACE	813.22 810.2			
	Concrete	809.7			
	SW(SAND)FILL, medium coarse, brown, moist				
2.5			1SS	☒	7
	ML(SILT), some sand, blue-green, moist	806.2			
5.0			2SS	☒	9
7.5			3SS	☒	7
	OL(SILT), sandy, black, moist to saturated				
10.0			4SS	☒	10
			5SS	☒	50
12.5	END OF HOLE @ 12 FT. BGS	798.2			
15.0					
17.5					
20.0					
22.5					
25.0					
27.5					
30.0					
32.5					

MONITOR INSTALLATION



SCREEN DETAILS:
Screened Interval:
10.0' to 12.0' BGS
Length -2.0'
Diameter -2"
Slot # 10
Material - Stainless Stee
Sand pack interval:
7.0' to 12.0' BGS
Material - #30 Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

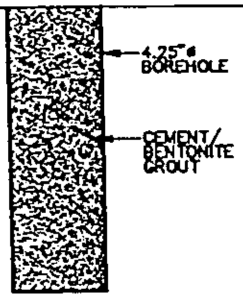
GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

(L-4)

PROJECT NAME: FORD SITE B
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: BH-A
DATE COMPLETED: JUNE 19, 1989
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	GROUND SURFACE	810.0				
	Concrete	809.5		1SS	☒	7
	SP(SAND)FILL, medium grained, tan, dry, product odor	809.0				
2.5	ML(SILT), sandy, some clay, black and gray, moist, product odor				☐	
5.0				2SS	☒	24
				3SS	☒	52
7.5	END OF HOLE @ 7.5 FT. BGS	802.5				
10.0						
12.5	Note: 1SS = OVA = 40 ppm					
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

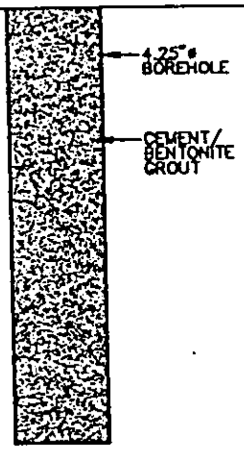
STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

(L-5)

PROJECT NAME: FORD SITE B
PROJECT NO.: 2853
CLIENT: FORD
LOCATION: ST. PAUL, MINNEAPOLIS

HOLE DESIGNATION: BH-B
DATE COMPLETED: JUNE 19, 1989
DRILLING METHOD: HSA
CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	'N' VALUE
	GROUND SURFACE	810.0				
	Concrete	809.5				
	SW(SAND)FILL and CH(CLAY), intermixed sand, fine to coarse, tan, slightly moist clay, some sand, trace gravel, blue-gray, moist, strong, product odor			1SS		10
2.5				2SS		24
5.0				3SS		5
				4SS		13
7.5				5SS		9
10.0				6SS		100
	END OF HOLE @ 11.5 FT. BGS	798.5				
12.5						
15.0	Notes: 1SS OVA = 10 ppm 2SS OVA = 40 ppm 3SS OVA = 45 ppm 4SS OVA = 40 ppm 5SS OVA = 150 ppm 6SS OVA = 100 ppm					
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○ WATER FOUND ▽ STATIC WATER LEVEL ▼

APPENDIX C

WELL ABANDONMENT LOGS

FORD SITE C

6022

GME CONSULTANTS, INC.
CONSULTING ENGINEERS
14000 21st Ave. No. / Minneapolis, MN 55447 / 612/559-1859

June 6, 1989

Mr. Steve Mockenhaupt
Conestoga-Rovers & Associates
382 West County Road D
St. Paul, Minnesota 55112

GME Project No. 2014

Re: Report for monitoring well abandonment and monitoring well surface protection at the Ford Plant in South St. Paul, Minnesota

Dear Mr. Mockenhaupt:

On March 3, 1989, we received authorization for the abandonment of existing monitoring wells, and the installation of surface protection at this site in Minneapolis, Minnesota. In accordance with your acceptance of our proposal, we have completed our services. This project was completed in compliance with our understanding of Minnesota Department of Health (MDH) regulations. Enclosed is our report including the MDH well abandonment logs, and a description of our services.

MONITORING WELL ABANDONMENT

Two existing monitoring wells (B-2 and B-4) were abandoned. Our drill crew retrieved as much down-hole 2 inch PVC riser pipe as possible by hand and with the Mobile B-24 rig. The wells were then grouted with neat cement to within two feet of the surface. Native soil was used to fill the remaining space in the boreholes.

You also requested that we upgrade the above ground protection for three existing monitoring wells at the site. Our drill crew installed three, 4 inch diameter by 8 foot long protective steel posts and one, 4 inch diameter by 5 foot long locking protective steel cap at B-1, B-3, and B-5. At B-5, the existing 2 inch PVC riser pipe was cut-off below grade and replaced with a new section. All the protective posts were cemented into place.

GEOTECHNICAL • MATERIALS • ENVIRONMENTAL SOILS
WILLIAM C. KWASNY, P.E. THOMAS P. VENEMA, P.E. KENNETH J. LaFOND, P.E. WILLIAM E. BLOEMENDAL, P.E.

The monitoring well abandonment procedures and above ground protection installation were supervised by our Minnesota Licensed Water Well Driller in accordance with MDH regulations.

GENERAL QUALIFICATIONS

This report is a summary of the services performed at the Ford Plant site in South St. Paul, Minnesota. No warranty, either expressed or implied, is presented in this report with respect to the soil and groundwater conditions at this site.

We appreciate the opportunity to be of service to you for this project. If you have any questions regarding this report or if we may be of further assistance to you, please do not hesitate to contact us.

Sincerely,

GME CONSULTANTS, INC.

James A. Nordstog

James A. Nordstog
Director of Drilling Operations
Hydrogeologist

Thomas H Moore

Thomas H. Moore
Minnesota Licensed Water Well Driller

Enclosures: MDH Monitoring Well Abandonment Logs

JAN:WCK:jan

STATE OF MINNESOTA DEPARTMENT OF HEALTH

ABANDONED WELL RECORD

#2

MINNESOTA UNIQUE WELL NO. (leave blank if not known) ______

1. LOCATION OF WELL

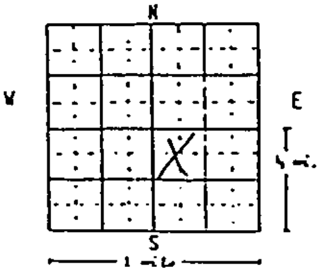
County Name Ramsey

Township Name	Township Number	Range Number	Section No.	Fraction ¼ ¼ of ¼
	28 [✓ N] or S	23 E or [✓ W]	17	NWSE

Numerical Street Address and City of Well Location or Distance from Road Intersection

500' from Mississippi Blvd, St. Paul, Mn

Show exact location of well (in section grid with "X")



Sketch map of well location

Ford Plant

enclosed site map

4. WELL DEPTH (completed) 44.5 ft.

Date sealed 5-31-89

5. DRILLING METHOD (if known)

1☐ Cable tool 4☐ Reverse 7☐ Driven 10☐ Dug
2☐ Hollow Rod 5☐ Air 8☐ Bored 11☐ ______
3☐ Rotary 6☐ Jetted 9☒ Power Auger

6. OBSTRUCTIONS

Well obstructed ☐ Yes ☒ No
Obstructions removed ☐ Yes ☐ No If obstructions cannot be removed, contact MDH before sealing.

7. USE

1☐ Domestic 4☒ Monitoring 8☐ Heat Loop
2☐ Irrigation 5☐ Public 9☐ Industry
3☐ Test Well 6☐ Municipal 10☐ Commercial
7☐ Air Conditioning 11☐ ______

2. PROPERTY OWNER'S NAME

Ford Motor Company
966 S. Mississippi Blvd.
St. Paul, Mn

Mailing Address if different than property address indicated above

8. CASING(S)

1☐ Black 4☐ Threaded 7☒ ______
2☐ Galv. 5☐ Welded
3☒ Plastic 6☐ Stainless Steel Not Known

______ in. to ______ ft.
______ in. to ______ ft.

3. FORMATION LOG

If not known, indicate formation log from new well or nearby well.

FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
cobbles, boulders			0	7
gravel, sand	brown		7	13
sand	brown		13	25
sand-gravel	brown		25	44

9. SCREEN

☒ Screened well from ____ ft. to Not Known (if known)
☐ Open Hole from ____ ft. to ____ ft.

10. STATIC WATER LEVEL

29.5 ft. ☒ below ☐ above land surface Date Measured 11-18-81

11. WELLHEAD COMPLETION

1☐ Pitless Adapter 4☐ Found Buried N/A
2☐ Basement offset 5☐ ______
3☐ Well Pit

16. REMARKS, ELEVATION, SOURCE OF DATA - CASINGS REMOVED, CASINGS PERFORATED, ETC.

Enclosed site map.
Site mw #2

12. GROUTING INFORMATION

1☒ Neat Cement 2☐ Bentonite 3☒ cement

Grout material cement from 0 to 2 ft. cu. yds ____
neat cement 2 44.5

13. NEAREST SOURCES OF CONTAMINATION

____ feet ______ direction ______ type

Well disinfected before sealing? ☐ Yes

14. PUMP ☐ Removed ☐ Not Present N/A

Type: 1☐ Submersible 3☐ L.S. Turbine 5☐ Reciprocating
2☐ Jet 4☐ Centrifugal 6☐ ______

15. EXISTING WELLS (Please sketch locations of abandoned and active wells in remarks section or on back.)

Other unused well(s) on property? ☐ Yes ☐ No
Abandoned: ☒ Permanent ☐ Temporary ☐ Not sealed

17. WATER WELL CONTRACTORS CERTIFICATION

This well was sealed under my jurisdiction and this report is true to the best of my knowledge and belief.

GME Consultants, Inc
Licensee Business Name License No.

Address 14000 21st Ave N. Mpls, Mn

Signed ______ Date ______

Tom Moore Date 6-9-89
Name of Driller

MN-COMP 0044775

OFFICIAL ABANDONED WELL RECORD (May be used for Property Transfer)

IMPORTANT: FILE WITH DEED

STATE OF MINNESOTA DEPARTMENT OF HEALTH

#4

ABANDONED WELL RECORD

1. LOCATION OF WELL

MINNESOTA UNIQUE WELL NO. (leave blank if not known)

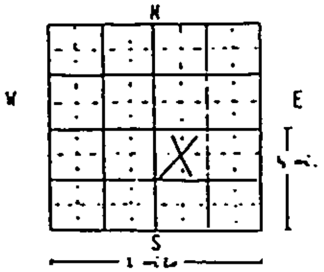
County Name Ramsey

Township Name	Township Number	Range Number	Section No.	Fraction ¼ ¼ of ¼
	28 [✓ N] or S	23 E or [✓ W]	17	NW-SE

Numerical Street Address and City of Well Location or Distance from Road Intersection

500' from Mississippi Blvd, St. Paul, Mn

Show exact location of well (in section grid with "X")



Sketch map of well location

Ford Plant Enclosed site map

4. WELL DEPTH (completed) 29.5 ft.

Date sealed 5-31-89

5. DRILLING METHOD (if known)

1☐ Cable tool 4☐ Reverse 7☐ Driven 10☐ Dug
2☐ Hollow Rod 5☐ Air 8☐ Bored 11☐ ____
3☐ Rotary 6☐ Jetted 9☒ Power Auger

6. OBSTRUCTIONS

Well obstructed ☐ Yes ☒ No
Obstructions removed ☐ Yes ☐ No If obstructions cannot be removed, contact MDH before sealing.

7. USE

1☐ Domestic 4☒ Monitoring 8☐ Heat Loop
2☐ Irrigation 5☐ Public 9☐ Industry
3☐ Test Well 6☐ Municipal 10☐ Commercial
7☐ Air Conditioning 11☐ ____

2. PROPERTY OWNER'S NAME

Ford Motor Company
966 S. Mississippi Blvd.
St. Paul, Mn

Mailing Address if different than property address indicated above

8. CASING(S)

1☐ Black 4☐ Threaded 7☐ ____
2☐ Galv. 5☐ Welded
3☒ Plastic 6☐ Stainless Steel Not Known
____ in. to ____ ft.
____ in. to ____ ft.

3. FORMATION LOG If not known, indicate formation log from new well or nearby well.

FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
clay	brown		0	1
sand	brown		1	2
sand-fill	black		2	7
sand	brown		7	29

9. SCREEN

☐ Screened well from ____ ft. to ____ ft. Not Known (if known)
☐ Open Hole from ____ ft. to ____ ft.

10. STATIC WATER LEVEL

19.5 ft. ☒ below ☐ above land surface Date Measured 11-19-81

11. WELLHEAD COMPLETION

1☐ Pitless Adapter 4☐ Found Buried
2☐ Basement offset 5☐ N/A
3☐ Well Pit

12. GROUTING INFORMATION

1☒ Neat Cement 2☐ Bentonite 3☐ ____
Grout material ____ from ____ to ____ ft. cu. yds ____
EOB to surface

13. NEAREST SOURCES OF CONTAMINATION

____ feet ____ direction ____ type
Well disinfected before sealing? ☐ Yes

14. PUMP ☐ Removed ☐ Not Present N/A

Type: 1☐ Submersible 3☐ L.S. Turbine 5☐ Reciprocating
2☐ Jet 4☐ Centrifugal 6☐ ____

15. EXISTING WELLS (Please sketch locations of abandoned and active wells in remarks section or on back.)

Other unused well(s) on property? ☒ Yes ☐ No
Abandoned: ☐ Permanent ☒ Temporary ☐ Not sealed

16. REMARKS, ELEVATION, SOURCE OF DATA - CASINGS REMOVED, CASINGS PERFORATED, ETC.

Enclosed site map.
Site MW #4

17. WATER WELL CONTRACTORS CERTIFICATION

This well was sealed under my jurisdiction and this report is true to the best of my knowledge and belief.

GME Consultants, Inc
Licensee Business Name License No.

Address 14000 21st Ave N. Mpls, Mn

Signed ____ Date ____

Tom Moore Date 6-9-89
Name of Driller

OFFICIAL ABANDONED WELL RECORD (May be used for Property Transfer)

IMPORTANT: FILE WITH DEED

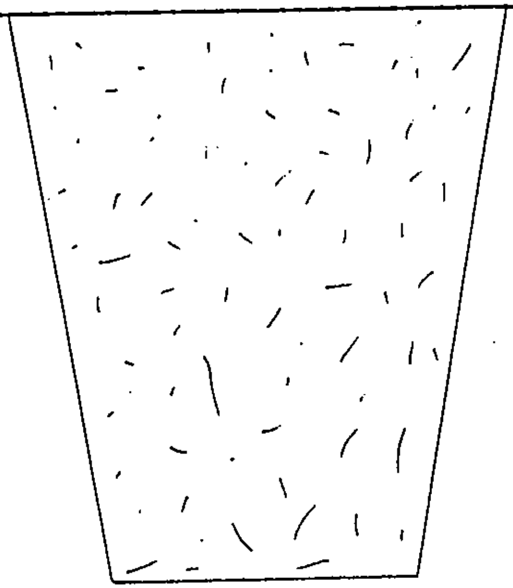
APPENDIX D

TEST PIT LOGS
FORD SITE C

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

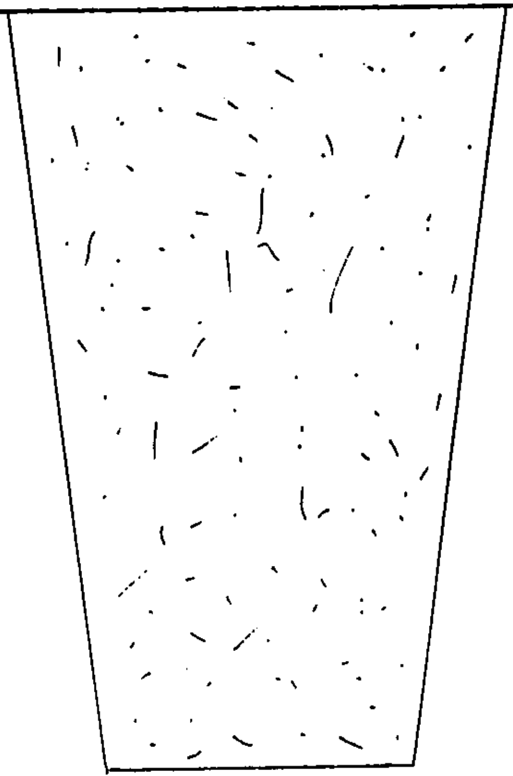
HOLE DESIGNATION: TP1-87
DATE COMPLETED: 12/4/87
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SP) SAND, fine to medium grained, trace silt, trace gravel, dry.		
2			
3			
4	Occasional seams of sandy silt (ML)		
5			
6			
7			
8			
9			
10	End of Test Pit at 9.0' BGS		
11	Hole backfilled		
12			
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

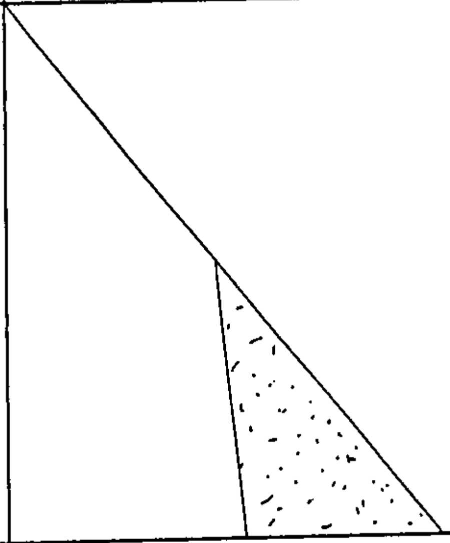
HOLE DESIGNATION: TP2-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SM) SAND, silty, some limestone, some well rounded gravel and cobbles		
2			
3			
4			
5			
6			
7			
8	Layered silt (ML) and clay (CL), brown to light brown		
9			
10			
11	(SP) SAND, very fine grained, brown to light brown		
12			
13	End of Test Pit at 12.0' BGS, Hole backfilled		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

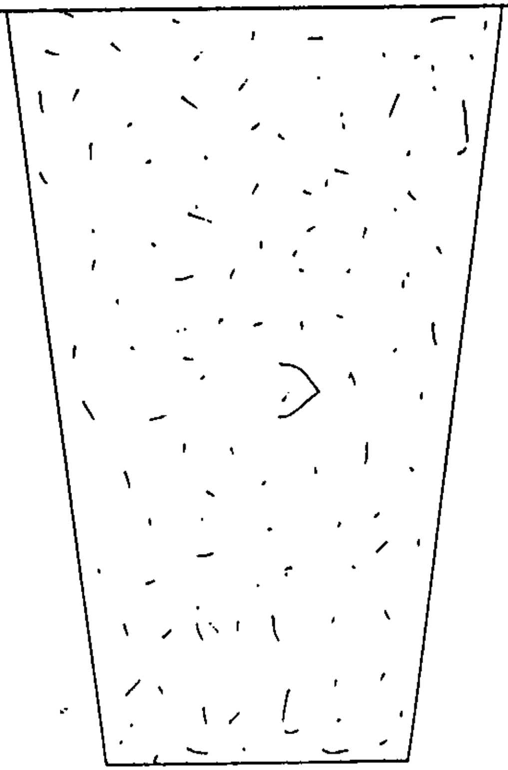
HOLE DESIGNATION: TP2A - 88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

FT ABV. GRADE	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
7			
6			
5			
4			
3	(Test Pit dug into side of bluff)		
2	Building rubble: very large pieces of concrete (>3'Ø) glass, iron, lumber		
1			
0	Grade		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

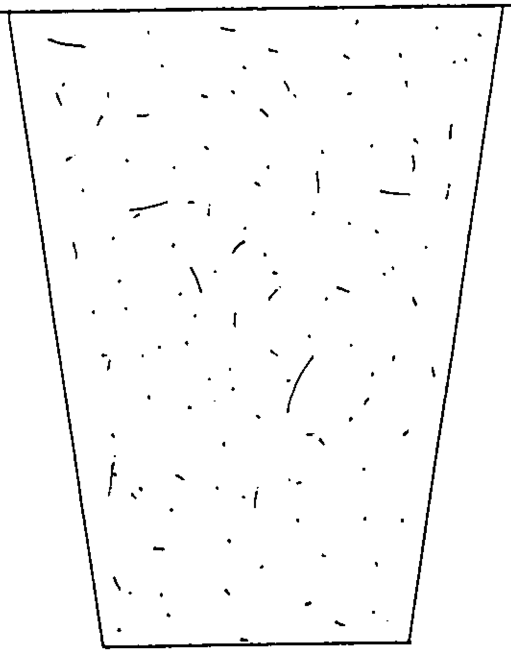
HOLE DESIGNATION: TP3-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SM) SAND, some gravel, silty, brown to light brown		
2			
3	seam of black/gray silty sands (SM), very strong odor from 2.0' to 3.0' BGS (sample taken)		
4			
5			
6	clean silty sands (SM) from 3.0' to 4.5' BGS		
7			
8	(SM) SAND, gray, some odor as 2.0' to 3.0' BGS soil		
9			
10			
11			
12			
13	End of Test Pit at 12.0' BGS gray color and odor to 12.0 BGS Hole Backfilled		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

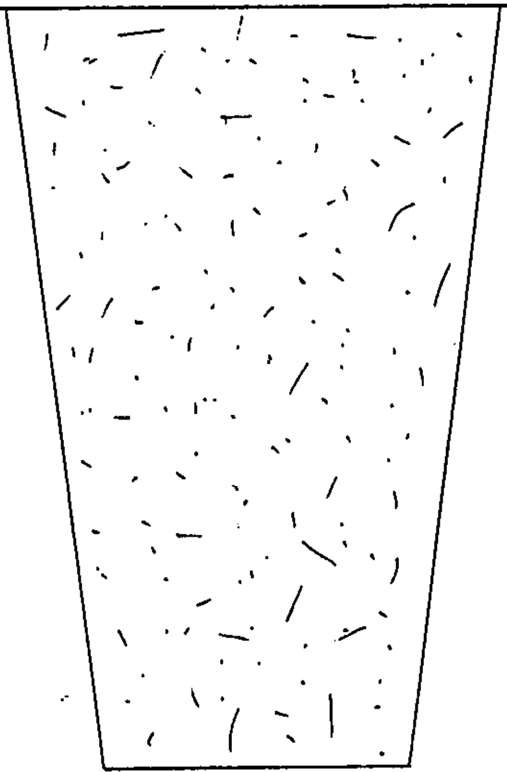
HOLE DESIGNATION: TP4-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SP) SAND, very fine grained, some silt, moist		
2			
3	occasional lenses of sandy silt (ML)		
4			
5			
6			
7			
8			
9			
10			
11	End of Test Pit at 10.0' BGS Hole Backfilled		
12			
13			

T E S T   P I T   L O G

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

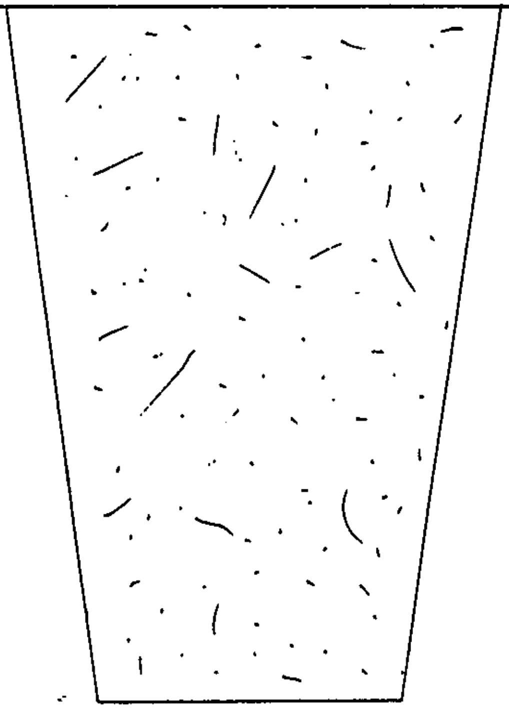
HOLE DESIGNATION: TP5-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1			
2	(CL-ML) CLAY and SILT, sandy, gray to gray/blue, moist		
3			
4			
5			
6	(SP) SAND, fine to very fine grained, trace silt, trace gravel, light brown to brown		
7			
8			
9			
10			
11			
12			
13	End of Test Pit at 12.0' BGS Hole Backfilled		

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

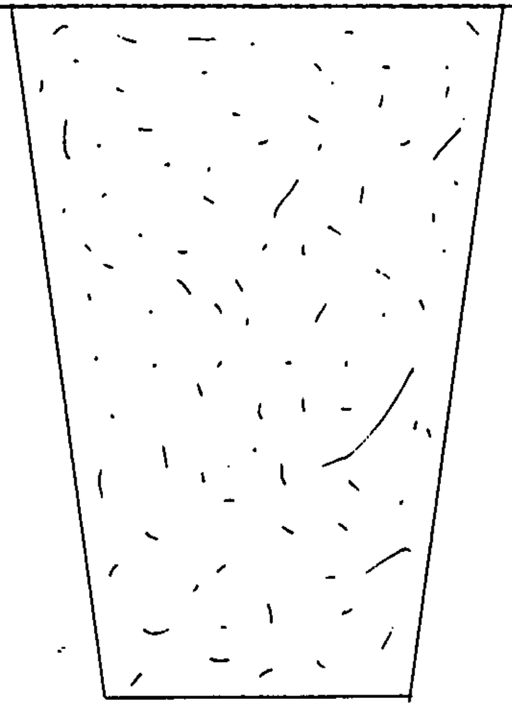
HOLE DESIGNATION: TP6-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(ML) SILT, very sandy, occasional seams of yellow SM		
2			
3			
4			
5	(SW-GW) SAND and GRAVEL, fine to coarse grained, some large well rounded cobbles		
6			
7			
8			
9			
10			
11			
12	End of Test Pit at 11.0' BGS Hole Backfilled		
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP7-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	Building rubble, concrete, railroad ties, timbers		
2			
3			
4			
5			
6			
7			
8			
9			
10	(SP) SAND, very loose St. Peter sand, yellow to white yellow to white		
11			
12	End of Test Pit at 11.0' BGS Hole backfilled		
13			

T E S T   P I T   L O G

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS

PROJECT NO.: 2191

CLIENT: FORD MOTOR COMPANY

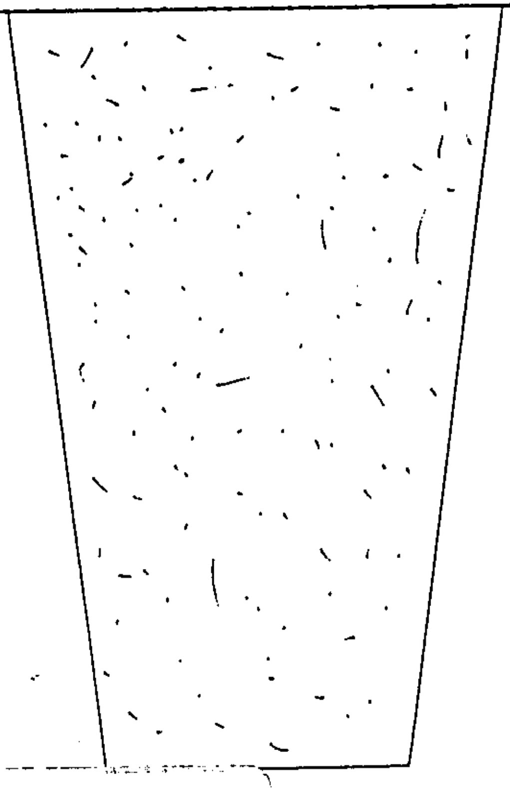
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP8-88

DATE COMPLETED: 1/19/88

EXCAVATION METHOD: BACKHOE - CAT 211 LC

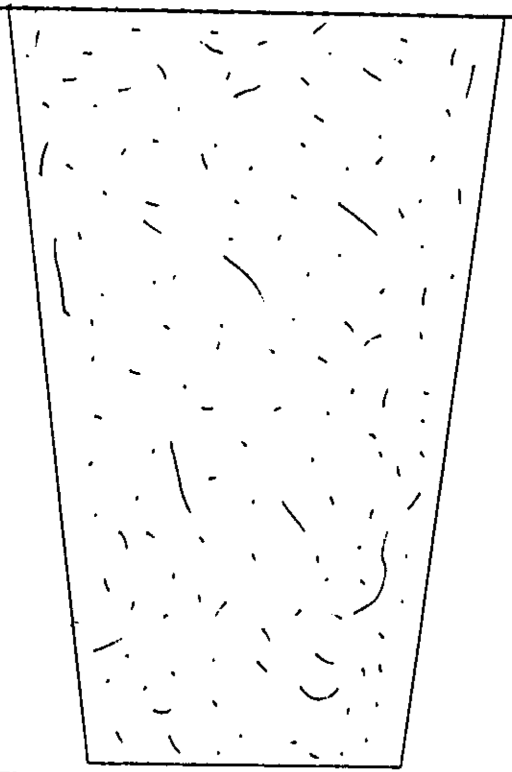
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(GW) GRAVEL and COBBLES, very coarse grained, trace sand.		
2			
3			
4			
5			
6			
7			
8	Small piece of metal at 9.5'		
9			
10	(SP) SAND, very fine grained, color change to gray/black (sample taken)		
11			
12	End of Test Pit at 12.0' BGS Hole backfilled		
13			

TEST PIT LOG

PROJECT NAME: PRELIMINARY ASSESSMENT OF WASTE DISPOSAL AREAS
PROJECT NO.: 2191
CLIENT: FORD MOTOR COMPANY
LOCATION: ST. PAUL, MINNESOTA

HOLE DESIGNATION: TP9-88
DATE COMPLETED: 1/19/88
EXCAVATION METHOD: BACKHOE - CAT 211 LC
CRA SUPERVISOR: S. MOCKENHAUPT

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	DIAGRAM
0			
1	(SP) SAND, very fine grained, yellow/orange, trace silt.		
2			
3			
4	Occasional seams of fine gravel and coarse sand.		
5			
6			
7			
8			
9			
10			
11			
12	(SM) SAND, silty, gray, wet to saturated		
13	End of Test Pit at 12.0' BGS Hole backfilled		

APPENDIX E

DATA QUALITY ASSESSMENT
GROUNDWATER AND
SURFACE WATER SAMPLES
FORD SITE C

MEMORANDUM

TO: Jon Christofferson
REFERENCE NO.: 2853
FROM: David Dempsey
DATE: June 7, 1990
RE: Data Quality Assessment and Validation for Seven Groundwater Samples Collected During the April 1990 Sampling Event at the Ford Site C Project Site

The following details a data quality assessment and validation for seven groundwater samples collected on April 19, 1990 at the Ford Site C Project Site. The samples were analyzed for site-specific parameters, namely, volatile organic compounds (VOC) and metals by Pace Laboratories, Inc. (Pace).[1] Quality assurance criteria were established by the analytical methods.[2]

Holding Time Periods

Holding time periods were established by the analytical methods and are summarized below:

VOC -14 days from sample collection to completion of analysis

Metals -6 months from sample collection to completion of analysis, except for mercury
-28 days from sample collection to completion of analysis for mercury

As all samples met the above criteria, the data were found to be acceptable based upon the holding time periods.

Method Blank Samples

The potential for sample contamination through laboratory protocols was measured by means of method blank samples. The VOC method blank sample contained methylene chloride at a concentration of 1.42 µg/*l*. Methylene chloride data for samples

---

[1] Analytical methods were taken from 40 CFR Part 136 Appendix A and "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, revised March 1983 and are summarized below:

VOC -601/602
Metals -200 Series

[2] Application of quality assurance criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988 and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, July 1, 1988.

W-041990-JM-01, W-041990-JM-02 and W-041990-JM-03 were qualified as non-detect (U), as a result. Similarly, the metals method blank sample was found to contain analytes copper and zinc at concentrations of 0.023 mg/*l* and 0.05 mg/*l*, respectively. Sample W-041990-JM-06 had its copper datum qualified as non-detect (U), while no action upon the zinc data was required. Of interest was the fact that no method blank sample was reported for selenium. However, as all samples were reported to be free of selenium, no action upon the selenium data was necessary.

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was to be monitored via surrogate recoveries. To date, no surrogate data have been received from Pace. Therefore, matrix spike/matrix spike duplicate data were solely used to judge the VOC data.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy was monitored by MS/MSD analyses. An in-house sample at Pace underwent MS/MSD analyses for VOC. Therefore, direct application of these data was not possible. The method was shown to have been precise as the percent recoveries were within control limits established by Pace.

Sample W-041990-JM-04 underwent a matrix spike analysis for the metal analyte selenium, while sample W-041990-JM-06 had matrix spike analyses performed for metal analytes arsenic and zinc. All remaining metal analytes had matrix spike analyses performed upon in-house samples. Arsenic and selenium percent recoveries fell below the control limits set by Pace; therefore, the results for all samples for these analytes were qualified as estimated (UJ). As the percent recoveries for the remaining metals were within limits, the methods were shown to be accurate.

Laboratory Duplicate Analyses

The level of analytical precision for metals analyses was measured through laboratory duplicate analyses. The duplicate analysis for barium was performed upon sample W-041990-JM-02, while in-house samples at Pace were used for the remaining analytes duplicate analyses. Only lead analyses were shown to have an unacceptable level of precision. Therefore, all lead data were qualified as estimated (UJ).

Rinsate Sample

Cleanliness of sampling equipment was checked by collection of rinsate sample W-041990-JM-03. The only analyte detected within the sample was methylene chloride. However, this methylene chloride datum was qualified as non-detect (U) based upon the method blank sample. Therefore, the sampling equipment was properly cleaned prior to collection of samples.

Field Duplicate Samples

Overall precision of this sampling event was monitored by collection of field duplicate samples W-041990-JM-04 and W-041990-JM-05. Both samples were found to be free of all target analytes, indicating that an acceptable level of precision was achieved.

Overall Assessment

Methylene chloride data for sample W-041990-JM-01, W-041990-JM-02 and W-041990-JM-03 were qualified as non-detect (U) based upon method blank sample data. Metals analytes arsenic, lead and selenium had all results qualified as estimated (UJ). The remaining data were found to be acceptable for the quanitative assessment of analytes within the groundwater at the project site.

cc: Bruce Clegg

MEMORANDUM

TO: Steve Mockenhaupt
REFERENCE NO.: 2853
FROM: Dave Dempsey
DATE: August 1, 1990
RE: Data Quality Assessment and Validation for Seven Groundwater Samples Collected during the June 1990 Sampling Event at the Ford Site C Site

The following details a data quality assessment and validation for seven groundwater samples collected on June 6, 1990, at the Ford Site C site. Samples were analyzed for volatile organic compounds (VOC) and metals by Pace Laboratories Inc. (Pace).[1] Quality assurance criteria were established by analytical methods.[2]

Holding Time Periods

Holding time periods are established in analytical methods and are summarized below:

VOC - 14 days from sample collection to completion of analysis

Metals- 6 months from sample collection to completion of analysis, except for mercury
- 28 days from sample collection to completion of mercury analysis

Reviewing analysis dates showed that all holding time periods were met.

Method Blank Sample

Laboratory contamination of samples was checked for with method blank samples. The VOC method blank sample contained no target analytes. However, zinc was detected at a concentration of 0.066 mg/*l* within metals method blank sample. Zinc data for samples W-060690-RF-01, W-060690-RF-02, W-060690-RF-04 through W-060690-RF-06 were qualified as non-detect (U).

Surrogate Compound Percent Recoveries

Individual sample results for VOC analyses were assessed using surrogate compound fluorobenzene recoveries. Examining the recoveries revealed that VOC Method 602 was in control. No surrogate compound was used to check the accuracy of Method 601. Hence, MS/MSD recoveries were used to assess Method 601 results.

---

[1] Analytical methods are taken from 40 CFR Part 136, Appendix A, and "Chemical Methods for Analysis of Water and Wastes", USEPA-600/4-79-020, Revised March 1983 and are summarized below:

VOC - 40 CFR 601/602
Metals - USEPA 200 Series

[2] Application of quality assurance criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988, and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses", July 1, 1988.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Effects upon the data due to matrix interference were checked via MS/MSD analyses. Pace sample 21699 underwent VOC MS/MSD analyses. As all percent recoveries fell within limits, the level of precision was acceptable.

Sample W-060690-RF-07 underwent matrix spike analysis for target metals. The silver percent recovery was low. Therefore, silver data were qualified as estimated (UJ) for all samples.

Laboratory Duplicate Analyses

Precision for metals analyses was measured by means of duplicate analyses. Samples W-060690-RF-03 and W-060690-RF-06 had duplicate analyses for analytes mercury and selenium, respectively. Precision for both were acceptable. No other duplicate analyses were performed by Pace, therefore, field duplicate samples were used to assess precision.

Rinsate Sample

Cleanliness of sampling equipment was checked with rinsate sample W-060690-RF-01. Target VOC detected were 1,1,1-trichloroethane, tetrachloroethene and 1,1-dichloroethene. As all investigative samples were free of these analytes, no action upon the data was necessary.

Zinc was also detected within this sample. However, the zinc datum was qualified as non-detect (U) based upon the method blank sample.

Field Duplicate Samples

Precision was measured by collecting field duplicate samples W-060690-RF-04 and W-060690-RF-05. As both sets of data were within limits of agreement, the precision was acceptable.

Overall Assessment

Silver data were qualified as estimated (UJ) for all samples, while five samples had zinc data qualified as non-detect (U). Remaining data are acceptable to quantitatively assess target analyte concentrations.

cc: Bruce Clegg

APPENDIX F

SOIL EXPLORATION REPORT AND LOGS, 1984

FORD UST SITE AREA

soil exploration
company

662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-6446

a sister corporation to TWIN CITY TESTING AND ENGINEERING LABORATORY INC.

October 29, 1984

Pope Associates, Inc.
533 St. Clair Avenue
St. Paul, MN 55102

Attn: Robert L. Pope

Gentlemen:

SUBJ: Subsurface Exploration Program
Proposed Hazardous Waste Building
Ford Motor Plant
St. Paul, Minnesota
#120-12734

We have conducted a subsurface exploration program and foundation review for the referenced project. We are transmitting eight copies of our report. This work was done in accordance with your verbal authorization on October 22, 1984.

About 50% of the soil samples will be held at this office for one month and will then be discarded unless we are notified to hold them for a longer period of time.

We trust that this report will provide you with the needed information. If questions arise concerning interpretation of the data, please contact us for review.

Very truly yours,

Wilfred A. Wahl

Wilfred A. Wahl, P.E.

WAW/rjr

Encs.

REPORT OF SUBSURFACE EXPLORATION PROGRAM
PROPOSED HAZARDOUS WASTE BUILDING
FORD MOTOR PLANT
ST. PAUL, MINNESOTA
#120-12734

INTRODUCTION

We understand the proposed construction at this site will consist of a one-story, slab-on-grade structure. The building will be approximately 60' by 63' in plan dimensions.

In accordance with your verbal authorization on October 22, 1984, we have conducted a subsurface exploration program for the proposed construction. The scope of our work on this project is as follows:

1. Explore the subsurface soil and bedrock conditions by means of three test borings.
2. Provide recommendations for foundation support of the proposed building.
3. Provide recommendations for site preparation for support of the foundation.

Our work program for accomplishment of the above objectives included three soil test borings, a few laboratory tests and observation of the recovered soil samples.

The purpose of this report is to describe our field operations, to present the results of our field and laboratory tests and to provide you with our engineering recommendations.

EXPLORATION PROGRAM RESULTS

Site Conditions

The building will be constructed south of the existing paint building. There is an existing storm sewer that runs in a north-south direction in about the center of the building. The site is relatively level with surface elevations at the boring locations varying from 95.2' to 95.9'.

Subsurface Conditions

The subsurface soil conditions encountered at the boring locations are shown on the attached boring logs. We wish to point out that the subsurface conditions at other times and locations on this site may differ from those found at our test locations. If different conditions are encountered during construction, it is necessary that you contact us so that our recommendations can be reviewed.

The test boring logs also indicate the probable geologic origin of the encountered soil.

It will be noted from the boring logs that shale was encountered at depths of from 3' to 6½' at the boring locations. The soil conditions overlying the shale were quite variable. Mixed alluvium consisting primarily of weathered limestone and some soil was encountered at boring 1. At boring 2, the soil consisted of sand with a little gravel, coarse alluvium. At boring 3, the overburden consists of fill.

The overlying soils generally are medium dense to very dense. The primary exception is the very loose sand encountered at a depth of about 5' at boring 2.

All of the borings terminated in shale. The shale is part of the Decorah Formation which is underlain with the Platteville Limestone Formation. Our geological data indicates the depth to the top of the Platteville Formation should be about 30' at this site. The shale contains lenses and thin layers of limestone. The borings were obstructed at depths varying from 8.6' to 15.7'. It is our opinion that the obstructions represents thin layers of limestone within the Decorah Formation rather than the underlying Platteville Formation. The N values in the shale vary from 13 to well over 100 blows per foot.

Water Levels

Water level measurements were made in the borings and the data is included on the logs. Ground water was encountered at borings 1 and 2 just above the underlying shale. Seasonal and yearly fluctuations of the ground water levels can be anticipated.

ENGINEERING REVIEW

Project Information

The following data represents our understanding of the project. It comprises an important part of our engineering review. If, as the project develops, there are changes from the stated values, we request that you contact us for additional review.

We understand the proposed construction at this site will consist of a one-story, slab-on-grade structure. The building will be approximately 60' by 63' in plan dimensions. The building will be essentially a steel-frame metal clad building with concrete foundation walls supported on a concrete slab. The slab will be approximately 1' below existing grade. We anticipate the average loading under the slab, including live load, will be on the order of 500 to 600 psf (pounds per square foot).

Discussion

It is our opinion that the soils and underlying shale are capable of supporting the foundation loads with an adequate factor of safety against shear failure and with minimal settlement.

However, the shale is known to be expansive. No laboratory tests were conducted on samples from this site to further evaluate the expansive properties. However, based on previous tests on the Decorah Shale, the typical swell pressure would be on the order of 6 to 8 tons per square foot. Under very light loads, the percent swell is on the order of 3% to 4%. As a result, the swelling is most critical under the very light structures and especially under lightly loaded floor slabs.

For swelling to occur, the shale must come in contact with a source of water. At this particular site, ground water was encountered immediately above the shale at two of the boring locations. Therefore, it is quite probable that the upper portion of the shale has already undergone some swelling.

Therefore, supporting the lightly loaded structure on or immediately above the shale will entail some risk. However, the majority of the Ford Plant is supported on the shale. In many areas, the floor slab is only a short distance above the underlying shale. We understand that there have been no unusual problems with foundations or floor slabs in the existing plant due to swelling.

Therefore, based on this information, it is our opinion that the structure can be supported on a slab foundation above existing shale with only minimal risk of future excessive differential swelling.

Foundation Recommendations

Because of the wide variation in the composition of the soils (colluvium, alluvium and fill) immediately below the slab elevation, we suggest that the building area be subcut to a minimum depth of 18" below the bottom of the floor slab. Additional subcutting could be performed if localized fill is encountered extending to a greater depth. We then recommend placing a relatively clean, free-draining granular soil to the bottom of slab elevation. This fill should be compacted to a minimum of 95% of standard Proctor density. The slab can then be supported directly on the controlled fill at normal elevation. The excavation and compacted fill should extend beyond the edge of the slab a distance equal to the depth of compacted fill beneath the slab foundation.

Originally, it was planned to place a draintile system at the bottom of the granular fill. We recommend that no draintile be installed. We feel it is important to attempt to maintain the present moisture condition in the underlying shale, since a change in moisture content could cause a change in volume.

Site Observation

We recommend that the excavation be observed by a soil engineer before placing any newly compacted fill. We also recommend that density tests be taken in the fill as it is placed to document that proper compaction is being obtained.

FIELD EXPLORATION PROCEDURES

Three soil test borings were made on October 24, 1984. The borings were put down at the locations shown on the attached sketch. The locations were changed somewhat from the suggested locations because of material stored on the site and due to existing utilities. The surface elevations were referenced to the top of the hydrant where shown, taken as 100.0', an assumed elevation.

Soil Sampling

Soil sampling was performed in accordance with ASTM: D 1586-67. Using this procedure, a 2" O.D. split barrel sampler is driven into the soil by a 140 lb weight falling 30". After an initial set of 6", the number of blows required to drive the sampler an additional 12" is known as the penetration resistance or N value. The N value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. Thin wall tube samples were obtained according to ASTM: D 1587-67 where indicated by appropriate symbol on the boring logs.

Soil Classification

As the samples were obtained in the field, they were visually and manually classified by the crew chief in accordance with ASTM: D 2487-83 and 2488. Representative portions of the samples were then returned to the laboratory for further examination and for verification of the field classification. In addition, selected samples were submitted to a program of laboratory tests. Logs of the borings indicating the depth and identification of the various strata, the N value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are attached. Charts illustrating the soil classification procedure, the descriptive terminology and symbols used on the boring logs are also attached.

EXPLORATION LIMITATIONS

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering practices at this time and location. Other than this, no warranty is implied or intended.

This report was prepared by: Wilfred A. Wahl
Wilfred A. Wahl, P.E.

This report was reviewed by: Richard S. Dutcher
Richard S. Dutcher, P.E.

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

Wilfred A. Wahl
WILFRED A. WAHL
Date 10-29-84 Reg. No. 6969

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.

Richard S. Dutcher
RICHARD S. DUTCHER
Date 10-29-84 Registration No. 8656

Proofread by: M. Courteau

LOG OF TEST BORING

JOB NO. 120-12734 VERTICAL SCALE 1" = 3' BORING NO. 1

PROJECT PROPOSED HAZARDOUS WASTE BUILDING - FORD MOTOR COMPANY - ST. PAUL, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 95.9'	GEOLOGIC ORIGIN	N	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS W	D	L.L./P.L	Qu
½	CLAYEY SAND W/A LITTLE (See#1)(SC)	MIXED*			1	SB				
	WEATHERED LIMESTONE W/SOME PIECES OF HARD LIMESTONE, a little silty sand and gravel, brown, moist to about 3' then wet, very dense (GM)	MIXED ALLUVIUM OR COLLUVIUM	34		2	SB				
			40	▼	3	SB				
4	SHALE, gray, contains a few lenses of limestone	DECORAH FORMATION	43		4	SB	18	* 111		
			100/0.3		5	SB				
9	Obstruction #1 - GRAVEL, brownish gray, soft (SC) *Estimated Dry Density	*ALLUVIUM								

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-24	9:55	3½'	2'	3½'	to	3'
10-24	10:20	9'	9'	9'	to	None
10-24	10:25	9'	None	2'	to	None
					to	

START 10-24-84 COMPLETE 10-24-84

METHOD HSA 0-9' @ 10:20

CREW CHIEF White

LOG OF TEST BORING

JOB NO. 120-12734 VERTICAL SCALE 1" = 3' BORING NO. 2

PROJECT PROPOSED HAZARDOUS WASTE BUILDING - FORD MOTOR COMPANY - ST. PAUL, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 95.6'	GEOLOGIC ORIGIN	N	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	D	L.L. / P.L.	Qu
	SAND W/A LITTLE GRAVEL, fine to medium grained, brown, moist, medium dense (SP)	COARSE ALLUVIUM	12		1	SB				
			12		2	SB				
4	SAND W/A LITTLE GRAVEL, medium grained, brown, moist to 5½' then waterbearing, very loose (SP)		1½	▼	3	SB				
6½	SHALE, gray, contains a few lenses of limestone	DECORAH FORMATION	100/0.9		4	SB				
			79		5	SB				
			100/0.4		6	SB				
			100/0.7		7	SB				
15.7	Obstruction									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-24	10:45	6½'	4½'		to	5½'
10-24	11:20	15.7'	14½'	15.7'	to	None
10-27	11:30	15.7'	None	9½'	to	None
					to	

START 10-24-84 COMPLETE 10-24-84

METHOD HSA 0-14½' @ 11:20

CREW CHIEF White

LOG OF TEST BORING

JOB NO. 120-12734 VERTICAL SCALE 1" = 3' BORING NO 3

PROJECT PROPOSED HAZARDOUS WASTE BUILDING - FORD MOTOR COMPANY - ST. PAUL, MINNESOTA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
	SURFACE ELEVATION 95.2'				NO	TYPE	W	D	L.L / P.L	Qu
	FILL, MIXTURE OF SAND, SILTY SAND AND CLAYEY SAND W/A LITTLE GRAVEL, a few pieces of blacktop, dark brown, black and gray	FILL	20		1	SB				
					2	SB				
3	SHALE, gray, contains a few lenses of limestone	DECORAH FORMATION	13		3	SB	32	90*		
					4	3T				
			37		5	SB	24	101*		
			100/0.7		6	SB				
8.6	Obstruction									
	*Estimated Dry Density									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
					to	
10-24	1:10	8.6'	8.6'	8.6'	to	None
10-24	1:20	8.6'	None	4½'	to	None
					to	

START 10-24-84 COMPLETE 10-24-84

METHOD HSA 0-8.6' @ 1:10

CREW CHIEF White

APPENDIX G

LABORATORY REPORT
SOLVENT SHIPMENT
SEPTEMBER 1989
FORD UST SITE

Report:RCI300 AVGANICS RC INVENTORY 16-Jan-90 04:17 PM

SAMPLE LABORATORY REPORT FORM

Company : FORD MOTOR COMPANY
Location:
Customer Nr: F01445
Salesperson: Branch: R
Analyzed By: SS Date: 09/28/89
Approved By: SS

Lab Analysis Nr: A020502
Sales lab Nr:
Incoming Nr: I909484
Retain Lab Nr:
PCB Lab Nr: P909246
Lab Type: QCA
Part Nr: RW007400
Waste Master Nr: 00007421
Authorization Nr: 022814
Batch Nr:
Lot Nr:
Other Nr:

LABORATORY DATA

Waste Density: 0.882 pH: 7.10
Solvent Density: pH:
Total Distillate: 37/50 Solids: NF
% Yield: 50
% Chlorides: PCB (ppm):
Acid Acceptance:
APHA Color: Odor:
BTU/lb: BTU/Gal:
% Water by KF:
Flash Point (TCC Deg F):

Material Comments: AA
Recommend:
Label:
UN/NA Nr:
Dot Hazard Class:
EPA Waste Code Nr:
DOT PSN:

Comments:

*** Information contained is believed to be ***
*** correct to the best of our knowledge ***
*** and based on the sample supplied. ***

CHROMATOGRAPHIC ANALYSIS

----ACTIVES----

0.5 %	Acetone
8.0 %	N-Butyl Acetate
0.0 %	Cyclohexanone
0.0 %	Ethyl Acetate
0.0 %	Glycol Ether EB
0.0 %	Glycol Ether EE
0.2 %	Glycol Ether EEAc
0.0 %	Glycol Ether EM
0.0 %	Glycol Ether EEP
0.0 %	Glycol Ether EP
0.0 %	Glycol Ether PM
0.5 %	Glycol Ether PMA
0.0 %	Isobutyl Acetate
0.0 %	Isopropyl Acetate
1.0 %	MEK
13.5 %	MIBK
0.0 %	N-Propyl Acetate
0.0 %	Tetrahydrofuran

----ALCOHOLS----

4.5 %	N-Butanol
0.0 %	Ethanol
1.5 %	Isobutanol
1.0 %	Isopropanol
1.5 %	Methanol
0.5 %	N-Propanol
1.0 %	Water
0.0 %	Diacetone Alcohol

----DILUENTS----

1.5 %	Heptane
0.0 %	Hexane
0.0 %	Mineral Spirits
3.5 %	100 Flash Naphtha
0.0 %	Stoddard Solvent
12.5 %	Toluene
2.0 %	VMP Naphtha
45.0 %	Xylene

----CHLORINATEDS----

0.0 %	Methylene Chloride
0.0 %	Perchloroethylene
0.0 %	1,1,1-Trichloroethane
0.0 %	1,1,2-Trichloro-1,2,2-Trifluoroethane
0.0 %	Trichloroethylene
0.0 %	NOS

--------MISC--------

0.0 %	
0.0 %	
0.0 %	
0.0 %	
0.0 %	
0.0 %	

APPENDIX H

LABORATORY REPORT
SOIL EXCAVATION BY FORD
NOVEMBER 6, 1989
FORD UST SITE

pace.
laboratories, inc.

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas
Irvine, California
Asheville, North Carolina
Charlotte, North Carolina
Wappingers Falls, New York

REPORT OF LABORATORY ANALYSIS

Ford Motor Company
966 S. Mississippi River Blvd.
St. Paul, MN 55116

March 29, 1990
PACE Project
Number: 891106516

Attn: Mr. John Rohlf

Parameter	Units	MDL	Solvent Recovery
PACE Sample Number:			421540
Date Collected:			11/06/89
Date Received:			11/06/89
ORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Moisture content	%	1.0	7.3
MDH VOLATILE ORGANICS SOIL EXTRACT-465C			
Date Analyzed			11/13/89
Chloromethane	ug/kg	240	ND
Bromomethane	ug/kg	380	ND
Dichlorodifluoromethane	ug/kg	380	ND
Vinyl chloride	ug/kg	380	ND
Chloroethane	ug/kg	240	ND
Methylene Chloride	ug/kg	240	260
Acetone	ug/kg	10000	ND
Trichlorofluoromethane	ug/kg	100	ND
Allyl chloride	ug/kg	1000	ND
1,1-Dichloroethylene	ug/kg	76	ND
Tetrahydrofuran	ug/kg	3600	ND
1,1-Dichloroethane	ug/kg	50	ND
trans-1,2-Dichloroethylene	ug/kg	76	ND
cis-1,2-Dichloroethylene	ug/kg	120	ND
Ethyl ether	ug/kg	76	ND
Chloroform	ug/kg	120	ND
1,1,2-Trichlorotrifluoroethane	ug/kg	180	190
Methyl ethyl ketone	ug/kg	5000	ND
1,2-Dichloroethane	ug/kg	50	ND
Dibromomethane	ug/kg	360	ND
1,1,1-Trichloroethane	ug/kg	120	ND
Carbon tetrachloride	ug/kg	76	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

pace.
laboratories, inc.

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas
Irvine, California
Asheville, North Carolina
Charlotte, North Carolina
Wappingers Falls, New York

REPORT OF LABORATORY ANALYSIS

Mr. John Rohlf
Page 2

March 29, 1990
PACE Project
Number: 891106516

PACE Sample Number: 421540
Date Collected: 11/06/89
Date Received: 11/06/89

Parameter	Units	MDL	Solvent Recovery
ORGANIC ANALYSIS			
MDH VOLATILE ORGANICS SOIL EXTRACT-465C			
Bromodichloromethane	ug/kg	50	ND
Dichloroacetonitrile	ug/kg	20000	ND
2,3-Dichloro-1-propene	ug/kg	120	ND
1,2-Dichloropropane	ug/kg	50	ND
1,1-Dichloro-1-propene	ug/kg	240	ND
cis-1,3-Dichloro-1-propene	ug/kg	120	ND
1,1,2-Trichloroethylene	ug/kg	120	ND
Benzene	ug/kg	240	ND
1,3-Dichloropropane	ug/kg	150	ND
Dibromochloromethane	ug/kg	240	ND
1,1,2-Trichloroethane	ug/kg	240	ND
trans-1,3-Dichloro-1-propene	ug/kg	76	ND
1,2-Dibromoethane	ug/kg	1000	ND
2-Chloroethylvinyl ether	ug/kg	1200	ND
Bromoform	ug/kg	240	ND
1,1,1,2-Tetrachloroethane	ug/kg	76	ND
Methyl isobutyl ketone	ug/kg	240	ND
1,2,3-Trichloropropane	ug/kg	1000	ND
1,1,2,2-Tetrachloroethane	ug/kg	240	ND
1,1,2,2-Tetrachloroethylene	ug/kg	240	ND
Pentachloroethane	ug/kg	500	ND
Toluene	ug/kg	240	1300
Chlorobenzene	ug/kg	240	ND
Ethylbenzene	ug/kg	240	3300
Cumene	ug/kg	240	ND
m-Xylene	ug/kg	240	13000(1)
p-Xylene	ug/kg	240	14000(1)
o-Xylene	ug/kg	240	4500

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
(1)	These compounds co-elute

pace laboratories, inc.

REPORT OF LABORATORY ANALYSIS

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas
Irvine, California
Asheville, North Carolina
Charlotte, North Carolina
Wappingers Falls, New York

March 29, 1990
PACE Project
Number: 891106516

PACE Sample Number: 421540
Date Collected: 11/06/89
Date Received: 11/06/89

Parameter	Units	MDL	Solvent Recovery
ORGANIC ANALYSIS			
MDH VOLATILE ORGANICS SOIL EXTRACT-465C			
1,3-Dichlorobenzene	ug/kg	1000	ND
1,2-Dichlorobenzene	ug/kg	1000	ND
1,4-Dichlorobenzene	ug/kg	1000	ND
Dichlorofluoromethane	ug/kg	240	ND

MDL Method Detection Limit
ND Not detected at or above the MDL.

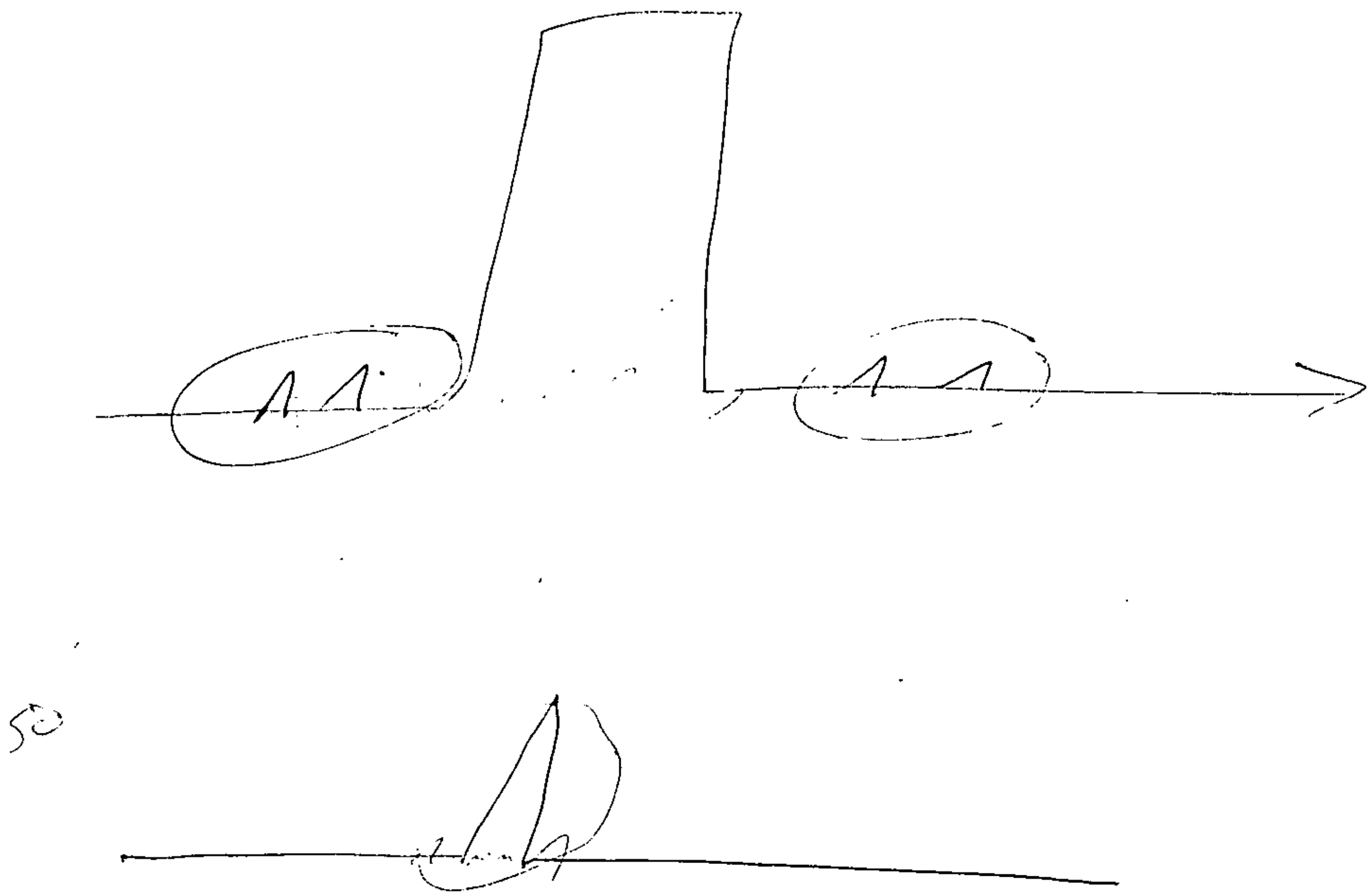
The analyses of soil samples were performed 'as received' and do not reflect analyses on a dry weight basis unless indicated.

The data contained in this report were obtained using EPA or other approved methodologies. All analyses were performed by me or under my supervision.

SDM

Susan D. Max
Organic Chemistry Manager

MN-COMP 0044812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APPENDIX I

LABORATORY QA/AC PLAN
PACE LABORATORIES INC.

LABORATORY
QUALITY ASSURANCE
PLAN

PACE, Inc.

Submitted by:

____

Approved by:

Roger C Splinter

Roger C. Splinter, Ph.D.
Vice President

Rev. #0 - DATE: November 1, 1989
Rev. #1 - DATE: May 17, 1990

II. TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF TABLES

III. INTRODUCTION, PROGRAM OBJECTIVES, AND STATEMENT OF POLICY

This Generic Quality Assurance (QA) Plan is written in compliance with the elements required in the U.S. EPA, "Guidelines and Specifications for Preparing Quality Assurance Program Plans." (QAMS-004 80, September 20, 1980). This document contains the required elements of a Quality Assurance Plan and is prepared in such a way that entire sections can be referenced in subsequent specific project plans. This Laboratory QA Manual defines the systems of quality control and quality assessment that constitute the comprehensive Quality Assurance Program at PACE, Inc. Quality Control consists of specific procedures applied to all phases of analysis from sample receipt through the final reporting of results. The purpose of quality control is to insure that quality goals are met under routine operating procedures. Quality assessment involves the continuous evaluation of data and monitoring of analytical processes for the purpose of insuring that the quality control systems are performing effectively.

PROGRAM OBJECTIVES

The major elements of the overall Quality Assurance Program are summarized below:

- Use of appropriate methodologies by technically competent, well-trained personnel with state-of-the-art instrumentation and equipment.
- Adherence to well-defined standard operating procedures with emphasis on good laboratory and measurement practices.
- Analysis and assessment of quality control samples including (but not limited to) matrix spike samples, duplicate samples, surrogate spikes, blanks, and independent laboratory control standards.
- Participation in external quality evaluation programs such as the EPA Water Pollution and Water Supply (WP & WS) Study Programs.
- Maintainance of accreditation by State, Federal, and other applicable agencies for work performed.
- Monitor internal and external compliance to procedures and to assess the performance of the analytical methods.

STATEMENT OF POLICY:

PACE, Inc. is committed to the policy of providing the highest quality product to its client. The validity and reliability of the information generated is maximized by the adherence to documented quality control procedures and quality assurance protocols. PACE emphasizes the application of sound quality assurance/quality control principles beginning with the initial planning of the project, through all the field and laboratory activities and ultimately to the generation of the final report. The principles of data quality objectives, representativeness, completeness, comparability, precision and accuracy are applied.

PACE is committed to providing the resources, including facilities, equipment and personnel, to ensure the adherence to rigorous QA/AC protocols. Individual Quality Assurance Project Plans are developed for monitoring analytical projects to conform with the established QA/QC protocols.

IV. LABORATORY ORGANIZATION AND RESPONSIBILITY

The organizational structures for PACE, Inc. are provided in Exhibits 1, 2, and 3.

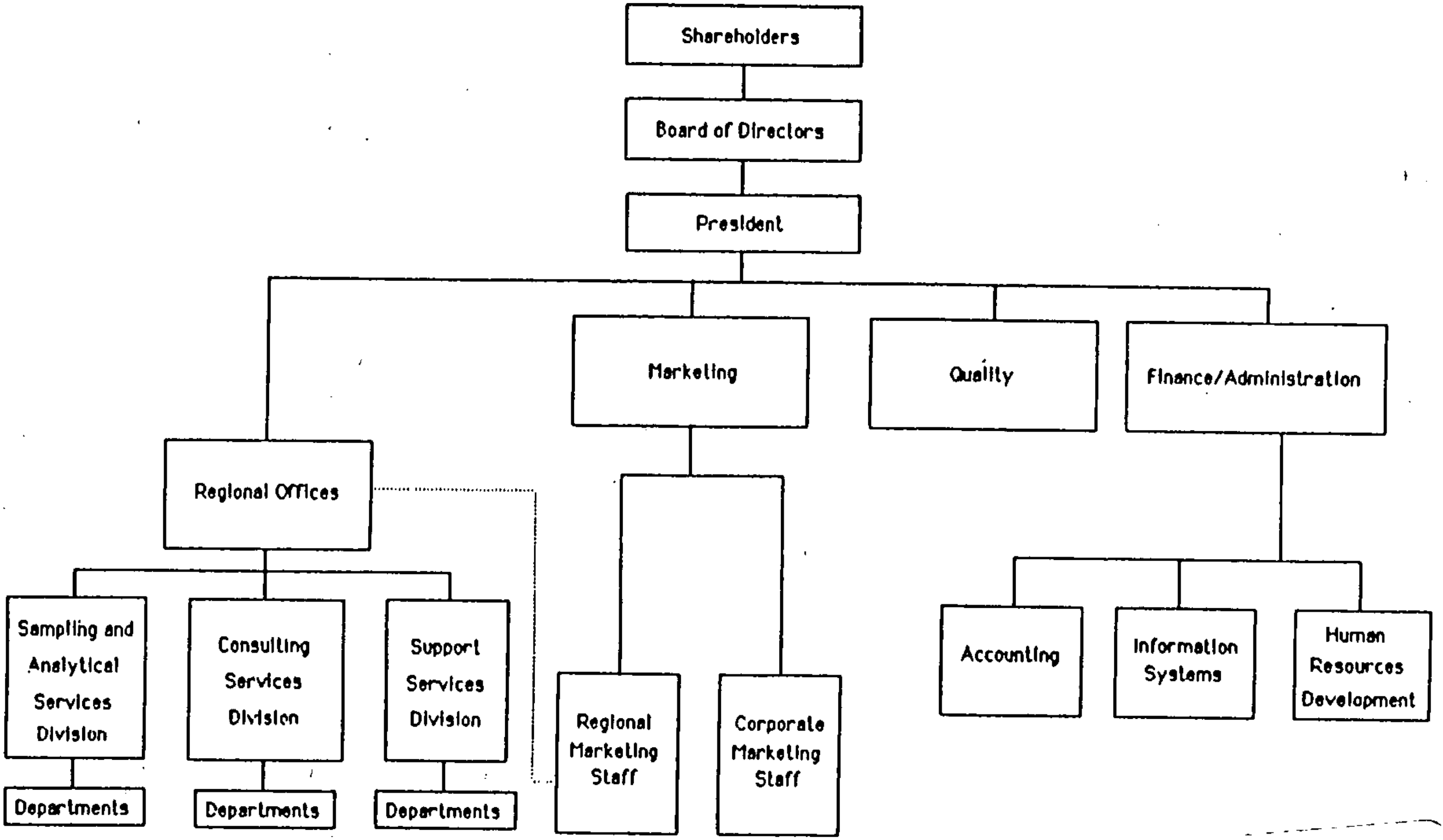
Exhibit #1	Illustrates the PACE, Inc. Organizational Structure
Exhibit #2	Illustrates the PACE Corporate Structure with Regional Designation
Exhibit #3	Illustrates a Typical Regional Structure Showing the Quality Responsibilities

Job descriptions are provided within Quality Assurance Project Plans, as they are designed and developed to address specific projects.

Laboratories Inc.

PACE Organizational Sructure

1.



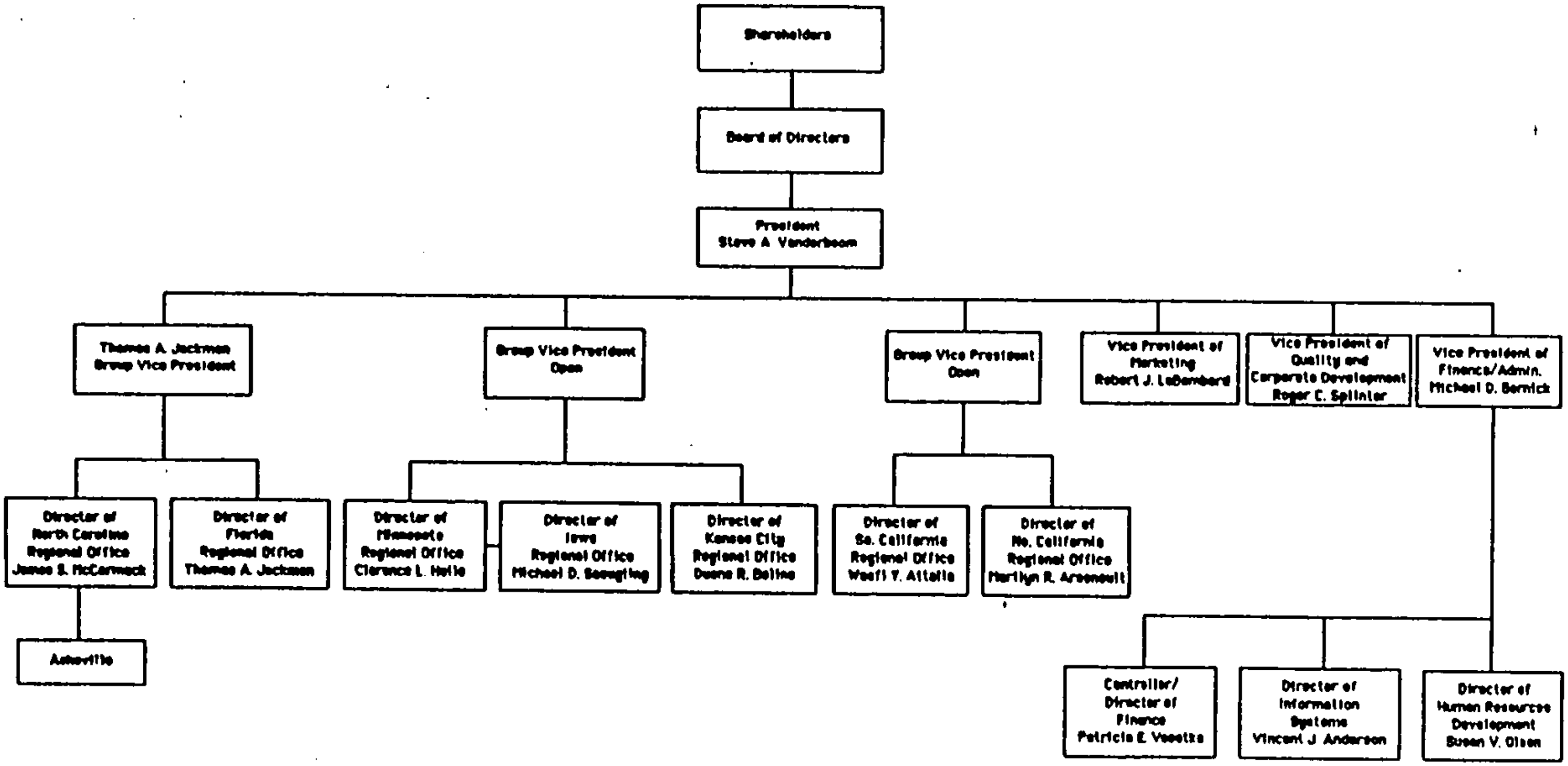
January 1990

pace laboratories inc.

EXHIBIT 2

Corporate Management Personnel & Regional Directors

1.1



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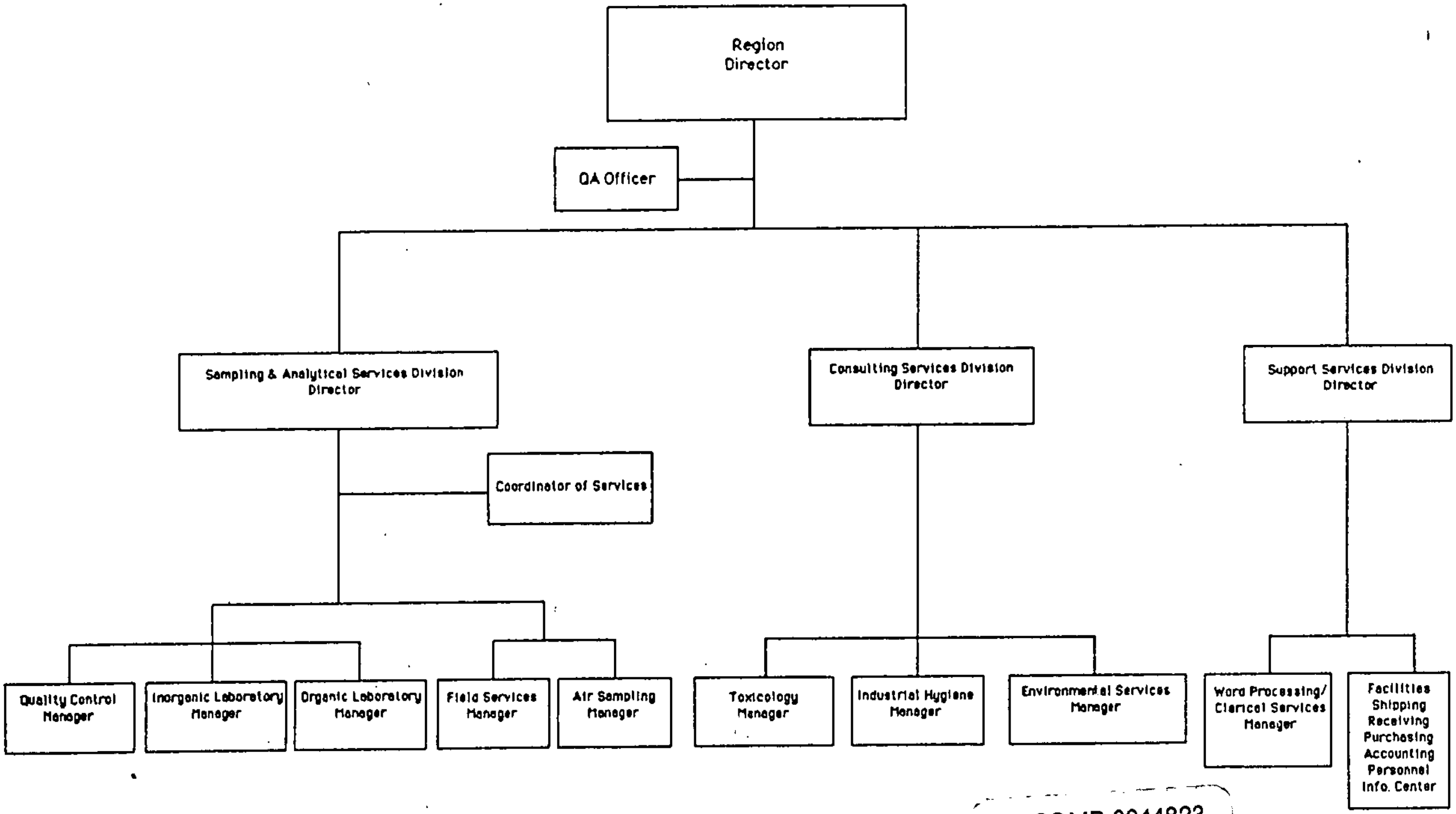
3.

Region



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V. QUALITY ASSURANCE/OBJECTIVES

A. INTRODUCTION

The purpose of the plan is to define procedures for the documentation, evaluation, validation, and reporting of data. The objective is to provide a uniform basis for sampling, sample handling, instrument maintenance and calibration, methods control, performance evaluation and analytical data generation and reporting. Specific procedures to be used for sampling, chain of custody, calibration of field instruments (pH, conductivity meters, etc.), laboratory analysis, reporting, internal quality control, audits, preventive maintenance, and corrective actions are described in specific sections of this plan. This section addresses the objectives of accuracy, precision, completeness, representative, and comparability.

The QA objectives for precision and accuracy are to achieve the QC acceptance criteria specified in the proposed analytical procedures. For the organic and inorganic procedures, the precision and accuracy guideline requirements are specified in the individual methods.

Field Blanks and duplicates are collected and analyzed to assess field sampling activities. The results check procedural contamination and/or ambient conditions at the site.

Due to the extensive number of organic parameters and potential matrices, the development of precision and accuracy objectives and control limits for every matrix is difficult. This is typically done with (1) matrix spike and matrix spike duplicate compounds which are added to selected samples before extraction and analysis, and/or (2) surrogate spike compounds which are added to every sample, before extraction and analysis. Although the surrogate and matrix spike analyses do not provide statistically valid statements about precision and accuracy for every compound in a sample, they do give the data reviewer enough information to make judgements about precision and accuracy on a sample-by-sample basis.

Inorganic precision and accuracy data are determined by using duplicate samples (precision), matrix spike and laboratory control samples (accuracy). The following procedure is used:

For a duplicate sample analysis, at least one duplicate sample is analyzed per sample matrix type (e.g. water, soil) and concentration (e.g. low, medium) per batch of samples or for each 20 samples received, whichever is more frequent, or as specified by state/project requirements. Samples identified as field blanks can NOT be used for duplicate samples analyses. If two analytical methods are used to obtain the reported values for the same element for a batch of samples (i.e., ICP, GFAA), duplicate samples will be run by each method. The relative percent difference (RPD) for each component is calculated for later use during data assessment.

Completeness is a measure of all information necessary for a valid scientific study. For completeness, it is expected that the methodology proposed for chemical characterization of the samples collected will provide data meeting QC acceptance criteria for at least 90% of all samples collected. Completeness may also be defined as a comparison of the number of tests successfully completed (with acceptable QC) to the number of tests requested.

Representativeness is a qualitative element that is related to the ability to collect a sample that reflects the characteristics of that part of the environment that is to be assessed. Sample representativeness is dependent on the sampling techniques used and is considered individually for each project. It is specifically addressed in each work plan.

Comparability is also considered during preparation of the work plan. The objective of comparability is to ensure that results of similar activities conducted by different parties are comparable. For example, the use of EPA-approved or other methods and procedures ensures comparability with data from previous or following studies.

VI. SAMPLING PROCEDURES

PACE, Inc. receives samples collected by clients and also has the capability to perform sampling for clients. PACE prepares sample containers in accordance with EPA-issued guidelines for container and preservative requirements. Technical assistance from all supervisory and management staff is available to clients if needed.

A. BOTTLE PREPARATION PROCEDURES

The following is the procedure used for Sample Container Preparation:

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to provide clear, consistent methods for preparing containers for sample collection. Following this procedure will facilitate accurate and consistent analytical results.

2. Application

The policies and procedures contained in this SOP are applicable to the personnel in the container preparation area.

3. General Policies

a. Always use new bottles when preparing containers for sampling (exception: One gallon, amber glass bottles used for transporting deionized water can be re-used after proper cleaning). These may be commercially-obtained precleaned bottles.

b. Always wear disposable latex gloves when handling sample containers.

c. Several preparation procedures require the use of acids as a preservative or cleaning agent.

   1. Be extremely careful when working with acids.

   2. Always wear safety glasses and a laboratory coat.

d. Bottle labels will list the preservatives added and the analysis to be performed, minimizing the probability for error.

e. When shipping pre-preserved bottles containing corrosives or oxidizers, consult proper DOT regulations.

4. Procedures: Containers for Aqueous Samples

a. Volatile Organic (VOA) Sample Container Preparation

1. Vial cleaning procedures.

   a. Wash an entire package of vials in one washing session. Never store open packages of vials.

   b. Soak the vials in cleaning solution (one capful of Acationox detergent, American Scientific, per sink of hot tape water) for 5 minutes.

   c. After soaking, thrice rinse each vial thoroughly with hot tap water.

   d. Thrice rinse each vial thoroughly with carbon filtered, deionized water (CFDI).

   e. Stack rinsed vials in a drying tray (metal tray lined with aluminum foil, dull side exposed).

   f. Bake the vials at 103°C for a minimum of four hours.

   g. Cover baked vials with aluminum foil such that the dull side of the foil is in contact with the vials and set trays on a lab bench to cool.

2. Septum and cap cleaning procedures.

   a. Clean entire packages of caps and septums. Do not store open bags.

   b. Clean caps and septums separately.

   c. The same procedures used for vial cleaning are used for cap and septum cleaning. Follow B through D in Section 1.

   d. Spread evenly and thinly in drying trays to facilitate drying.

   e. Dry for one hour at 103°C. Extended periods of heat can damage caps and septums.

   f. Place clean caps and septums into a 1500 mL glass container which has been cleaned.

3. Assembling VOA vials.

   a. Place ten clean vials upright in a vial box with dividers. Recover drying trays with foil after vials have been removed.

   b. Add 4 drops of concentrated hydrochloric acid (HCL).

   c. Add (10 mg/40 ml) 0.008% sodium thiosulfate if chlorine is present (e.g. drinking water).

   d. Assemble a cap by inserting a septum in the cap such that the Teflon (white) side is exposed to the interior of the vial.

   e. Cap each vial tightly.

   f. Repeat assembly procedures until all vials are capped.

b. <u>**Semi-Volatile Container Preparation**</u>

1. Glass, amber jars (250, 500, and 1000 mL) with Teflon lined caps are used to hold samples for semi-volatile analysis.

2. Bottles and cap liners are rinsed with reagent grade acetone. (Acetone is a target compound for EPA 8240 and an HSL compound. If acetone interferes with the analyses, use of hexane and/or methanol may be an alternative, as specified in the method.)

   a. Acetone is highly flammable and acetone vapors are toxic.

   b. When using acetone, wear latex gloves, safety glasses and work in a vented hood.

   c. Pour a small amount of reagent grade acetone in the bottle to be rinsed.

   d. Cap the bottle with a Teflon lined cap.

   e. Shake the bottle making sure the acetone comes in contact with all sides of the bottle and the cap liner.

   f. Empty the bottle, invert it on a drying rack and allow it to air dry.

   g. Cap the bottle with a rinsed cap.

   h. Attach a blue dot to the top of the cap indicating the container has been acetone rinsed.

c. **Preparation of Containers for Metals Analysis**

1. Polyethylene bottles (125, 250, 500, and 1000 mL) with plastic caps are used to hold water samples to be analyzed for metals.
2. Add a small amount of 1:1 nitric acid to a bottle.
3. Cap the bottle and shake vigorously, being certain the acid comes in contact with all interior surfaces.
4. Empty the container.
5. Rinse the bottle and cap thrice with deionized water.
6. Add the appropriate amount of 1:1 nitric acid, cap, and place a pink or red dot on the cap to indicate the container contains nitric acid preservative.

Container Size	Quantity 1:1 Nitric Acid
125 mL	1/4 mL
250 mL	3/8 mL
500 mL	3/4 mL
1000 mL	1 1/2 mL

d. **Nutrient Container Preparation**

1. Polyethylene bottles (250, 500, and 1000 mL) with plastic caps are used to hold water samples for nutrient analysis.
2. Add the appropriate amount of sulfuric acid, diluted 1:1 from concentrate with carbon filtered deionized water, to each container.

Container Size	Quantity 1:1 Sulfuric Acid
250 mL	3/8 mL
500 mL	3/4 mL
1000 mL	1 1/2 mL

3. Attach an orange dot sticker to the cap of each prepared container.

e. **Cyanide Container Preparation**

1. Polyethylene containers (1000 mL) with plastic caps are used to hold samples for cyanide analysis.
2. Add one gram (8 to 10 pellets) or concentrated solution of sodium hydroxide and one gram of ascorbic acid to each container. If chlorine is present in the sample, use only ascorbic acid.
3. Attach a green dot sticker to the cap of each prepared container.
4. Cyanide containers have a short shelf life; do not prepare in large quantities. (See #6b)

f. **Phenol Container Preparation**

1. Clear glass, small mouth containers (1000 mL) with "poly seal" caps are used to hold samples for phenol analysis.
2. Add 1 1/2 mL of sulfuric acid, diluted 1:1 from concentrate with carbon-filtered deionized water, to each container.
3. Attach an orange dot sticker to the cap of each prepared container.

g. **Oil and Grease Container Preparation**

1. Clear glass, wide-mouth containers (1500 mL) with foil lined caps are used to hold samples for oil and grease analysis.
2. 1000 mL amber glass containers with Teflon lined caps are acceptable.
3. Add five mL of 1:1 sulfuric acid to each container.
4. Attach an orange dot sticker to the cap of each prepared container.

h. **Sulfide Container Preparation**

1. Polyethylene bottles (250 mL) with plastic caps are used to hold samples for sulfide analysis.

2. Add 0.5 mL of zinc acetate and NaOH (to pH greater than 9) to each container.

3. Attach a white dot sticker to the lid of each prepared container.

i. **Total Organic Carbon (TOC) Container Preparation**

1. Polyethylene bottles (250 mL) with plastic caps are used to hold samples for TOC analyses.

2. Add 0.25 mL of 1:1 sulfuric acid.

3. Attach an orange dot sticker to each prepared container.

j. **Radiological Containers Preparation**

1. Polyethylene bottles (one gallon) with wax coated, paper lined caps are used to hold samples for radiological analysis.

2. Add five mL of 1:1 nitric acid to each other.

3. Attach a pink dot sticker to the cap of each prepared container.

k. **CFDI Water Container Preparation**

1. One gallon, small mouth, amber glass bottles with Teflon lined caps are used to transport CFDI water.

2. These containers can be reused after appropriate cleaning.

3. Wash the bottle in hot tap water and Acationox detergent (American Scientific Products one cap of detergent per sink of water).

4. Thrice rinse the bottle with hot tap water.

5. Thrice rinse with CFDI water.

6. Bake the bottle at 103° until dry (at least four hours).

7. Remove the bottle from the oven, cover the mouth with foil, and let cool.

8. Cap the bottle with a new, Teflon lined cap.

1. **Other Container Preparation**

   1. Polyethylene bottles (125, 250, 500, and 1000 mL) with plastic caps are used to hold samples for general chemistry analysis.

   2. Clear glass bottles (125, 500, and 1000 mL) with foil lined caps are used to hold samples with high oil content to be analyzed for general chemistry parameters.

   3. Amber glass, small neck bottles (500 mL) with Teflon-lined caps are used to hold samples for total organic halide (TOX) analysis.

5. **Procedure: Containers for Soil Samples**

   a. **Volatile Organic Analysis Sample Container Preparation for Soil Samples**

   1. Wide-mouth, amber glass vials (65 mL) with Teflon-lined caps are used to hold samples for volatile organic analysis.

   2. The same preparations procedure is used as is used in preparation of VOA containers for aqueous samples except no preservative is added to the containers. (See #4a)

   b. **Semi-Volatile Container Preparation**

   1. Wide-mouth, amber glass jars (250, 500, and 1000 mL) with Teflon-lined caps are used to hold samples for semi-volatile analysis.

   2. Preparation procedures are identified as those used in preparation of semi-volatile containers for aqueous samples. (See #4b)

   c. **Inorganic Container Preparation**

   1. Polyethylene bottles (125, 250, 500, and 1000 mL) with plastic caps are used to hold samples for inorganic analysis.

   2. If the samples contain a large quantity of oil, clear glass jars (125, 500, and 1000 mL) with foil lined caps are used instead of the polyethylene bottles.

   3. Container preparation procedures are identical to those used in preparation of general containers for aqueous samples.

6. Sample Container Quality Control and Lot Assignment

a. Bottles of a given type, prepared in one session, constitute a lot.

b. Lot sizes will vary, depending on the demand for a given bottle type.

  1. A lot should be large enough to meet one week's demand for the given bottle type. Containers for samples to be analyzed for cyanide and VOA are exceptions.

  2. Due to an extremely short shelf life, cyanide containers should be prepared in lot sizes required for approximately 2 days demand and prepared as necessary.

  3. Due to spatial limitations, VOA vials should be prepared daily.

c. When a lot is prepared, it is assigned an eight character lot code.

  1. The first two characters indicate the bottle type.

     GN: General Unpreserved
     MU: Metals Unfiltered
     NT: Nutrients
     CN: Cyanide
     PH: Phenol
     OG: Oil and Grease
     SD: Sulfide
     GV: GC VOA Water
     GC: GC VOA Solid
     GL: GC Q-Amber
     GS: GC Sm Amber
     GM: GC Misc. Refrigerated
     HW: Hazardous Waste
     OC: Total Organic Carbon
     OX: Total Organic Halides
     RA: Radiological

     A complete listing of codes can be found in Section I of the LDMS User's Manual

  2. The next three digits indicate the bottle size.

     125: 125 mL
     250: 250 mL
     500: 500 mL
     000: 1000 mL and one gallon

3. The last three digits are the lot number. They are assigned in sequential order.

4. When the lot code is assigned, it is listed on the Lot Log Sheet (Exhibit 4).

5. The person who prepared the containers initials the Lot Sheet next to the lot code.

One container per lot is used to hold a deionized water blank. This blank is analyzed to determine the level of contamination in the lot.

- The appropriate analyses are performed for the given container type.
- Use carbon-filtered, deionized water for all blanks.
- Fill all containers, except VOA's, up to the neck of the bottle.
- Fill VOA's such that no bubbles are trapped when the vial is capped.
- Label each blank with the following information:

  Client: PACE, QC

  Sample description: (Lot Code)
  Date Collected:
  Collected by: (Initials)
  Time Collected:
  Analysis: (As indicated for the bottle type)
  Preservative: (Check appropriate preparation)

6. Complete a Chain-of-Custody form to accompany the samples. Client, sample description, time sampled, preservative, analysis: as listed on the bottle label.

   Report to: (Name of container preparation person)

   Project Name: Container QA

   Requested Due Date: Priority 2

   Matrix: H_2O

   Route samples and Chain-of-Custody to Sample Check-in.

EXHIBIT 4

LOT LOG SHEET

		LOCATION						LOCATION			
LOT #	INIT.	OUT	SHELF	TIER 1	TIER 2	LOT #	INIT.	OUT	SHELF	TIER 1	TIER 2

7. Sample Analysis Data Entry Form Tracking for Bottle Prep QC

Forms will be kept in an Outstanding QC file.

a. When a Report of Laboratory Analysis is received for the project, the Sample Analysis Data Entry Form is moved to the Complete QC file.

b. A copy of the Report of Laboratory Analysis is then routed to QC Data Entry and data are entered into the appropriate data base.

c. The data are reviewed by the supervisor of the Bottle Preparation Area and signed off as being certified "clean" if the following criteria are met. After subtraction of the daily DI water blank, all laboratory contaminants shall be less than 2 times the detection limit. If this criterion is not met, the bottles are re-cleaned and another blank analyzed.

The following are guidelines for the addition of sample preservatives to containers. Check the list of analyses to be performed and determine the types and sizes of containers needed and required.

Add the appropriate preservative to its designated container under a hood. Pack the bottles into a cooler with blue ice for the client.

PREPARING ACID PRESERVATIVES

All acid preservatives are prepared using a concentration of 1:1 acid to water. Reagent grade acids are used when making the 1:1 concentrations.

COMMON ANALYSES PRESERVATIVES

Analysis	Bottle Type	Preservative	pH	Approx. Amount
Metals	1 liter plastic	1:1 HNO_3	2.0	1.5 mL
EPA 602/8020	2 XVOA vials	1:1 HCl	2.0	3 drops
Cyanide	1 liter plastic	NaOH tablets	12.0	4-5 tabs
Sulfide	500 mL plastic	Zn acetate, NaOH	9.0	2 mL Zn acetate 2 tabs NaOH
Ammonia	1 liter plastic/ glass	1:1 H_2SO_4	2.0	1.5 mL
Phenolics	1 liter amber glass	1:1 H_2SO_4	2.0	1.5 mL

Sample containers, preservatives, and holding times for representative analytical groups are listed in Table 1. Refer to 40CFR 136 for complete information and details.

pace® laboratories, inc.

Inorganic Analytical Guide

TABLE 1

Common Non-Metals Analysis

Parameter	Typical Method(s)	Comparable SW-846 Method(s), If Applicable	Sample Container/ Preservative*	Preferred Volume (ml)*	EPA Holding Time*
Acidity	EPA 305.1		P, G/4°C	100	14 Days
Alkalinity	EPA 310.1/310.2		P, G/4°C	100	14 Days
Bacteria, Total Coliform	Standard Method 909A	9131/9132	WK/4°C	100	6 Hours
Bacteria, Fecal Coliform	Standard Method 909C		WK/4°C	100	6 Hours
Bacteria, Total Plate	Standard Method 907		WK/4°C	100	48 Hours
BOD, 5 Day	EPA 405.1		P, G/4°C	500	48 Hours
BOD, 5 Day Carbonaceous	EPA 405.1		P, G/4°C	500	48 Hours
Boron	EPA 212.3		$HNO_3 < 2$	100	6 Months
Bromide	EPA 320.1		P, G	200	28 Days
COO	EPA 410.1/410.2		P, G/4°C, H_2SO_4	250	28 Days
Color	EPA 110.3		P, G/4°C	250	48 Hours
Chloride	EPA 325.2/325.3	9251/9252	P, G	100	28 Days
Chlorine, Residual	EPA 330.1		P, G	500	Immed.
Cyanide, Total	EPA 335.2	9010	P, G/4°C, NaOH pH > 12	500	14 Days
Fluoride, Total	Standard Method 413A		P	500	28 Days
Fluoride, Electrode	EPA 340.2		P	200	28 Days
Fluoride, (SPADNS)	EPA 340.1		P	500	28 Days
Grease & Oil	EPA 413.1	9070/9071	G/4°C, H_2SO_4	1500	28 Days
Hardness, Total ($CaCO_3$)	EPA 130.2		P, G/4°C	250	6 Months
Ion Chromatography (Including common anions such as: Br^-, Cl^-, F^-, NO_2^-, NO_3^-, $PO_4^{\equiv}$, $SO_4^{=}$, SO_3^-, & others)	EPA 300		P, G/4°C	100	28 Days
Nitrogen, Ammonia	EPA 350.1/350.2		P, G/4°C, H_2SO_4	500	28 Days
Nitrogen, Kjeldahl	EPA 351.2/351.3		P, G/4°C, H_2SO_4	1000	28 Days
Nitrogen, Nitrate	EPA 353.2	9200	P, G/4°C	100	48 Hours
Nitrogen, Nitrite	EPA 353.2		P, G/4°C	100	48 Hours
Nitrogen, Nitrate & Nitrite	EPA 353.2		P, G/4°C, H_2SO_4	100	28 Days
Nitrogen, Organic	EPA 351.3		P, G/4°C, H_2SO_4	100	28 Days
Odor	EPA 140.1		G/4°C	1000	24 Hours
Oxygen, Dissolved	EPA 360.1		G - Bottle & Top	500	Immed.
pH	EPA 150.1	9040/9041/9045	P, G/4°C	100	Immed.
Phenol	EPA 420.1	9065	G/4°C, H_2SO_4	1000	28 Days
Phosphorus, Total	EPA 365.1/365.2		P, G/4°C, H_2SO_4	100	28 Days
Phosphorus, Ortho	EPA 365.1/365.2		P, G/Filter	100	48 Hours
Silica, Dissolved	EPA 370.1		P/4°C	100	28 Days
Solids, Total	EPA 160.3		P, G/4°C	100	7 Days
Solids, Total Volatile	EPA 160.4		P, G/4°C	100	7 Days
Solids, Total Dissolved	EPA 160.1		P, G/4°C	100	7 Days
Solids, Total Suspended	EPA 160.2		P, G/4°C	100	7 Days
Solids, Suspended Volatile	Standard Method 209A		P, G/4°C	100	7 Days
Solids, Settleable	EPA 160.5		P, G/4°C	1 Gal.	48 Hours
Specific Conductance	EPA 120.1	9050	P, G/4°C	100	28 Days
Sulfate	EPA 375.4	9036/9038	P, G/4°C	100	28 Days
Sulfide, Total	EPA 376.1	9030	P, G/4°C, NaOH pH > 9, Zn acetate	500	7 Days
Sulfite	EPA 377.1		P, G	500	Immed.
Surfactants	EPA 425.1		P, G/4°C	250	48 Hours
Total Organic Carbon	EPA 415.1	9060	P, G/4°C HCl pH < 2	100	28 Days
Total Organic Halogen	EPA 450.1	9020/9021	GA/4°C	500	14 Days
Turbidity	EPA 180.1		P, G/4°C	100	48 Hours

Sample Containers

P	Plastic, polyethylene bottle with a polypropylene cap
G	Glass
WK	Whirl-Pak®
GA	Glass, amber bottle with a Teflon® lined cap

Preservatives

H_2SO_4	Sulfuric Acid
HNO_3	Nitric Acid
NaOH	Sodium Hydroxide

*Sample container, preferred volume and holding time are for water matrix. Consult laboratory for solid matrix sampling recommendations.

NOTE: The methods shown are those commonly employed in performing environmental analyses. It is not intended to be inclusive of all possible EPA analytical methods or to indicate that any laboratory routinely provides the methods or parameters shown.

TABLE 1 (CONT.)

Common Metals Analysis

Solid

Sample Container: Plastic or glass
Preservative: 4°C
Preferred Volume: 100 grams
EPA Holding Time: 6 Months

Water

Sample Container: Plastic or glass
Preservative: HNO_3 pH < 2
Preferred Volume: 100 ml
EPA Holding Time: 6 Months

	FLAME**		FURNACE	
Parameter	**EPA or Standard Method**	**SW-846 Method**	**EPA or Standard Method**	**SW-846 Method**
Aluminum	202.1	7020	202.2	NA
Antimony	204.1	7040	204.2	7041
Arsenic	206.3**	7060	206.2	7061
Barium	208.1	7080	208.2	NA
Beryllium	210.1	7090	210.2	7091
Cadmium	213.1	7130	213.2	7131
Calcium	215.1	7140	NA	NA
Chromium, Total	218.1	7190	218.2	7191
Chromium, Hexavalent	Standard Method 312B	7195-7198	218.5	NA
Cobalt	219.1	7200	219.2	7201
Copper	220.1	7210	220.2	NA
Gold	231.1	NA	231.2	NA
Iron, Total	236.1	7380	236.2	NA
Lead	239.1	7420	239.2	7421
Lithium	Standard Method 317B	NA	NA	NA
Magnesium	242.1	7450	NA	NA
Manganese	243.1	7460	243.2	NA
Mercury (Cold Vapor)	245.1	7470/7471	NA	NA
Molybdenum	246.1	7480	246.2	7481
Nickel	249.1	7520	249.2	NA
Potassium	258.1	7610	NA	NA
Selenium	270.3**	7740	270.2	7741
Silicon	Standard Method 303C	NA	NA	NA
Silver	272.1	7760	272.2	NA
Sodium	273.1	7770	NA	NA
Strontium	Standard Method 303A	NA	NA	NA
Tellurium	Standard Method 303A	NA	Standard Method 304	NA
Thallium	279.1	7840	279.2	7841
Tin	282.1	7870	282.2	NA
Titanium	283.1	NA	283.2	NA
Vanadium	286.1	7910	286.2	7911
Zinc	289.1	7950	289.2	NA

Metals by Inductively Coupled Plasma (ICP): Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Si, Ag, Na, Tl, V, Zn: EPA ICP Method 200.7 or SW-846 Method 6010

**Flame A.A. or Hydride

pace laboratories, inc.

Organic Analytical Guide

TABLE 1 (CONT.)

Water and Wastewater Analysis

EPA Method	Parameter	Technique	Sample Preparation	Sample Container/ Preservative	Preferred Volume (ml)	EPA Holding Time
601	Purgeable Halocarbons	GC-HALL	P&T	VOA/4°C	40	14 Days
602	Purgeable Aromatics	GC-PID	P&T	VOA/4°C	40	14 Days
603	Acrolein and Acrylonitrile	GC-FID	P&T	VOA/4°C, pH Adjusted	40	14 Days
604	Phenols	GC-FID	EXT	GA/4°C	1000	7/40 Days
605	Benzidines	HPLC-Electrochem	EXT	GA/4°C	1000	7/40 Days
606	Phthalate Esters	GC-ECD	EXT	GA/4°C	1000	7/40 Days
607	Nitrosamines	GC-NPD	EXT	GA/4°C	1000	7/40 Days
608	Organochlorine Pesticides and PCB's	GC-ECD	EXT	GA/4°C	1000	7/40 Days
609	Nitroaromatics and Isophorone	GC-FID + ECD	EXT	GA/4°C	1000	7/40 Days
610	Polynuclear Aromatic Hydrocarbons	HPLC-UV/Fluor or GC-FID	EXT	GA/4°C	1000	7/40 Days
611	Haloethers	GC-HALL	EXT	GA/4°C	1000	7/40 Days
612	Chlorinated Hydrocarbons	GC-ECD	EXT	GA/4°C	1000	7/40 Days
613	2, 3, 7, 8-Tetrachlorodibenzo-p-dioxin	GC/MS	EXT	GA/4°C	1000	7/40 Days
614	Organophosonate Pesticides	GC-FPD or NPD	EXT	GA/4°C	1000	7/40 Days
615	Chlorinated Herbicides	GC-ECD or Hall	EXT	GA/4°C	1000	7/40 Days
624	Purgeables	GCMS	P&T	VOA/4°C	40	14 Days
625	Base/Neutrals, Acids and Pesticides	GC/MS	EXT	GA/4°C	1000	7/40 Days

Solid Waste Analysis

EPA Method	Parameter	Technique	Sample Preparation	Sample Container/ Preservative	Preferred Volume	EPA Holding Time
8010	Purgeables Halogenated Volatile Organics	GC-HALL	5030	VOA/4°C	*	14 Days
8015	Purgeables Non-Halogenated Volatile Organics	GC-FID	5030	VOA/4°C	*	14 Days
8020	Aromatic Volatile Organics	GC-PID	5030	VOA/4°C	*	14 Days
8030	Acrolein, Acrylonitrile, Acetonitrile	GC-FID	5030	VOA/4°C	*	14 Days
8040	Phenols	GC-FID	3550	GA/4°C	*	14 Days or 7/40 Days**
8060	Phthalate Esters	GC-ECD	3550	GA/4°C	*	14 Days or 7/40 Days**
8080	Organochlorine Pesticides and PCB's	GC-ECD	3550	GA/4°C	*	14 Days or 7/40 Days**
8090	Nitroaromatics and Cyclic Ketones	GC-FID or ECD	3550	GA/4°C	*	14 Days or 7/40 Days**
8100	Polynuclear Aromatic Hydrocarbons	GC-FID	3550	GA/4°C	*	14 Days or 7/40 Days**
8120	Chlorinated Hydrocarbons	GC-ECD	3550	GA/4°C	*	14 Days or 7/40 Days**
8140	Organophosphorus Pesticides	GC-FPD or NPD	3550	GA/4°C	*	14 Days or 7/40 Days**
8150	Chlorinated Herbicides	GC-ECD or HALL	3550	GA/4°C	*	14 Days or 7/40 Days**
8240	Volatile Organics	GC/MS	5030	VOA/4°C	*	14 Days
8250	Semi-Volatile Organics	GC/MS	3550	GA/4°C	*	14 Days or 7/40 Days**

Technique

Instruments:

GC	Gas Chromatograph
GC/MS	Gas Chromatograph-Mass Spectrometer
HPLC	High Performance Liquid Chromatograph

Detectors:

ECD	Electron Capture
Fluor	Fluorescence
FID	Flame Ionization
FPD	Flame Photometric
HALL	Electrolytic Conductivity
NPD	Nitrogen Phosphorous
PID	Photoionization
UV	Ultraviolet

Sample Preparation Method Used:

EXT	Extraction Methods that could be used include 3510, 3520, 3540 and 3550.
P&T	Purge and Trap
3510	Separatory Funnel Extraction of Liquid Samples
3520	Continuous Liquid-Liquid Extraction
3540	Soxhlet Extraction of Solid Samples
3550	Sonication Extraction of Solid Samples
5030	Purge and Trap, Direct Injection of Liquid Samples. Solid Samples Mixed then Injected.

Sample Container/Preferred Volume:

GA	Glass Amber Bottle with Teflon Lined Cap
VOA	Volatile Organic Analysis: 40 ml Amber Glass Vial with Teflon Septum
*	Contact Laboratory for recommendation

EPA/Holding Time:

7/40	7 Days for Extraction and 40 Days for Analysis
**	Depends upon Sample Matrix

NOTE:
The methods shown are those commonly employed in performing environmental analyses. It is not intended to be inclusive of all possible EPA analytical methods or to indicate that any laboratory routinely provides the methods or parameters shown.

B. SAMPLING PROCEDURE FOR GROUNDWATER AND SURFACE WATER

Groundwater and surface water sampling techniques employed by PACE are in accordance with the EPA Regional IV Standard Operating Procedures and Quality Assurance Manual, and the PACE Field Services SOP Manual.

Trained field sampling crews are dispatched to the site for sample collection and deliver collected samples to the laboratory.

For groundwater sampling, the water level within the well is determined prior to sampling using an electronic water level meter, then recorded on the field log data sheet with all additional pertinent information (Exhibit 5). The volume of water in the casing is calculated and three to five times that volume is purged from the well. In all cases, the well is purged until the conductivity, temperature, and pH have all stabilized.

Samples from monitoring wells are taken with a precleaned Teflon or stainless steel bailer. Bailers are precleaned by washing first with detergent, then rinsed with tap water, triple rinsed with deionized water, and baked to dryness. Precleaned bailers are used between each sampling point.

All samples collected for metals analysis are preserved with nitric acid. The bailer to be used for sampling is used for purging two inch diameter wells and a gas-driven centrifugal pump is used when larger volumes of water need to be removed (static water levels of less than 25 feet). Wells with static water levels greater than 25 feet and casing diameters greater than 3 inches are purged using a submersible pump.

Quality Control Protocols:

A. All Quality Control (QC) procedures are as specifically required by the method, state, or project requirements.

B. The USEPA requires as a minimum one matrix spike, one duplicate or MSD, one blank, per set of samples of similar matrix with a maximum of 20 samples per set. This is a recommended minimum frequency for QC, unless stated otherwise by method, state or project requirements. A client may also request more frequent QC in which case it will be necessary to collect additional samples.

EXHIBIT 5

FIELD LOG DATA SHEET
PACE, Inc.

WELL SAMPLING

Client:______________________ Project:__________________ Project #:______________

Sample Site:____

Well Identification and Description: (Locked_____ Not Locked_____) Key#:___________

ID inches______PVC:_____Steel:_____Stainless Steel:_____Other:_____Labeled:_________

Total Well Depth (from top of casing)______meters______feet Elevation:___________feet

Static Water Level (from top of casing) Before Prepumping:__________meters________feet

Static Water Level (from top of casing) At Time of Sampling:__________meters ________feet

Static Water Elevation:______feet Water Column:______feet One Casing Volume______gal

Date Prepumped:___________Time Prepumped:____________Volume Prepumped:____________gal

Prepumping Method Used:___________________________________ Pump Rate:____________gpm

Date Sampled:___________Time Sampled:___________Sampling Equipment Used:_____________

Sample Temperature:_____°C Sample pH:______Sample Specific Conductance:______umho/cm2

Field Measurements Temperature Corrected: Yes___No___Metals Filtered in Field: Yes___No__

Weather Conditions:____

Observations:____

____

Sample Description:____

Name and Affiliation of Sampler(s)____

Name and Affiliation of Inspector(s) Present:_____________________________________

STABILIZATION TEST

Time	pH	Specific Conductance (umhos/cm2)	Temp. (°C)	Cumulative Volume Removed (gallons)

C. SAMPLING PROCEDURES FOR SOILS AND SEDIMENTS

Soil and sediments are collected according to procedures in the latest edition of Test Methods for Evaluating Solid Waste, EPA-SW-846.

Soil sampling is designed to determine the depth and range of contamination from spillage or the leaching effects of rain on materials stored above ground. If borings are required, the depth and placement of the borings are planned by the project manager/subcontractor and client, using the suspected range of contamination as a guide.

VII. SAMPLE CUSTODY

A. SAMPLE RECEIPT

Sample shipments are received at the sample receiving area. Sample custodians verify the number of shipping containers received against the numbers listed on the shipping manifest/chain-of-custody. Any damage to the shipping containers or other discrepancy observed is noted on the chain-of-custody before signing it. A copy is kept for future reference.

The external chain-of-custody must be signed by the carrier for relinquishment of samples and signed by sample custodian personnel for sample receipt. The actual chain-of-custody may be supplied by PACE, (Exhibit 6), or may be the client's own form. The chain-of-custody remains in the project file at all times.

B. SAMPLE VERIFICATION

Upon arrival of a sample shipment, sample control personnel perform sample inspection. PACE's Sample I.D. and Condition Sheet (Exhibit 7) serves as a check-off list of procedures to follow and as documentation of the following:

1. Presence/absence of custody seals or tapes of the shipping containers and the condition of the seals (i.e., intact, broken).
2. Presence/absence of chain-of-custody; (if present, is it complete?)
3. Presence/absence of sample tags; (if present, are they removable?)
4. Agreement/non-agreement between the sample tags, chain-of-custody, and any client documentation.
5. Condition of the samples when received, including:
   - Cold or ambient
   - Intact, broken/leaking
   - Headspace in VOA vials
   - Sample holding time (has it been exceeded)?
   - Sample pH (less than 2 if acid preserved)

If discrepancies are found, the PACE project manager is contacted immediately (verbally and by using the Discrepancy Report Form) (Exhibit 8). If the project manager is not available, the QC manager is contacted for further directions. A copy of a Discrepancy Report Form is attached to the project data package.

EXHIBIT 6

pace laboratories, inc.

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CHAIN-OF-CUSTODY RECORD
Analytical Request

Client
Address

Phone

Report To:
Bill To:
P.O. # / Billing Reference
Project Name / No.

Pace Client No.
Pace Project Manager
Pace Project No.
*Requested Due Date:

Sampled By (PRINT):

Sampler Signature
Date Sampled

							PRESERVATIVES						
ITEM NO.	SAMPLE DESCRIPTION	PH	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	VOA		ANALYSES REQUEST	REMARKS
1													
2													
3													
4													
5													
6													
7													
8													

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE	ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME

Additional Comments

EXHIBIT 7

SAMPLE I.D. AND CONDITION FORM

Client: ______________
Project No.: ___________
Date Received: ________

SAMPLE CONDITION UPON RECEIPT CHECKLIST

Complete checklist (A) during sample receipt. If any items are marked "NO," complete section (B) of this form. Otherwise, go to record samples.

			YES	NO
(A)	1.	Are there custody seals or tapes on the shipping container?	___	___
	2.	Are custody seals on the shipping container intact?	___	___
	3.	Is there a completed Chain-Of-Custody (C-O-C)?	___	___
	4.	Do the numbers of samples received and the sample matrices agree with C-O-C?	___	___
	5.	Are there tags attached to each sample?	___	___
	6.	Are sample tags, sample containers and C-O-C all in agreement?	___	___
	7.	Is the C-O-C complete with requested analyses?	___	___
	8.	Are the samples preserved correctly?	___	___
	9.	Is there enough sample to do all analyses?	___	___
	10.	Do the samples have the proper temperature?	___	___
	11.	Are the sample containers intact (e.g., not broken, leaking)?	___	___
	12.	Are VOA vials head-space free?	___	___
	13.	Are all samples within the holding times for requested analyses?	___	___
	14.	Is pH recorded for non-VOA's?	___	___

(B) Explain "NO" item here: ______________________________

____

____

Send a copy of this form to Project Manager with Discrepancy Report Form. Copy of both forms remain in the QC file.

Custodian Signature: ______________

EXHIBIT 8

PACE, INC.
DISCREPANCY REPORT FORM

Urgency Level: 1(______) Requires immediate attention
2(______) Requires attention today
3(______) Requires attention this week

Initiator: ________________ Client: ________________________
Date: __________________
Project # ________________

Sample(s) # ________ ________ ________ ________ ________
________ ________ ________ ________ ________
________ ________ ________ ________ ________

Discrepancy (if more space needed, use the back of this form): ____________

To QC Manager: __________________ Date: __________________

Client Notified? YES ( ) NO ( ) Date & Time: ____________

Project Manager Notified? YES ( ) NO ( ) Date & Time: ____________

QC Response: ____________________________________

Project Manager Response: ____________________________

Cause and Resolution (proposed or carried out): Completed by: __________

Manager's Initials:

PM Signature: ____________________________ Date: ____________

QC Signature: ____________________________ Date: ____________

cc: Project File

C. SAMPLE LOG-IN

1. General Policies

a. Upon completing sample receipt/custody procedures, all sample and analysis data must be complete and documented on the chain-of-custody or accompanying forms for input into the Lab Data Management System (LDMS).

Sample and analysis data must include:

1. Client name and contact
2. Client number
3. PACE project number
4. PACE project manager
5. Sample descriptions
6. Due date
7. List of analyses requested

b. Sample and requested analyses data are input into the LDMS.

c. All samples received are logged into the LDMS on the day of receipt.

d. A Sample and Analysis Data Entry Form (SADEF) is generated immediately by the LDMS.

Distribution of SADEF:

- To the PACE Project Manager with a photocopy of the chain-of-custody. (Include a copy of the Discrepancy Report is applicable).
- To the QC project file with the original chain-of-custody.
- Photocopy to the Organic or Inorganic Department Manager as it applies for RUSH samples.
- To the client.

e. SADEF is to be reviewed against the chain-of-custody.

f. Sample containers are labeled with the corresponding sample number and the stamped date of receipt.

g. Samples are ready for storage.

2. When Samples Are Received With No Paperwork

a. If delivered by a client: Client is asked if previous arrangements were made for analysis (and with whom). The client completes a chain-of-custody and/or request for analysis, relinquishes samples to sample custodian personnel, and is given a copy of the C-O-C.

b. If received by courier or shipping:

1st: Routine Client File is checked
2nd: Anticipate Sample Alert File is checked
3rd: Sampling Kit Request File is checked
4th: PACE key client contact is consulted
5th: QC department manager is consulted to determine the designated PACE project manager
6th: Information is requested from the PACE project manager.

c. If analysis information can not be determined on the day of sample receipt, sample data entry personnel proceed to assign sample numbers and put samples on hold. Follow-up with project manager occurs until the analyses are determined and samples can be properly logged in.

3. Responsibilities for Sample Log In

a. Quality Control Manager/Sample Management Officer

- Has the overall responsibility for ensuring that this procedure is implemented for all samples received into the laboratory.
- Has overall responsibility for ensuring that samples are logged in correctly (given that appropriate information has been supplied).

b. Sample Custodian

- Has the primary responsibility of ensuring that sample information is input into the LDMS as described in the SOP.
- Has the responsibility to make recommendations to the QC manager for revising the SOP.

D. SAMPLE STORAGE

1. General Procedures

Samples for analysis are properly stored in the lab according to container type, preservative, and type of security required by the project.

Samples are stored immediately upon receipt to prevent sample degradation.

2. Refrigerated Storage Area Maintenance

All refrigerated storage areas are maintained at 4°C + 2°C. The temperature is monitored and recorded daily. If the temperature fails outside the limit of 2° to 6°C, corrective action is to be taken as follows and appropriately documented.

a. Temperature is monitored at 30 minute intervals with the refrigerator door closed.

b. QC Manager is notified if the problem persists longer than one hour.

c. Samples are relocated to a proper storage environment if temperature cannot be maintained after corrective actions are implemented.

3. Routine Sample Storage

a. General Samples

Samples within each project are stored in sample number order. Waters and soils are generally stored on labeled separate shelves.

4. Specific Procedures

a. Volatiles

Samples within a project are stored in numerical order in vial containers. The holders are then stored where space permits in one of the designated volatile organic refrigerated storage areas.

b. Semi-Volatiles

Samples within a project are stored in numerical order in a designated, refrigerated storage area.

c. Hazardous Materials

Pure product or potentially heavily contaminated samples are tagged as "hazardous" and stored within a secured area, separate from other samples. This area is used only for hazardous samples and is labeled per OHSA requirements.

d. Special Projects

- Volatiles

  Samples within a project are stored in sample number order in vial containers. The holders are then stored as space permits in the Special Project VOA refrigerated storage area.

e. Asbestos

No refrigeration required. Samples are taken to asbestos lab for storage.

5. **Responsibilities for Sample Storage**

a. QC Department Manager/Sample Management Officer has direct responsibility for ensuring that the SOP is followed, samples are stored properly upon receipt, and refrigerated storage area temperatures are maintained.

b. Sample custodians are responsible for storing all samples upon receipt into the appropriate storage area, maintaining high level security for those samples under custody, and for keeping a current custody sample inventory.

c. Analytical personnel have the responsibility of daily sample storage area maintenance, disposal of old samples, and providing space for incoming samples in routine storage areas.

d. Assigned individuals are responsible for maintaining and documenting: (a) refrigerated storage area temperatures, and (b) corrective actions.

See temperature log (Exhibit 9).

Exhibit 9

TEMPERATURE LOG FORM

Storage Area No. ____________________

Date	Temperature	Initials	Corrective Action/Comments

Note: Temperature must be 4°C ± 2°C. If temperature is outside the limit of 2° to 6° continue to monitor at 30 minute intervals (door must remain closed). If no correction within one hour, notify the QC Manager.

F. SAMPLE/DATA ACCESS AND INTERNAL CHAIN-OF-CUSTODY

1. General Policies and Procedures

PACE has implemented standard operating procedures to assure the integrity of samples and data so that they are not degraded or disclosed to unauthorized personnel. In order to ensure that this policy is maintained, the laboratory facilities are under controlled access. Only employees are allowed into the laboratory facilities; visitors must register at the front desk.

Samples are removed from their proper location by the analyst and returned to the storage area immediately after the required sample quantity has been taken. This minimizes unnecessary time spent searching for samples and helps prevent matrix degradation from prolonged exposure to room temperature. Most samples are retained in storage in their original locations for approximately two months. Preserved metals samples and hazardous waste samples are stored up to six months. After the final report is sent and clients are allowed adequate time to review the results, the samples are properly discarded or returned to the client.

PACE normally completes the sample analysis within 15 working days after receipt. Holding times may require faster turnaround times.

Upon client request, additional and more rigorous chain-of-custody protocols for samples and data can be implemented. For samples involving a high degree of confidentiality or potential litigation, PACE, Inc. has developed extensive sample and data handling protocols to assure the scientific and legal defensibility of the report submitted. These protocols include those specified by the USEPA Contract Laboratory Program.

Analysts and technicians follow strict internal chain-of-custody procedures to further ensure the validity of all data. All samples are signed out in a sample custody log book when they are removed for analysis. The sample ID, date, time, analyst, and lab of analysis is recorded in the sample custody log (Exhibit 10). Samples are signed back in noting date, time, and storage location, upon return.

Exhibit 10

CHAIN-OF-CUSTODY
LAB CONTROL FORM

Contract/Project No.: ______________

Date Received: ______________

Received by: ______________

Time: ______________

Witness: ______________

Stored in: ______________

Samples No(s). ______________

Date & Time Removed	Sample Nos. Removed	Name	Witness	Time Returned	Name	Witness

REMINDER: Samples must be returned at the end of the shift.

2. **Responsibilities for SOP Compliance**

   a. The QC manager has the overall responsibility for ensuring that the SOP is implemented and followed.

   b. The sample custodian personnel have the responsibility for ensuring that the SOP is properly followed, and to notify the QC manager of problems.

   c. All employees checking out samples are required to follow procedures.

G. EXCESS SAMPLE DISPOSITION

Samples not totally consumed during the analyses are returned to the client. It is the project manager's responsibility to ensure that proper disposal has taken place. If the sample is water or wastewater and is considered non-hazardous by the project manager, it may then (by request) be properly disposed of at PACE facilities and not returned to the client.

1. **Notification of Sample Return**

The project manager and client receive written notification at the time of project initiation in the following manner:

a. The project proposal states the following paragraph in its Conditions and Terms Statement:

PACE, Inc. Standard Operating Procedures is to return all samples of hazardous materials or wastes to the client at project completion, and PACE, Inc. reserves the right to return or dispose of all samples at our discretion.

This is a standard form used by PACE's Marketing Department.

b. The Sample and Analysis Data Entry Form states the following sentence:

- PACE, Inc. reserves the right to return all samples at our discretion.
- This form is printed out by the LDMS at sample check-in.

c. The Sample and Analysis Data Entry Form cover letter will state the following paragraph:

1. PACE, Inc. Standard Operating Procedure is to return all samples of hazardous materials or wastes to the client at project completion. PACE, Inc. reserves the right to return or dispose of all samples at our discretion. (Exhibit 11)

2. This is a pre-printed cover letter that accompanies the Sample and Analysis Data Entry Form.

d. The Sample and Analysis Data Entry Form and cover letter is sent to the project manager and to the client by the sample custodian personnel.

2. <u>Sample Return and Disposal</u>

Upon completion of laboratory analysis and/or the project, the LDMS automatically prints a report, invoice and sample disposition form. This form is part of the report package and is routed to the project manager.

a. The Sample Disposition Form (Exhibit 12) contains the following information:

1. Client name, address, and contact
2. PACE project number
3. Client project identification number
4. PACE sample identification number
5. PACE project manager name

pace laboratories, inc.
PROFESSIONAL ANALYTICAL CHEMISTRY & ENGINEERING

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas
Irvine, California
Asheboro, North Carolina

1710 Douglas Drive North □ Minneapolis, MN 55422 □ Phone (612) 544-5543 □ FAX (612) 544-3974

Exhibit 11

November 1, 1989

Dear Valued Client:

A new policy has been implemented in the Sample Receiving Department of PACE Laboratories, Inc. We hope that this policy will be helpful to you.

Upon receipt of samples into the laboratory, the Sample Custodian completes a Sample and Analysis Data Entry Form. This form is designed to accommodate a short description of the samples received (sample name and/or sample reference), the type of container, and a list of the analyses requested to be performed on each sample. A copy of this form will be sent to the client (submitter).

Enclosed is a copy of the Sample and Analysis Data Entry Form relevant to the samples we recently received from you. Please compare the information on the form to assure that it is consistent with your request. If there is any inconsistency or if you have any questions on your project, please call the PACE Contact indicated on Sample and Analysis Data Entry Form. The PACE Contact has primary responsibility for monitoring the progress of your project through the laboratory.

It is also part of PACE Laboratories, Inc. Standard Operating Procedure to return all samples pertaining to the information attached that are hazardous materials or hazardous wastes to the client at project completion. PACE Laboratories, Inc. reserves the right to return or dispose of all samples at our discretion.

We have implemented this procedure to better serve our clients, and would appreciate any comments you may have.

Sincerely,

Vice President, Corporate Quality

an equal opportunity employer

Exhibit 12

SAMPLE DISPOSITION FORM

____

____

____

____

____

Date removed: __________
Initials: __________

Date shipped: __________
Initials: __________

RE: Client Project ID: ____________________

PACE Project No.: ____________________

Sample ID

Dear ____________________:

All requested analyses of the samples for the above referenced project have been completed. Enclosed are the remaining portions of the samples which are being returned to you for final disposition.

If you have any questions, please call me.

Sincerely,

____

Project Manager

3. Procedure for Use of the Sample Disposition Form

a. The project manager separates the sample disposition form from the report package, signs the form, and routes it to the sample custodian. If the sample is water or wastewater and non-hazardous, the project manager may wish to properly dispose of the waste.

- If the project requires, the project manager may hold the form for an acceptable amount of time before return or disposal.

- It is important that this form be used and not discarded. It is part of the internal chain-of-custody and is filed with the project report.

- The project manager will use action codes such as:

  1 = Return to client
  2 = In house disposal
  C = Clean
  D = Dirty

  As a general rule, soil samples will be returned and water samples will be disposed of in-house. Water samples which are highly contaminated will be returned. Preserved samples, VOA's, and extracted/tainted samples will not be returned to the client. Therefore, it is necessary to note clean or dirty to facilitate handling. If a sample has an extremely high level of contamination, note the contaminant.

For In-House Sample Disposal

All preserved - Clean - Neutralize/sink
Dirty - Toxic waste

Un-preserved water - Clean - Sink
Dirty - Toxic waste

Soil/Sludge - Clean - Trash
Dirty - Toxic waste

All VOA's - Clean - Neutralize/sink
Dirty - Toxic waste

All Extracted/Tainted Samples

CAM Extracts - Clean - Neutralize/sink
Dirty - Acid metals waste

Other Extracts - Toxic waste

Liquid/Unknown Misc. - Project manager specify

- Project manager will complete the sample disposition form and route it back to invoicing.

- The invoicing department will put completed sample disposition form in sample control mailbox.

b. Upon receipt of the Sample Disposition Form by the sample custodian personnel, the custodian personnel will remove the samples from storage using the information provided on the form.

- If the Sample Disposition Form indicates "Dump," the sample custodian personnel will remove them from storage and place them at a sample disposal station for proper disposal. The process of disposal is performed by the sample custodian personnel or appropriate laboratory staff. The Sample Disposition Form is signed and dated by the sample custodian personnel, then routed to the file clerk for filing with other project information.

- If the samples are to be returned, the sample custodian removes the sample or samples from storage, initials and dates the Sample Disposition Form. The samples, the Sample Disposition Form, and a copy of the client's chain-of-custody are then delivered to the shipping clerk by the sample custodian for return to the client.

c. Upon receipt of the samples and Sample Disposition Form, the shipping clerk signs and dates the form.

The Sample Disposition Form is copied and the original form with the samples is returned to the client, along with a copy of the client's chain-of-custody. A copy of the Sample Disposition Form and the original chain-of-custody is routed to the file clerk for filing with other project information (QC file).

- The shipping clerk labels the box with an appropriate hazard label and ships the samples back to the client using UPS or any other requested manner for shipment. (Note: It is important for proper packaging to prevent breakage during shipment.)
- All shipping costs will be charged against the appropriate project number.

d. Upon receipt of Sample Disposition Form, the file clerk files it with other project related information.

4. **Hazardous Material/Waste Sample Disposition Option**

The preferred method for disposition of excess hazardous material/waste samples is to return the excess sample to the client. It may not be feasible to return samples in all cases or the client may require PACE to dispose of excess samples. PACE will dispose of excess hazardous samples when required and will charge a disposal fee to recover costs for management and disposal.

Procedure for Disposal Option for Excess Hazardous Material/Waste Samples:

a. The project manager informs the client that excess sample disposal will require an additional charge.

b. When analyses are complete, the project manager indicates disposal as the option on the Sample Disposition Form and completes and attaches Hazardous Material/Waste Disposal Option Form (Exhibit 13). An entry is to be made in all fields of this form as it will determine the basis for lab packing and disposal.

c. The project manager routes the Disposal Option Form to sample check-in.

d. The project manager is responsible for billing the client for disposal.

e. The sample custodian is responsible for maintaining a file of Disposal Option Forms for all samples awaiting disposal. Hazardous material/waste samples are stored in safe manner, segregated by compatibility groups as indicated by the hazardous waste disposal SOP.

EXHIBIT 13

HAZARDOUS MATERIAL/WASTE SAMPLE DISPOSAL OPTION FORM

Client ______________________

Contact ______________________

Address ______________________

____

Phone # ______________________

____

Client Project ID ______________________

PACE Project # ______________________

Project Manager ______________________

Report Sent Date ______________________

Pull Sample Date ______________________

Sample #	Matrix	Location	Disposal Method	Charge

Remarks: 1=Return to Client C=Clean
2=In House Disposal D=Dirty

Removed from Refrigerator (initial/date) ______________________

Returned to Client (initial/date) ______________________

Disposed of Samples (initial/date) ______________________

f. The Quality Control Manager is responsible for reviewing accumulated samples awaiting disposal and initiating the disposal process when warranted. The Field Services, Inorganic, Organic, and Environmental Services Departments cooperate and participate in the disposal process. (For compatibility and compositing, see the Hazardous Waste Disposal SOP.)

VIII. CALIBRATION PROCEDURES AND FREQUENCY

Most measurements taken in the laboratory are based upon comparison to reference standards as analyzed by the standard method. The standard results are utilized to generate calibration curves or calibration factors. The results of the sample analysis are then quantified.

All instruments are calibrated using standard solutions of known concentrations. The standards are prepared from certified reference materials and are generally traceable back to NIST. Refer to Section XI for additional information.

Continuous calibration is verified by analysis of calibration standards or laboratory control samples from different sources at regular intervals. Recalibration is performed at specified time intervals or when indicated by the continuous verification procedure or as required by the method. Typical acceptance criteria for some common organic analyses are summarized in Table 2.

Forms to document initial and continuing calibration have been developed (Exhibits 14 and 15).

Refer to Section IX for additional calibration information and frequency as specified in the specific analytical methods.

TABLE 2 CALIBRATION AND QC ACCEPTANCE CRITERIA[a] FOR HALOGENATED VOLATILE ORGANICS

Parameter	Range for Q (ug/L)	Limit for s (ug/L)	Range for $\bar{X}$ (ug/L)	Range P, P_s (%)
Bromodichloromethane	15.2-24.8	4.3	10.7-32.0	42-172
Bromoform	14.7-25.3	4.7	5.0-29.3	13-159
Bromomethane	11.7-28.3	7.6	3.4-24.5	D-144
Carbon tetrachloride	13.7-26.3	5.6	11.8-25.3	43-143
Chlorobenzene	14.4-25.6	5.0	10.2-27.4	38-150
Chloroethane	15.4-24.6	4.4	11.3-25.2	46-137
2-Chloroethylvinyl ether	12.0-28.0	8.3	4.5-35.5	14-186
Chloroform	15.0-25.0	4.5	12.4-24.0	49-133
Chloromethane	11.9-28.1	7.4	D-34.9	D-193
Dibromochloromethane	13.1-26.9	6.3	7.9-35.1	24-191
1,2-Dichlorobenzene	14.0-26.0	5.5	1.7-38.9	D-208
1,3-Dichlorobenzene	9.9-30.1	9.1	6.2-32.6	7-187
1,4-Dichlorobenzene	13.9-26.1	5.5	11.5-25.5	42-143
1,1-Dichloroethane	16.8-23.2	3.2	11.2-24.6	47-132
1,2-Dichloroethane	14.3-25.7	5.2	13.0-26.5	51-147
1,1-Dichloroethene	12.6-27.4	6.6	10.2-27.3	28-167
trans-1,2-Dichloroethene	12.8-27.2	6.4	11.4-27.1	38-155
1,2-Dichloropropane	14.8-25.2	5.2	10.1-29.9	44-156
cis-1,3-Dichloropropene	12.8-27.2	7.3	6.2-33.8	22-178
trans-1,3-Dichloropropene	12.8-27.2	7.3	6.2-33.8	22-178
Methylene chloride	15.5-24.5	4.0	7.0-27.6	25-162
1,1,2,2-Tetrachloroethane	9.8-30.2	9.2	6.6-31.8	8-184
Tetrachloroethene	14.0-26.0	5.4	8.1-29.6	26-162
1,1,1-Trichloroethane	14.2-25.8	4.9	10.8-24.8	41-138
1,1,2-Trichloroethane	15.7-24.3	3.9	9.6-25.4	39-136
Trichloroethene	15.4-24.6	4.2	9.2-26.6	35-146
Trichlorofluoromethane	13.3-26.7	6.0	7.4-28.1	21-156
Vinyl chloride	13.7-26.3	5.7	8.2-29.9	28-163

Q = Concentration measured in QC check sample, in ug/L.

s = Standard deviation of four recovery measurements, in ug/L.

$\bar{X}$ = Average recovery for four recovery measurements, in ug/L.

P, P_s = Percent recovery measured.

D = Detected; result must be greater than zero.

[a] Criteria from 40 CFR Part 136 for Method 601 and were calculated assuming a QC check sample concentration of 20 ug/L.

TABLE 2. CALIBRATION AND QC ACCEPTANCE CRITERIA[a] FOR AROMATIC VOLATILE ORGANICS

Parameter	Range for Q (ug/L)	Limit for s (ug/L)	Range for $\bar{X}$ (ug/L)	Range P, P_s (%)
Benzene	15.4-24.6	4.1	10.0-27.9	39-150
Chlorobenzene	16.1-23.9	3.5	12.7-25.4	55-135
1,2-Dichlorobenzene	13.6-26.4	5.8	10.6-27.6	37-154
1,3-Dichlorobenzene	14.5-25.5	5.0	12.8-25.5	50-141
1,4-Dichlorobenzene	13.9-26.1	5.5	11.6-25.5	42-143
Ethylbenzene	12.6-27.4	6.7	10.0-28.2	32-160
Toluene	15.5-24.5	4.0	11.2-27.7	46-148

Q = Concentration measured in QC check sample, in ug/L.

s = Standard deviation of four recovery measurements, in ug/L.

$\bar{X}$ = Average recovery for four recovery measurements, in ug/L.

P, P_s = Percent recovery measured.

[a] Criteria are from 40 CFR Part 136 for Method 602 and were calculated assuming a QC check sample concentration of 20 ug/L. These criteria are based directly upon the method performance data in Table 4. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 1.

TABLE 2. QC ACCEPTANCE CRITERIA[a] FOR ORGANOCHLORINE PESTICIDES & PCB's

Parameter	Test conc. (ug/L)	Limit for s (ug/L)	Range for $\bar{X}$ (ug/L)	Range P, P_s (%)
Aldrin	2.0	0.42	1.08-2.24	42-122
α-BHC	2.0	0.48	.98-2.44	37-134
β-BHC	2.0	0.64	0.78-2.60	17-147
δ-BHC	2.0	0.72	1.01-2.37	19-140
γ-BHC	2.0	0.46	0.86-2.32	32-127
Chlordane	50	10.0	27.6-54.3	45-119
4,4'-DDD	10	2.8	4.8-12.6	31-141
4,4'-DDE	2.0	0.55	1.08-2.60	30-145
4,4'-DDT	10	3.6	4.6-13.7	25-160
Dieldrin	2.0	0.76	1.15-2.49	36-146
Endosulfan I	2.0	0.49	1.14-2.82	45-153
Endosulfan II	10	6.1	2.2-17.1	D-202
Endosulfan Sulfate	10	2.7	3.8-13.2	26-144
Endrin	10	3.7	5.1-12.6	30-147
Heptachlor	2.0	0.40	0.86-2.00	34-111
Heptachlor epoxide	2.0	0.41	1.13-2.63	37-142
Toxaphene	50	12.7	27.8-55.6	41-126
PCB-1016	50	10.0	30.5-51.5	50-114
PCB-1221	50	24.4	22.1-75.2	15-178
PCB-1232	50	17.9	14.0-98.5	10-215
PCB-1242	50	12.2	24.8-69.6	39-150
PCB-1248	50	15.9	29.0-70.2	38-158
PCB-1254	50	13.8	22.2-57.9	29-131
PCB-1260	50	10.4	18.7-54.9	8-127

s = Standard deviation of four recovery measurements, in ug/L.

$\bar{X}$ = Average recovery for four recovery measurements, in ug/L.

P, P_s = Percent recovery measured.

D = Detected; result must be greater than zero.

[a] Criteria from 40 CFR Part 136 for Method 608. These criteria are based directly upon the method performance data in Table 4. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 4.

TABLE 2. CALIBRATION AND QC ACCEPTANCE CRITERIA[a] FOR GC/MS VOLATILE ORGANICS

Parameter	Range for Q (ug/L)	Limit for s (ug/L)	Range for $\bar{X}$ (ug/L)	Range p, p_s (%)
Benzene	12.8-27.2	6.9	15.2-26.0	37-151
Bromodichloromethane	13.1-26.9	6.4	10.1-28.0	35-155
Bromoform	14.2-25.8	5.4	11.4-31.1	45-169
Bromomethane	2.8-37.2	17.9	D-41.2	D-242
Carbon tetrachloride	14.6-25.4	5.2	17.2-23.5	70-140
Chlorobenzene	13.2-26.8	6.3	16.4-27.4	37-160
2-Chloroethylvinyl ether	D-44.8	25.9	D-50.4	D-305
Chloroform	13.5-26.5	6.1	13.7-24.2	51-138
Chloromethane	D-40.8	19.8	D-45.9	D-273
Dibromochloromethane	13.5-26.5	6.1	13.8-26.6	53-149
1,2-Dichlorobenzene	12.6-27.4	7.1	11.8-34.7	18-190
1,3-Dichlorobenzene	14.6-25.4	5.5	17.0-28.8	59-156
1,4-Dichlorobenzene	12.6-27.4	7.1	11.8-34.7	18-190
1,1-Dichloroethane	14.5-25.5	5.1	14.2-28.4	59-155
1,2-Dichloroethane	13.6-26.4	6.0	14.3-27.4	49-155
1,1-Dichloroethene	10.1-29.9	9.1	3.7-42.3	D-234
trans-1,2-Dichloroethene	13.9-26.1	5.7	13.6-28.4	54-156
1,2-Dichloropropane	6.8-33.2	13.8	3.8-36.2	D-210
cis-1,3-Dichloropropene	4.8-35.2	15.8	1.0-39.0	D-227
trans-1,3-Dichloropropene	10.0-30.0	10.4	7.6-32.4	17-183
Ethyl benzene	11.8-28.2	7.5	17.4-26.7	37-162
Methylene chloride	12.1-27.9	7.4	D-41.0	D-221
1,1,2,2-Tetrachloroethane	12.1-27.9	7.4	13.5-27.2	46-157
Tetrachloroethene	14.7-25.3	5.0	17.0-26.6	64-148
Toluene	14.9-25.1	4.8	16.6-26.7	47-150
1,1,1-Trichloroethane	15.0-25.0	4.6	13.7-30.1	52-162
1,1,2-Trichloroethane	14.2-25.8	5.5	14.3-27.1	52-150
Trichloroethene	13.3-26.7	6.6	18.5-27.6	71-157
Trichlorofluoromethane	9.6-30.4	10.0	8.9-31.5	17-181
Vinyl chloride	0.8-39.2	20.0	D-43.5	D-251

Q = Concentration measured in QC check sample, in ug/L.
s = Standard deviation of four recovery measurements, in ug/L.
$\bar{X}$ = Average recovery for four recovery measurements, in ug/L.
p, p_s = Percent recovery measured.
D = Detected; result must be greater than zero.

[a] Criteria from 40 CFR Part 136 for Method 624 and were calculated assuming a QC check sample concentration of 20 ug/L. These criteria are based directly upon the method performance data in Table 7. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 7.

TABLE 2. QC ACCEPTANCE CRITERIA[a] FOR GC/MS SEMIVOLATILE ORGANICS

Parameter	Test conc. (ug/L)	Limit for s (ug/L)	Range for $\bar{X}$ (ug/L)	Range p, p_s (%)
Acenaphthene	100	27.6	60.1-132.3	47-145
Acenaphthylene	100	40.2	53.5-126.0	33-145
Aldrin	100	39.0	7.2-152.2	D-166
Anthracene	100	32.0	43.4-118.0	27.133
Benzo(a)anthracene	100	27.6	41.8-133.0	33-143
Benzo(b)fluoranthene	100	38.8	42.0-140.4	24-159
Benzo(k)fluoranthene	100	32.3	25.2-145.7	11-162
Benzo(a)pyrene	100	39.0	31.7-148.0	17-163
Benzo(ghi)perylene	100	58.9	D-195.0	D-219
Benzyl butyl phthalate	100	23.4	D-139.9	D-152
β-BHC	100	31.5	41.5-130.6	24-149
δ-BHC	100	21.6	D-100.0	D-110
Bis(2-chloroethyl)ether	100	55.0	42.9-126.0	12-158
Bis(2-chloroethoxy)methane	100	34.5	49.2-164.7	33-184
Bis(2-chloroisopropyl)ether	100	46.3	62.8-138.6	36-166
Bis(2-ethylhexyl)phthalate	100	41.1	28.9-136.8	8-158
4-Bromophenyl phenyl ether	100	23.0	64.9-114.4	53-127
2-Chloronaphthalene	100	13.0	64.5-113.5	60-118
4-Chlorophenyl phenyl ether	100	33.4	38.4-144.7	25-158
Chrysene	100	48.3	44.1-139.9	17-168
4,4'-DDD	100	31.0	D-134.5	D-145
4,4'-DDE	100	32.0	19.2-119.7	4-136
4,4'-DDT	100	61.6	D-170.6	D-203
Dibenzo(a,h)anthracene	100	70.0	D-199.7	D-227
Di-n-butyl phthalate	100	16.7	8.4-111.0	1-118
1,2-Dichlorobenzene	100	30.9	48.6-112.0	32-129
1,3-Dichlorobenzene	100	41.7	16.7-153.9	D-172
1,4-Dichlorobenzene	100	32.1	37.3-105.7	20-124
3,3'-Dichlorobenzidine	100	71.4	8.2-212.5	D-262
Dieldrin	100	30.7	44.3-119.3	29-136
Diethyl phthalate	100	26.5	D-100.0	D-114
Dimethyl phthalate	100	23.2	D-100.0	D-112
2,4-Dinitrotoluene	100	21.8	47.5-126.9	39-139
2,6-Dinitrotoluene	100	29.6	68.1-136.7	50-158
Di-n-octylphthalate	100	31.4	18.6-131.8	4-146
Endosulfan sulfate	100	16.7	D-103.5	D-107
Endrin aldehyde	100	32.5	D-188.8	D-209
Fluoranthene	100	32.8	42.9-121.3	26-137
Fluorene	100	20.7	71.6-108.4	59-121
Heptachlor	100	37.2	D-172.2	D-192
Heptachlor epoxide	100	54.7	70.9-109.4	26.155
Hexachlorobenzene	100	24.9	7.8-141.5	D-152
Hexachlorobutadiene	100	26.3	37.8-102.2	24-116
Hexachloroethane	100	24.5	55.2-100.0	40-113

TABLE 2. QC ACCEPTANCE CRITERIA[a] FOR GC/MS SEMIVOLATILE ORGANICS (CONT.)

Parameter	Test conc. (ug/L)	Limit for s (ug/L)	Range for $\bar{X}$ (ug/L)	Range p, p_s (%)
Indeno(1,2,3-cd)pyrene	100	44.6	D-150.9	D-171
Isophorone	100	63.3	46.6-180.2	21-196
Naphthalene	100	30.1	35.6-119.6	21-133
Nitrobenzene	100	39.3	54.3-157.6	35-180
N-Nitrosodi-n-propylamine	100	55.4	13.6-197.9	D-230
PCB-1260	100	54.2	19.3-121.0	D-164
Phenanthrene	100	20.6	65.2-108.7	54-120
Pyrene	100	25.2	69.6-100.0	52-115
1,2,4-Trichlorobenzene	100	28.1	57.3-129.2	44-142
4-Chloro-3-methylphenol	100	37.2	40.8-127.9	22-147
2-Chlorophenol	100	28.7	36.2-120.4	23-134
2,4-Chlorophenol	100	26.4	52.5-121.7	39-135
2,4-Dimethylphenol	100	26.1	41.8-109.0	32-119
2,4-Dinitrophenol	100	49.8	D-172.9	D-191
2-Methyl-4,6-dinitrophenol	100	93.2	53.0-100.0	D-181
2-Nitrophenol	100	35.2	45.0-166.7	29-182
4-Nitrophenol	100	47.2	13.0-106.5	D-132
Pentachlorophenol	100	48.9	38.1-151.8	14-176
Phenol	100	22.6	16.6-100.0	5-112
2,4,6-Trichlorophenol	100	31.7	52.4-129.2	37-144

s = Standard deviation of four recovery measurements, in ug/L.

$\bar{X}$ = Average recovery for four recovery measurements, in ug/L.

p, p_s = Percent recovery measured.

D = Detected; result must be greater than zero.

[a] Criteria from 40 CFR Part 136 for Method 625. These criteria are based directly on the method performance data in Table 7. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 7.

INITIAL CALIBRATION DATA
EXTRACTABLE 8080/608 COMPOUNDS
EXHIBIT 14

CALIBRATION DATE:

COLUMN ID:

INSTRUMENT ID:

DETECTOR ID:

MAXIMUM % RSD IS 20%

Standard ID	#	#	#		
Compound	CF 20	CF 40	CF 60	$\overline{CF}$	%RSD
Alpha-BHC					
Beta- BHC					
Lindane					
Delta- BHC					
Heptachlor					
Aldrin					
Heptachlor Epoxide					
Endosulfan I					
DDE/Dieldrin					
Endrin					
Endosulfan II					
4,4'-DDD					
Endrin Aldehyde					
4,4'-DDT					
Endosulfan Sylfate					

$$CF = \text{CALIBRATION FACTOR} = \frac{\text{Total ng of Standard}}{\text{Area}}$$

$$\overline{CF} = \text{AVERAGE CALIBRATION FACTOR} = CF/n$$

$$\%RSD = \text{RELATIVE STANDARD DEVIATION} = \frac{(\text{Standard Dev.})\ (100)}{\overline{CF}}$$

CONTINUING CALIBRATION CHECK
Semi-Volatile Compounds
EXHIBIT 15

CASE NO: ____________________ CALIBRATION DATE: ____________

LABORATORY NAME: PACE LABORATORIES TIME: ____________

CONTRACT/PROJECT NO. ____________ ANALYST: ____________

INSTRUMENT I.D.: ____________ INITIAL CALIBRATION DATE: ____

MAXIMUM %D FOR CCC IS 10%

COMPOUND	CF	CF	%D	CCC
Alpha-BHC				
* Beta-BHC				
Lindane				
Delta-BHC				
Heptachlor				
* Aldrin				
Heptachlor Epoxide				
* Endosulfan I				
DDF/Dieldrin				
* Endrinion				
Endosulfan II				
4,4'-DDD				
Endrin Aldehyde				
4,4'-DDT				
Endosulfan Sulfate				
Aroclor 1016				
Aroclor 1221				
Aroclor 1232				
Aroclor 1242				
Aroclor 1248				
Aroclor 1254				
Aroclor 1260e				
Chlordane				
Toxaphene				
Methoxychor				
DBC				

CF -Calibration Factor from daily standard at ug/L

CF-Average Calibration Factor from initial calibration Form VI

%D-Percent Difference

CCC-Calibration Check Compounds

IX. ANALYTICAL PROCEDURES

Analytical methods employed at PACE can be EPA methodologies from the Federal Register and SW 846 (References 2 and 3) or approved equivalent methods. When there is no approved EPA method, industrial methods are used. A list of analytical methods utilized at PACE is as follows:

A. LIST OR ANALYTICAL METHODS

1. Organic Analyses

Parameter	Method	DW	WW Method	SW 846	Spec.
Purgeable Halocarbons	GC	502.1/502.2	601	8010	
Non-Halogenated Volatile Organics	GC			8015	
Purgeable Aromatics and Unsaturated Organics	GC	503.1/502.2	602	8020	
Acrolein & Acrylonitrile	GC		603	8030	
Phenols	GC	515.1	604	8040	
Benzidines	HPLC		605		
Phthalate Esters	GC		606	8060	
Nitrosamines	GC		607		
Organochlorine Pesticides and PCBs	GC	508/505/508A 507/515.1	608/608.1 608.2	8080	CA Mod 8080 MN. 570A
Nitroaromatics and Isophorone	GC		609	8090	
Polynuclear Aromatic Hydrocarbons	HPLC/GC	502.2/503.1	610	8310/ 8100	
Haloethers	GC		611		
Alachlor, Atrazine, Chlordane, Hepatchlor, Heptachlor Epoxide, Lindane, Methoxychlor, Toxaphene, and PCBs (as Aroclors)	GC	505/507	645		MN 570A

Parameter	Method	DW	WW Method	SW 846	Spec.
Chlorinated Hydrocarbons	GC		612	8120	
2, 3, 7, 8 - TCDD	GC/MS		613		
Volatile Organics					(MN)465C
Base/Neutrals & Acids	GC/MS	525 (NCA)	625	8250/8270	
Organophosphorus Pesticides	GC	507	614/622	8140/ 8220	(MN)570A (CA)AB1803
Chlorinated Herbicides	GC	515.1	615/608.1/ 608.2	8150	(MN)574A (CA)509B
EDB and DBCP	GC	504			(CA) DOHS
Volatile Organic Compounds	GC/MS	524.2/524.1	624	8240	
Carbamates & Urea & Pesticides	HPLC	531.1	632		(CA)AB1803 (MN)572A
Fuel Hydrocarbons & BTEX	GC		602	8020	(CA) Mod. 8015
Alachlor, Atrazine	GC	507/505	619/645		(CA)AB1803 (MN)570A
Chlordane, Heptachlor, Heptachlor Expoxide, Lindane; Methoxychlor	GC	508/505	608/617	8080	
Aldicarb; Aldicarb sulfone; Aldicarb sulfoxide; Carbofuran	GC	531.1			(CA)AB1803

2. INORGANIC ANALYSES

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1983	ASTM	SW 846
A. Non Metals					
Acidity	Potentiometric Titration	402	305.1	D1067-82	
Alkalinity	Potentiometric Titration	403	310.1	D1067-82	
Bacteria,					
Total Coliform	Membrane Filter	909A			9132
Fecal Coliform	Membrane Filter	908C			
Fecal Strept.	Membrane Filter	910A			
Total Plate Count	Agar Medium	907			
Biochemical Oxygen Demand, 5-Day	Winkler Electrode	507 507	405.1		
Boron	Curcumin 405-A	404A	212.3		
	ICP		200.7		6010
Chemical Oxygen Demand	Dichromate Reflux (High)	508A	410.1	D1252-83	
	Dichromate Reflux (Low)	508A	410.2	D1252-83	
Chloride	Mercuric Nitrate	407B	325.3	D512-81	9252
	Auto. Ferricyanide	407D	325.2		9251
	Titration	407A			
Chlorine, Residual	Amperometric Titration	408C	330.1 330.5	D1253-76	
	Colorimetric	408E			
Color	Visual Comparison	204A	110.2		
Cyanide, Total	Pyridine-Barbitutic Acid, Colorimetric	412D	335.2	D2036-82	9010
Amenable	Chlorination-Colorimetric	412F	335.1	D2036-82	9010

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1983	ASTM	SW 846
Flouride, Total	Distillation-Electrode	413A/B	340.2	D1179-80	
Flouride, Diss.	Electrode	413B	340.2	D1179-80	
Hardness, Total	EDTA Titration Calculation	314B	130.2	D1126-80	
Hardness, Calcium	EDTA Titration	303A	242.1	D511-84	
Nitrogen,					
Ammonia	Distillation Titration	417D	350.2		
	Potentiometric		350.3		
Kjeldahl	Digestion Distillation	420B	351.3	D3590-84	
Nitrate	Automated Cadmium	418F	353.2	D3867-85	9200
	Brucine Sulfate		352.1	D091-71	
Nitrite	Automated Cadmium	418F	353.2	D3867-85	
	Colorimetric	419			
Organic	Kjeldahl-NH_3	420A	351.3	D3590-84	
	Kjeldahl-Potentiometric		351.4		
Oil & Grease	Soxhlet	503C			
	Partition-Gravimetric	503A	413.1		9070/ 9071
Oxygen Dissolved	Winkler	421B	360.2	D888-81	
	Electrode	421F	360.1		
pH (Hydrogen Ion)	Electrode	423	150.1	D1293-84	9040
Phenol	Distillation-Extraction Colorimetric		420.1	D1783-80	9066
Phosphorus, Total	Persulfate Digestion- Ascorbic Acid Reduc.	424C/F	365.2	D515-82	
Ortho	Ascorbic Acid Reduc.	424F	365.2	D515.82	
Silica, Dissolved	Molybdosilicate	425C	370.1	D859-80	
	ICP		200.7		
Solids					
Total	Gravimetric	209A	160.3		
Total Volatile	Gravimetric	209D	160.4		
Suspended	Gravimetric	209C	160.2		
Suspended Volatile	Gravimetric	209D	160.4		
Total Dissolved	Gravimetric	209B	160.1		
Settleable	Gravimetric	209E	160.5		

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1983	ASTM	SW 846
Specific Conductance	Meter	205	120.1	D1125.82	9040
Sulfate	Ion Chromatography	426C	375.4	D516-82	
	Automated Methyl Thymol Blue		375.2		9036
Sulfide	Colorimetric	427C	376.2		9030
	Titration	427D	376.1		
Sulfite	Titration	428A	377.1	D1339-84	
Surfactants (MBAS)	Methylene Blue	512B	425.1	D2330-82	
Turbidity	Meter	214A	180.1	D1889-18	

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1979	SW 846
B. Metals				
Aluminum	AA-Direct Aspiration	303C	202.1	7020
	AA-Furnace	304	202.2	
	ICP-AES		200.7	6010
Antimony	AA-Direct Aspiration	303A	204.1	7040
	AA-Furnace	304	204.2	7041
	ICP-AES		200.7	6010
Arsenic	AA-Gaseous Hydride	303E	206.3	7061
	AA-Furnace	304	206.2	7060
	ICP-AES		200.7	6010

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1983	SW 846
Barium	AA-Direct Aspiration	303C	208.1	7080
	AA-Furnace	304	208.2	7081
	ICP-AES		200.7	6010
Beryllium	AA-Direct Aspiration	303C	210.1	7090
	AA-Furnace	304	210.2	7091
	ICP-AES		200.7	6010
Cadmium	AA-Direct Aspiration	303A	213.1	7130
	AA-Furnace	304	213.2	7131
	ICP-AES		200.7	6010
Calcium	AA-Direct Aspiration	303A	215.1	7140
	AA-Furnace	311C	215.2	
	ICP-AES		200.7	6010
Chromium, Total Hexavalent	AA-Direct Aspiration	303A	218.1	7190
	AA-Furance	304	218.2	7191
	ICP AES		200.7	6010
	Colorimetric	312B		7196
	MIBK Extraction			7197
Cobalt	AA-Direct Aspiration	303A	219.1	7200
	AA-Furnace	304	219.2	7201
	ICP-AES		200.7	6010
Copper	AA-Direct Aspiration	303A	220.1	7210
	AA-Furnace	304	220.2	7211
	ICP-AES		200.7	6010
Iron	AA-Direct Aspiration	303B	236.1	7380
	AA-Furnace	304	236.2	7381
	ICP-AES		200.7	6010
Lead	AA-Direct Aspiration	303A	239.1	7240
	AA-Furnace	304	239.2	7241
	ICP-AES		200.7	6010

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1983	SW 846
Lithium	AA-Direct Aspiration	317B		
Magnesium	AA-Direct Aspiration	303A	242.1	7450
	ICP AES		200.7	6010
Manganese	AA-Direct Aspiration	303A	243.1	7460
	AA-Furnace	304	243.2	7461
	ICP AES		200.7	6010
Mercury	AA-Cold Vapor	303F	245.1	7470 or 7471
Molybdenum	AA-Direct Aspiration	303C	246.1	7480
	AA-Furnace	304	246.2	7481
Nickel	AA-Direct Aspiration	303A	249.1	7520
	AA-Furnace	304	249.2	
	ICP AES		200.7	6010
Potassium	AA-Direct Aspiration	303A	258.1	7610
Selenium	AA-Gaseous Hydride	303E	270.3	7740
	AA-Furnace	304	270.2	7741
	ICP AES		200.7	6010
Silver	AA-Direct Aspiration	303A	272.1	7760
	AA-Furnace	304	272.2	7761
	ICP AES		200.7	6010
Sodium	AA-Direct Aspiration	303A	273.1	7770
	ICP AES		200.7	6010
Strontium	AA-Direct Aspiration	303A		7780
Thallium	AA-Direct Aspiration	303A	279.1	7840
	AA-Furnace	304	279.2	7841
	ICP AES		200.7	6010
Tin	AA-Direct Aspiration	303A	282.1	7870
	AA-Furnace	304	282.2	

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1983	SW 846
Titanium	AA-Direct Aspiration	303C	283.1	
	AA-Furnace	304	283.2	
Vanadium	AA-Direct Aspiration	303C	286.1	7910
	AA-Furnace	304	286.2	7911
	ICP AES		200.7	6010
Zinc	AA-Direct Aspiration	303A	289.1	7950
	AA-Furnace	304	289.2	7951
	ICP AES		200.7	6010

3. WASTES & OIL ANALYSIS

Parameter	Method	Standard Methods 15th Ed.	ASTM	SW 846
% Ash	Gravimetric	209F		
% Chlorine	Bomb Calorimeter		D808-81	
Density	Gravimetric	213E		
Flash Point Closed Cup	Tag		D93-80	1010
Free Liquids	Paint Filter			9095
Heat of Combustion	Bomb Calorimeter		D240-76	
Leach Test. EP Toxicity	Extraction			1310
ASTM Water	Extraction		D3987-85	
% Sulfur	Bomb Calorimeter		D129-64	

Parameter	Method	Standard Methods 15th Ed.	ASTM
Viscosity	Saybolt		D88-81
% Water	Distillation		D95-83

Parameter	Method	Standard Methods 15th Ed.	EPA Methods 1982	SW 846
Sulfide,Total	Titration			9030
Reactive	Titration		261.23	Chap. 7 7.3.4.2
pH	Electrode			9040
Specific Conductance	Meter			9050
Specific Gravity	Mass Displacement	213E		
Cyanide, Total	Pyridine-Barbituitic Acid Colorimetic			9010
Amenable	Chlorination-Colorimetric			9010
Cyanide, Reactive	Pyridine-Barbitutic Acid Colorimetric		261.23	Chap. 7 7.3.3.2
TCLP			40CFR268	

4. **List of Sample Preparation Methods**

3510	Separatory Funnel Liquid - Extraction
3520	Continuous Liquid - Extraction
3540	Soxhlet Extraction
3550	Sonication Extraction
3580	Waste Dilution
5080	Purge and Trap
3005	Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by Flame AA or ICP
3010	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by Flame AA or ICP
3020	Acid Digestion of Aqueous Samples and Extracts for Total Metals by Furnace AA
3050	Acid Digestion of Sediments, Soils, and Sludges

Method numbers refer to EPA Methods except:

1. S.M. = Standard Methods for the Examination of Water and Wastewater
2. USATHAMA = U.S. Army Toxic and Hazardous Materials Agency
3. NIOSH = Manual of Analytical Methods
4. Hach, Chevron, Calgon = Industrial Methods

B. GAS CHROMATOGRAPHY PROCEDURES

1. Calibration and Calibration Verification

All GC methods are calibrated by external calibration procedures using three to five standard concentrations, depending upon the method. A new calibration is performed at least once per month or as needed on routine analyses. Methods not utilized on a daily basis are calibrated before each run.

2. Laboratory Control Sample (LCS)

An EPA check sample is analyzed at least once per week, and when a new initial calibration is performed.

3. Matrix Spike

Performed at a minimum of every 20 samples or as required by either state or project-specific requirements.

4. Surrogate Spike

Surrogates are added to and analyzed for in every sample for methods 601, 602, 8010, 8020, 608, 8080, 8015, 615, 8150.

5. **Duplicate Sample Analysis**

Performed at a minimum of every 20 samples or as specified by state/project requirements. Many samples contain non-detectable amounts of the parameters to be measured, therefore, the matrix spike is duplicated. (Matrix Spike Duplicate)

6. **Blank Analysis**

The reagent/method blank must have no contaminants greater than the detection limit of the method. In the case of volatile organic analysis, common laboratory solvents may be present at a concentration of less than 5 times the MDL. Blank subtraction is normally not allowed by contract/project protocols, unless specified by terms of the contract/project.

7. **Other**

Method 608/8080 are also subject to the following QC criteria:

a. Combined breakdown of endrin and DDT may not exceed 20%. This is monitored through the daily analysis of an LCS containing these compounds.

b. Two LCS (each containing 1/2 the compounds of the method) are alternately analyzed after every tenth sample.

C. GAS CHROMATOGRAPHY/MASS SPECTROMETRY PROCEDURES

1. **Calibration and Continuing Calibration**

An internal three point calibration is performed when indicated by the continuing calibration. One check standard is analyzed at the beginning of each 12-hour shift to verify calibration. The acceptance limit for the check standard is 25% RSD. Recalibration is necessary from once per week to once per month. Fresh calibration standards must be prepared weekly.

2. **Validation of Mass Spectrometer**

The mass spectrometers are tuned at the start of each run period and at 12-hour intervals. The tuning procedure utilizes the EPA recommended compounds 4-bromofluorobenzene (BFB) for 624/8240 and decafluorotriphenyl phosphine (DFTPP) for 625/8270.

3. Internal Standards

All sample results are quantified using the internal standard technique described in EPA methods 624, 8240, 625, 8270. Three (VOA) or six (BNA) internal standard compounds are added to each sample immediately before analysis. The internal standard nearest the retention time of the analyte of interest is used in the quantitation of the analyte.

4. Laboratory Control Sample

An EPA check sample is analyzed at a minimum once every month. A standard is run every 12 hour shift.

5. Matrix Spike and Matrix Spike Duplicate

Performed at a minimum of every 20 samples or as specified by state/project requirements. This is the same procedure as the GC section.

6. Surrogate Spikes

Surrogate spiking compounds are added to and analyzed for, with every sample. A surrogate is a volatile sample prior to purging and prior to extracting a semi-volatile sample.

7. Reagent/Method Blank

VOA - one per 12-hour per shift
BNA - one per batch of samples extracted

Common laboratory solvents present in the blank at a concentration less than 5 times the MDL will be footnoted on the analysis report. Common solvents at greater concentrations or the presence of any contaminant not considered a common laboratory solvent at a concentration greater than the MDL indicates the need to re-extract/re-analyze the blank and associated samples.

D. METALS PROCEDURES

1. Calibration and Calibration Verification

All instruments are calibrated at the start of each run. The graphite furnace requires 4 point calibration. The Flame AA and ICP methods utilize a minimum of 3 points. Cold vapor analysis of mercury requires a 5 point calibration. Recalibration is performed after 50 samples, or more often if indicated by the laboratory control sample.

2. **Laboratory Control Sample**

Performed at a minimum of every 20 samples, or as specified by state/project requirements.

3. **Matrix Spike**

Performed at a minimum of every 20 samples, or as specified by state/project requirements.

4. **Duplicate Samples**

Performed at a minimum of every 20 samples, or as specified by state/project requirements.

5. **Blank Analysis**

a. Method Blank

If the concentration of the blank exceeds the MDL, all samples associated with the blank are redigested and reanalyzed concurrent with a new blank. Samples with a concentration greater than 10 times the blank are reported, without blank value correction.

b. Reagent Blank

Any reagent blank result greater than the MDL terminates the analysis until corrective action resolves the problem. For ICP metals, a negative blank value greater than two times the MDL also requires corrective action. In rare cases, if all corrective action fails to resolve the problem and the blank value still hovers at 1-3 times the MDL, the analyst may run the samples, report all values greater than 10 times the blank value, and correct the sample values less than that amount for the blank value.

E. GENERAL CHEMISTRY PROCEDURES

1. **Calibration and Verification**

All instruments are calibrated daily with 3-6 point curves, depending upon instrument requirements. The calibration is continuously verified throughout the run, with either a calibration standard or laboratory control standard inserted after every 10th sample.

2. **Laboratory Control Sample**

A laboratory control sample is analyzed at least once during each batch of samples.

3. **Matrix Spike and Duplicate Samples**

Performed at a minimum of every 20 samples, or as specified by state/project requirements.

F. RECORD KEEPING AND REVIEW

All records and data are stored in safe places such as metal cabinets or hard cover bound books.

The extractions section utilizes method-specific bound books to record all data pertaining to sample extraction and preparation. A copy of the extraction benchsheet is transferred to GC or GC/MS with each extracted sample (Exhibit 16 and 17).

The organic and inorganic departments utilize benchsheets, maintained by analysts; specific for injection data and instrument maintenance. Spectras and chromatograms are filed by acquisition date.

The individual analysts and technicians are responsible for maintaining accurate, legible records and logs in accordance with standard operating procedures. The supervisors are responsible for ensuring adherence to procedures.

Secondary review of all records and logs is performed periodically by someone other than the person generating the document, preferably the department supervisor. Evidence of secondary review is provided on the document as initials and review date by the secondary person.

See Section X for magnetic media storage.

Exhibit 16

PROJECT #

GC-MS EXTRACTABLES

BATCH #

Sample Location	Sample Number	Date/Time of Extraction	Initial Volume	Surrogate	Spike	Final Volume	Date of Conc.	% Emulsion	Comments	Extract Location

EXTRACTION METHOD

- Separatory Funnel ☐
- Continuous Liq/Liq ☐
- Soxhlet ☐
- Sonication ☐
- Other: ______________ ☐

Spike #

Dup. Spike #

QUALITY CONTROL INFORMATION

Surrogate:

Spike:

ROUTING

Person Who:	Initial
Extracted	______
Concentrated	______
Supervisor	______
GC/MS	______

WPPWGJ5

Exhibit 17

PROJECT #

GC EXTRACTION

BATCH #

Location	Sample Number	Weight of Sample	Date & Time of Extraction	Final Volume	Date of Conc.	% Emulsion	Comments	Extraction Location	Column	NCLSON File	% Recovery	Date & Time

EXTRACTION METHOD

Separatory Funnel ☐

Continuous Liq/Liq ☐

Soxhlet ☐

Sonication ☐

Other: ______ ☐

Spike #

Dup. Spike #

QUALITY CONTROL INFORMATION

Surrogate:

Spike:

ROUTING

Person Who: Initial
Extracted ______
Concentrated ______

Supervisor ______

GC/MS ______

G. ACCEPTANCE LIMITS AND CONTROL CHARTS

Acceptance criteria for quality control samples and instrument calibration/verification are summarized in Table 3.

TABLE #3

ACCEPTANCE CRITERIA FOR QUALITY CONTROL SAMPLES & INSTRUMENT CALIBRATION

	MATRIX SPIKE % RECOVERY	SURROGATE SPIKE % RECOVERY	RPD DUPLICATE SAMPLES	INITIAL CALIBRATION LINEARITY	CALIBRATION VERIFICATION	LCS/EPA QC SAMPLE
GC	Within calculated control limits*	Within calculated control limits	≤ maximum RPD acceptance limit	RSD ≤ 20%	± 15% of true value or initial response	±15% of true value or EPA limit
MS	Within calculated control limits*	Within calculated control limits	≤ maximum RPD acceptance limit	RSD ≤ 30%	± 30% of initial average RF	± 15% of true value or EPA limit
GENERAL CHEMISTRY	Within calculated control limits*	N/A	0-67 on samples < 10x MDL 0-20 on samples > 10x MDL MDL = Method Detection Limit	Correlation coefficient ≥ .995	± 10% of true value	± 15% of true value or EPA limit
METALS	Within calculated control limits*	N/A	0-67 on samples < 10x MDL 0-20 on samples > 10x MDL MDL = Method Detection Limit	Correlation coefficient of: ≥ .995 ≥ .995 :AA ≥ .995 :Cold Vapor	± 10% of true value	± 15% of true value or EPA limit

- Establisment and Utilization of Acceptance Limits

X. DATA REDUCTION, VALIDATION AND REPORTING

Final results are entered into the LDMS system by the analyst, independently validated, and reviewed by the department supervisor for verification (Exhibit 18).

Result verification sheets are attached to the QC files and reviewed by the QC manager. After QC file review by the QC manager, the department manager verifies the completeness and the validity of the report. When all required analyses on all of the samples in a project are complete, entered and verified, a report is generated. The report goes to the project manager for review. Each project is assigned to a project manager after samples are received at PACE. The project manager is responsible for tracking sample progress while in-house and ensuring timely analysis.

When the data re complete, the project manager reviews the final report according to these criteria:

- Reasonableness of data, i.e., whether the various sample analyses results make sense when compared to each other. Analyses such as BOD, COD, amount of organic contamination, general mineral balances, volatile organics measured by different methods, pH and electrical conductivity, and other analytical interrelationships are compared. Data on samples within the same project number are compared and if descriptive information about the samples is available, then it may be concluded that the results are reasonable in comparison to each other.

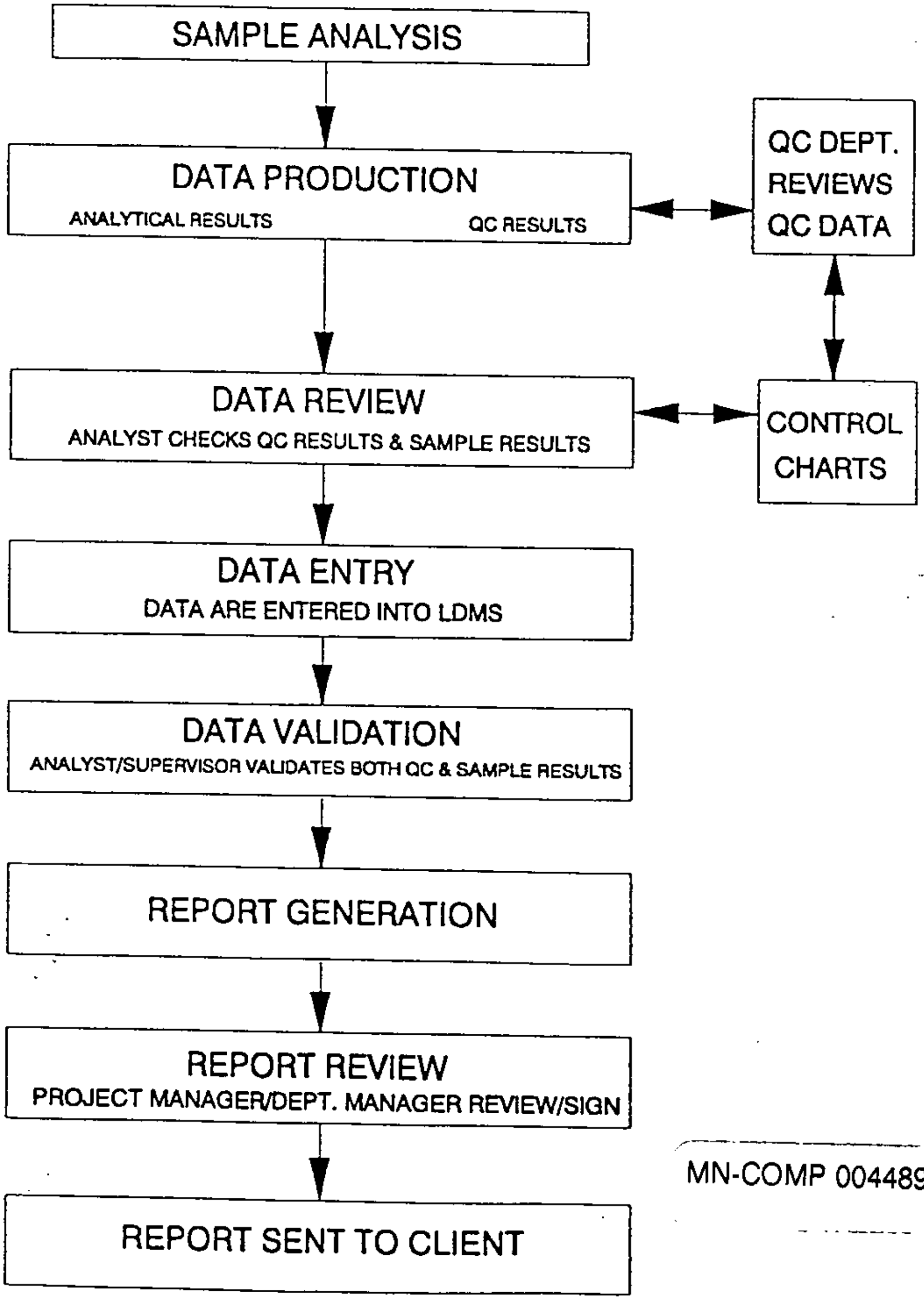
The report requires the signature of the project manager and the department manager. Client questions about the final report may be directed to these individuals or the Client Services manager when appropriate.

- Data Storage

  Data and reports are archived onto computer tape and written in documents for either off-site storage within a secured building, or within a locked storage cabinet.

EXHIBIT 18

LABORATORY DATA FLOW CHART



XI. INTERNAL QUALITY CONTROL

The Quality Assurance Plan is a document that reflects the actual operating and quality control programs in use at PACE. The reliability and credibility of analytical results is established by inclusion of a program of randomly scheduled replicate analyses, analysis of standard of spiked samples, and the cooperative analysis of split samples by several laboratories. These quality control checks are an integral part of the sampling and analytical plan.

Quality assurance, as practiced at PACE, consists of general quality control and assessment procedures that are adapted to the specific operating conditions within each section. The general elements of quality control are outlined below.

A. BLANK ANALYSIS

Reagent/Method Blanks: A reagent blank consists of laboratory pure water and any reagents added to a sample during analysis only, or straight solvent. A method blank is a water or soil blank which undergoes all of the preparation procedures applied to a sample (i.e., extraction, digestion).

It is standard policy throughout the laboratory to prepare and analyze a reagent or method blank (whichever is appropriate) with each sample batch. Separate water and soil method blanks are prepared for mixed matrix batches.

Reagent blanks may also be inserted at regular intervals on large (20 samples) batches, or after highly concentrated samples to check for carryover/contamination. For methods utilizing surrogate compounds, the surrogates are added to all blanks and are subject to meeting acceptance criteria.

A trip blank is submitted for analysis with most samples analyzed for volatile organic compounds. A field blank or procedure blank may also be submitted at the discretion of the client. Field, procedure, and trip blanks are analyzed upon request of the client. Reagent blanks are run daily on each instrument to check the contaminant level (Exhibit 19).

METHOD BLANK SUMMARY FORM

METHOD:

EXHIBIT 19

INST. ID: _-

Y	M	D	CONTAMINANT/ PPB	CORRECTION	S.R.	COMMENT
		1				
		2				
		3				
		4				
		5				
		6				
		7				
		8				
		9				
		10				
		11				
		12				
		13				
		14				
		15				
		16				
		17				
		18				
		19				
		20				
		21				
		22				
		23				
		24				
		25				
		26				
		27				
		28				
		29				
		30				
		31				

RE= REEXTRACTED

S.R.= PERCENT SURROGATE RECOVERY

ND= NOT DETECTED

P.Q.C.= PASS Q.C.

B. MATRIX SPIKE AND SURROGATE ADDITIONS

Accuracy and matrix biases are monitored using spiked samples and where possible, surrogate additions. It is standard policy throughout the laboratory to prepare and analyze at least one matrix spike for each batch of 20 samples, for each matrix type within the batch, or as specified by state/project requirements.

Surrogate spiking compounds (if available), are added to and analyzed for, with every sample. A measured amount of spike/surrogate concentration is added to the sample before extraction of preparation. Surrogate spiking is utilized for GC and GC/MS analyses only.

C. DUPLICATE SAMPLE ANALYSIS

Precision is assessed by result comparison of a sample prepared and analyzed in duplicate. It is standard policy throughout the laboratory to prepare and analyze at least one duplicate sample for each batch of 20 samples and matrix type within the batch, or as specified by state/project requirements.

D. STANDARDS

The term standard shall apply to any analyte solution of known concentration which is traceable to a certified reference material. This includes calibration standards, spiking solutions, and laboratory control samples. Claims of traceability establishes the accuracy of measurements. Therefore, maintaining standard traceability is critical to the achievement of known and defensible data quality.

To establish traceability, all purchased reference materials (neat and stock solutions) are recorded into section-specific standard log books when received.

All entries and PACE standard labels contain a unique PACE ID number, date received, date opened, and expiration date. Log book entries also include the manufacturer's lot number, certified purity, and storage location. Subsequent preparations of stock, intermediate, and working solutions are also recorded in the standard log books. These entries must include all discrete measurements made during a preparation, parent materials, solvent used, and a PACE ID number.

Exhibit 20 illustrates a standard log book entry. Standard Operating Procedure for standards preparation contains further instructions for assigning unique ID numbers, proper syringe technique, shelf life of standards, and good laboratory practices.

Labeling: The standard vial should have a reference label (covered with cellophane tape) with the following information:

1 - Standard
2 - Name of Standard
3 - Prep. Date
4 - Prep. Personnel Initials
5 - Solvent

Certified reference standards from the EPA Repository are used for calibration or laboratory control standards in many organic analyses. Reference standards may also be purchased from approved commercial vendors. Currently approved vendors for organic reference standards are Ultra-Scientific, Supelco, Chem-Service, Inc., and Aldrich Chemical Company, Inc. Inorganic standards are purchased from major scientific supply companies (Fisher, American Scientific, and VWR). Certificates of analyses are requested with each purchase.

E. METHOD DETECTION LIMIT

The method detection limit (MDL) is defined as the minimum substance concentration that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero. In general, the protocol described in Appendix B to 40CFR 136 (Federal Register, Vol. 49, No. 209, 10/26/84) is used to establish MDL's.

For GC/MS analyses and organochlorine pesticides by GC/EDC, the MDL has been determined according to EPA Contract Required Detection Limits (CRDL) as established for the Contract Laboratory Program. The MDL's for other organic analyses are set according to industry standards, client requirements, and instrument/method limitations. The MDL is validated using prepared standard solutions analyzed at detection limit concentrations.

The metals analyses MDL's correspond to instrument detection limits, and are established in the following manner: A standard solution of analyte in laboratory pure water with a concentration of 3-5 times the estimated instrument detection limit is analyzed seven consecutive times. The MDL is set at 3 times the standard deviation of the seven consecutive measurements.

EXHIBIT 20

NEAT STANDARDS:

NAME: Acephate CODE # Acephate-1

OTHER NAMES: Methamidophos

BRAND: Chem Service WARNING: POISON

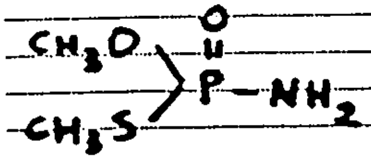
CAT. NO: PS-738

LOT NO: 30-13 LOCATION: Fr. # 2

PURITY: 98% Rack # 1

EXP. DATE: 9-90 position # 23

RECEIV. DATE:



Solvent used: Acetone

Source:

purity:

Lot #:

GC Extraction

DILUTIONS:

CODE # Acephate-D1

STOCK SOLUTIONS AND STANDARDS

STD #	CONC. (PPM)	SOLVENT	PREP. DATE	LOCATION
# 502	2,000 ppm	Acetone	3-1-89	Fr. #1, Rack #5
# 503	D.SM. 80 ppm	Hexane	3-2-89	Fr. #1, Rack #7
# 503 A	40 ppm	•	•	•
# 503 B	60 ppm	•	•	•
# 503 C	100 ppm	•	•	•

GC Extraction

For general (wet) chemistry methods, the MDL is established using a calibration standard analyzed at doubled dilutions until it becomes impossible to distinguish an instrument response for the analyte. The MDL is set at the lowest observable standard concentration.

F. CONTROL CHARTS

Control charts monitor daily variations in precision and accuracy of routine analysis and detect variation trends. QC charts are constructed from performance data of the complete analytical method. Control chart construction requires initial data to establish the mean and range of measurements. Currently, spikes, spike duplicates, RPD's and external check sample values are charted.

G. LABORATORY CONTROL SAMPLES

EPA quality control check samples are analyzed at least once per week, and when new calibrations are performed. They provide a means of assessing the accuracy and precision of a measurement system's performance. Parameters of interest that initially fall outside of QC acceptance criteria are compared against a prepared EPA QC check sample. If laboratory performance for the parameter is found to be out of control, then necessary corrective actions are implemented.

XII. PERFORMANCE AND SYSTEM AUDITS

A. PACE's INTERNAL SYSTEM AUDITS

1. All records, logs, and data files are routinely audited for completeness, accuracy, and adherence to standard operating procedures by an on-site auditing team. Audit team members generally include Corporate Vice-Presidents and Regional Directors. Several random project files are evaluated quarterly for compliance to procedure throughout the analytical process (i.e., from sample receipt through the final report). Supervisors, QC managers, and lab analysts routinely check all records for the same criteria.

2. System Audits:

   PACE is audited as required by regulatory agencies to maintain laboratory certifications, and by various commercial clients with laboratory auditing programs. These audits include audits by USEPA, USATHAMA, AIHA, and other appropriate federal, state and private agencies.

3. Performance Audits:

   a. USEPA Performance Evaluation Studies - PACE participates in the EPA semi-annual drinking water (WS Series) and semi-annual wastewater (WP Series) performance evaluation studies (four studies per year).

   b. PACE participates in various client sponsored performance evaluations by analyzing QC samples prepared and submitted by commercial clients in conjunction with their own QA program.

   c. Several government proficiency samples are analyzed annually to maintain various laboratory certifications (Exhibit 21).

   d. PACE regional offices are provided blind QC check samples quarterly.

4. Total Quality System Audit:

   The Corporate Quality Office performs a yearly on-site audit at each regional facility. Examples of the forms used as shown in Exhibit 22.

pace. laboratories, inc.

EXHIBIT 21

CONTRACTS AND CERTIFICATIONS

- ✔ U.S. Environmental Protection Agency Contract Laboratory (CLP) - 3 Facilities
  MN, KS, NY
- ✔ U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Certification
  MN
- ✔ Department of Energy Hazardous Waste Remedial Action Program (HAZWRAP) Certification
  NY
- ✔ American Industrial Hygiene Association (AIHA) Laboratory Accreditation - 2 Facilities
  MN, NC
- ✔ Contracted as an Analytical Support Laboratory for Minnesota Superfund Projects
  MN
- ✔ Accreditation in the National Voluntary Laboratory Accreditation Program (NVLAP) for Bulk Asbestos Analysis
  MN, NCA, FL
- ✔ Successfully Audited by the Missouri River Division of the U.S. Army Corps of Engineers
  NCA, FL
- ✔ Successful Participation in the National Institute for Occupational Safety and Health (NIOSH) Proficiency in Analytical Testing (PAT) Program
  MN
- ✔ Alabama Drinking Water Certification
  FL
- ✔ California Air Resources Board Certification for Emissions Monitoring
  NCA, MN
- ✔ California Drinking Water Certification
  NCA
- ✔ California Hazardous and Toxic Waste Certification - 3 Facilities
  NCA, SCA, MN
- ✔ California Pesticide Analysis Certification
  NCA
- ✔ Connecticut Laboratory Certification
  NY
- ✔ Florida Drinking Water Certification - 3 Facilities
  FLA, MN, NY (pending)
- ✔ Florida Environmental Laboratory Certification - with Approved Generic Quality Assurance Plan
  FL, MN, NY (pending)
- ✔ Iowa Drinking Water Certification
  IA, FL
- ✔ Kansas Drinking Water Certification
  KS, MN
- ✔ Kansas Solid & Hazardous Waste Certification
  KS, MN
- ✔ Minnesota Drinking Water Certification for Microbiological Analysis
  MN
- ✔ New Jersey Dept. of Environmental Protection Contract Laboratory for Environmental Analysis
  NY
- ✔ New Jersey Laboratory Certification
  NY
- ✔ New York Drinking Water Analysis Certification - 2 Facilities
  MN, NY
- ✔ New York Environmental Laboratory Certification - 2 Facilities
  MN, NY

EXHIBIT 21
(Continued)

- ✓ **North Carolina Drinking Water Certification**
  NC, FL
- ✓ **North Carolina Wastewater Certification**
  NC, FL
- ✓ **North Carolina Biological Toxicity Certification**
  NC
- ✓ **South Carolina Laboratory Certification - 2 Facilities**
  NC, FL
- ✓ **Tennessee Drinking Water Certification**
  NC
- ✓ **Virginia Drinking Water Certification**
  NC
- ✓ **Virginia Wastewater Certification**
  NC
- ✓ **Wisconsin Drinking Water Certification**
  MN
- ✓ **Wisconsin Environmental Laboratory Certification**
  MN

EXHIBIT 22

RATING SCALE:

(Doc. 349 - 27-31)

THE FOLLOWING SCALE MAY BE USED FOR ANY APPLICABLE AREA

1) UNSATISFACTORY Performance below acceptable level. Expected results have not been achieved.	2) PROVISIONAL Some requirements satisfied but needs improvement in several areas.	3) FULLY ADEQUATE All requirements met. Satisfied all standards and achieved expected results.	4) SUPERIOR Results above job standards. Achieved more than expected results.	5) DISTINGUISHED Results far in excess of standards extraordinary and exceptional results.

SECTION	RESULTS/STANDARDS OF PERFORMANCE	RATING					YES	NO	COMMENTS/RECOMMENDATIONS
		1	2	3	4	5			
Quality Control	SOP's: 1. Quality Control Manager aware of and familiar with Standard Operating Procedures for the company.								
	2. Documented Standard Operating Procedures for the Quality Control department.								
	3. Standard Operating Procedures for program areas on file in the Quality Control office.								
	4. Documented procedures for all Quality Control activities are displayed in the appropriate area.								
	5. Standard Operating Procedures updated regularly for analytical areas.								
	6. Analytical procedures updated regularly.								

SECTION	RESULTS/STANDARDS OF PERFORMANCE	RATING					YES	NO	COMMENTS/RECOMMENDATIONS
		1	2	3	4	5			
Quality Control (Cont.)	7. Analytical procedures are dated and initialed by QC Manager and Department Supervisor at time of update.								
	8. Procedure sections are updated rather than replacement of entire document.								
	<u>Staff</u>: 1. Defined roles for the Quality Control Manager, adherence to job description.								
	2. Defined roles for staff in the Quality Control department.								
	3. Staffing is adequate and staff assignments are documented.								
	<u>Administrative</u>: 1. Regularly scheduled meetings with Quality Control staff. Agenda for meetings are documented.								

SECTION	RESULTS/STANDARDS OF PERFORMANCE	RATING					YES	NO	COMMENTS/RECOMMENDATIONS
		1	2	3	4	5			
Quality Control (Cont.)	2. Regularly scheduled meetings with Analytical Department staff/managers. Agenda for meetings are documented.								
	3. Regularly scheduled meetings with Sampling and Analytical Services Division Director. Meeting agenda documented								
	<u>Control Charts/Corrective Actions</u>: 1. Quality Control charts available in Quality Control area for all analytical procedures.								
	2. Control chart acceptance limits are based upon current data. - Specify "current" date range of control charts/last update								
	- Specify frequency of acceptance limits updating								
	3. Preventative maintenance records for all instruments present in Quality Control.								

SECTION	RESULTS/STANDARDS OF PERFORMANCE	RATING					YES	NO	COMMENTS/RECOMMENDATIONS
		1	2	3	4	5			
Quality Control (Cont.)	4. Provision of quality control charts are in on a timely manner to analytical threats.								
	5. Record of corrective action taken when out-of-control situations are noted.								
	<u>QC Samples</u>: 1. Records of performance evaluations on blind PE samples in-house kept in Quality Control area.								
	2. Records of performance on quality control samples (MS, MSD, LCS, surrogates, & blanks) are available in Quality Control department.								
	3. Record of standard traceability to NIST present in the Quality Control area.								
	4. Standards are labeled with purchase date, date opened, expiration date, analyst initials.								

SECTION	RESULTS/STANDARDS OF PERFORMANCE	RATING					YES	NO	COMMENTS/RECOMMENDATIONS
		1	2	3	4	5			
Quality Control (Cont.)	<u>Sample Check-In</u>: 1. Chain-of-custody records kept on file when necessary, in the Quality Control area.								
	2. Sample check-in documentation present in sample check-in area.								

B. TRAINING AND TECHNICAL REVIEW

PACE considers competent, well-trained personnel to be a key to successful production of valid and reliable data. An extensive training and technical review program is in place at PACE, Inc. It includes:

1. Training Plans

The type and schedule of training required for each new or transferred employee is determined individually. A training plan is established to reflect individual and general training needs.

2. Training Classes

All sections conduct regularly scheduled training sessions specific to their needs.

Audio/visual training programs and open learning texts are available for use by all personnel.

Other laboratory QA and general training classes are offered periodically.

3. Technical Review Program

All employees are subject to technical reviews with their supervisor. The technical review assesses an individual's training progress and technical development and provides an opportunity to redirect the training plan accordingly to comprehensively cover further developmental needs. The schedule for technical reviews is:

a. New hire or transfer to new position/responsibilities: 6 months, 1 year.

b. After 1 year in same position/responsibilities: annually.

4. Support Programs

Attendance at outside seminars, classes, etc., is highly encouraged. PACE participates in many of these throughout the year. In-house seminars are presented by employees for employee bi-monthly meetings. Various topics are covered, including regulatory items and information from attendance at outside seminars. The PACE in-house library contains current periodicals and journals pertinent to the environmental industry and analytical chemistry, in addition to reference books, text books, and regulatory publications.

XIII. PREVENTIVE MAINTENANCE

PACE maintains service contracts for most major analytical equipment including all chromatography instruments, balances, atomic absorption, and inductively coupled plasma instruments. All instruments and equipment receive routine preventive maintenance, which is recorded in instrument specific maintenance logs. Routine maintenance insures that all equipment is operating under optimum conditions, reducing the possibility of instrument malfunction (consequently affecting sample results). An example of an instrument maintenance log is included (Exhibit 23).

EXHIBIT 23

INSTRUMENT MAINTENANCE LOGBOOK FORM

INSTRUMENT I.D.:

DATE	MAINTENANCE ACTIVITY	NAME

XIV ASSESSMENT OF PRECISION, ACCURACY, COMPLETENESS REPRESENTATIVENESS, AND COMPARABILITY

The Quality Control Program at PACE uses precision and accuracy data to determine the acceptability of analytical results. Precision refers to result reproductibility and accuracy measures the degree of difference between observed and true values. One of every 20 analyses performed at PACE is run in duplicate (precision). Also, one of every 20 samples is spiked with a synthetic standard to assist in evaluating the accuracy of the method. Once 20 sets of precision or accuracy data have been obtained, a quality control chart is prepared. The Shewhart technique is the statistical method used to construct the charts. These quality control charts provide a quick visual means for monitoring the daily performance of the laboratory. Exhibits 24 and 25 contain examples of accuracy and precision charts along with their corresponding data sheets (Exhibits 26 and 27).

A. ACCURACY

The actual test result is compared to the theoretical result of 100% recovery and the percent recovery is calculated.

$$\% \text{ Recovery} = \frac{\text{Spiked Sample Result - Sample Result}}{\text{Spike Quantity}} \times 100$$

The percent recovery must fall within specific control limits for the results to be accepted and subsequent data validated. (See Table 2)

B. PRECISION

The results of the duplicate analyses are computed and the absolute relative percent difference (RPD) is calculated.

$$\text{RPD} = \frac{|\text{Sample Result - Duplicate Result}|}{\text{Average Result}} \times 100$$

The RPD must fall within set control limits for the results to be accepted and subsequent data validated. A one-sided distribution with zero as a target value is typical, given absolute value requirements (CLP).

C. WARNING LIMITS

Warning limits represent the 95% confidence interval and are equal to the mean value for the control sample, plus or minus two standard deviations ($\pm$ 2S). Exceeding these limits is a warning that the analytical system may be approaching an out-of-control situation, and should be inspected for possible sources of error before continuing the analysis. Analysts will inform the QC manager or the supervisor of such problems.

EXHIBIT 24

WL = 73-81
CL = 121-113

SURROGATE % RECOVERY CHART

Matrix: Soil

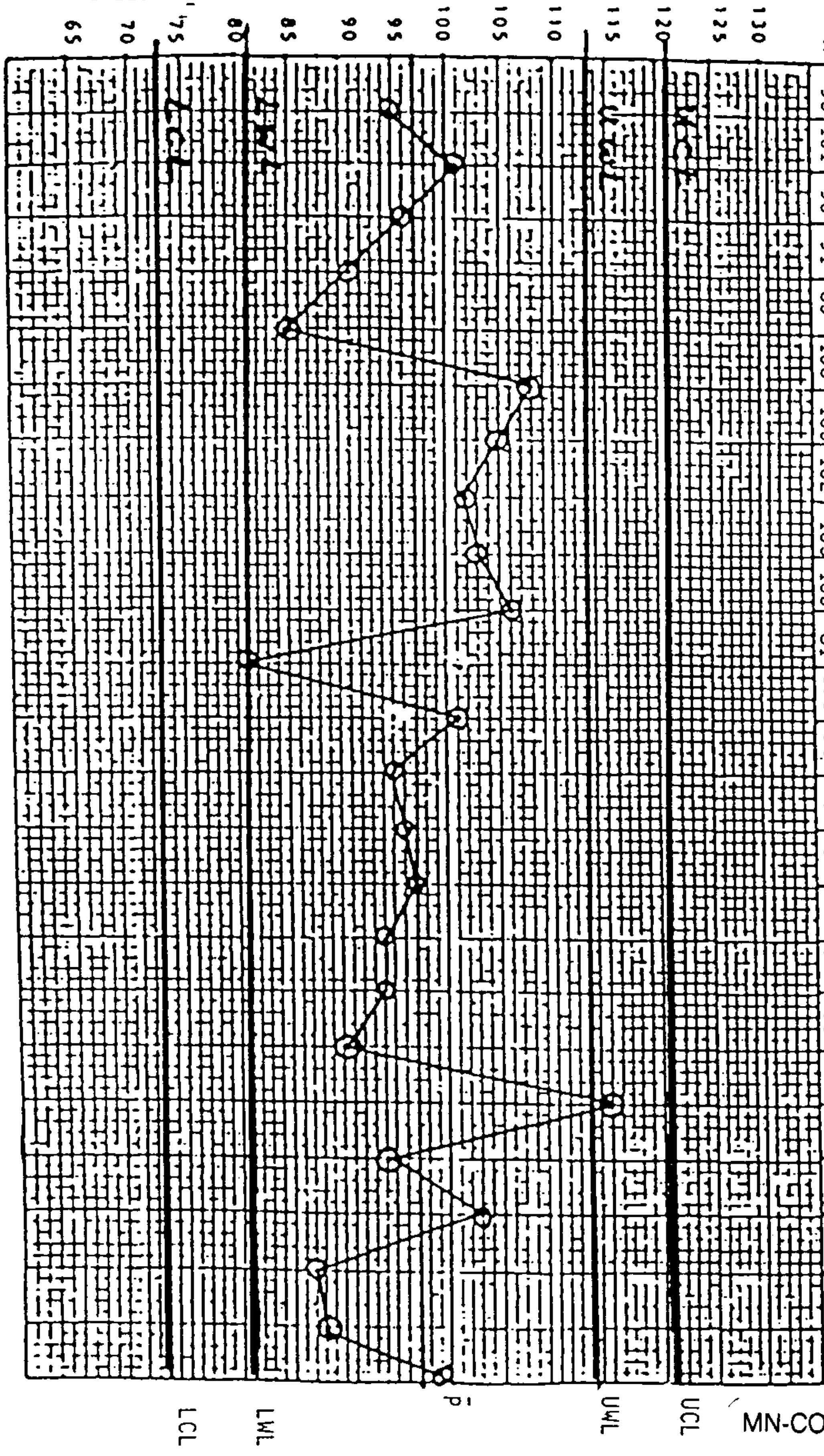
INSTRUMENT:

Average Recovery= 97%

METHOD:5030/8015 ANALYTE: Fluorobenzene

J Standard= 24

Date: 4/3-4/5



	Sample I.D #
95	71669
101	71673
96	71670
91	71671
85	71619
108	71710
105	71711
102	71712
103	71713
106	71715
81	71714
101	71721
98	71815
95	71816
94	71821
96	71670
97	71856
90	71668
115	71829
95	71824
103	71822
87	71669 SP
89	71669 SP
97	71856 SP

EXHIBIT 25

PACE PRECISION CHART

CHLORIDE IN WATER

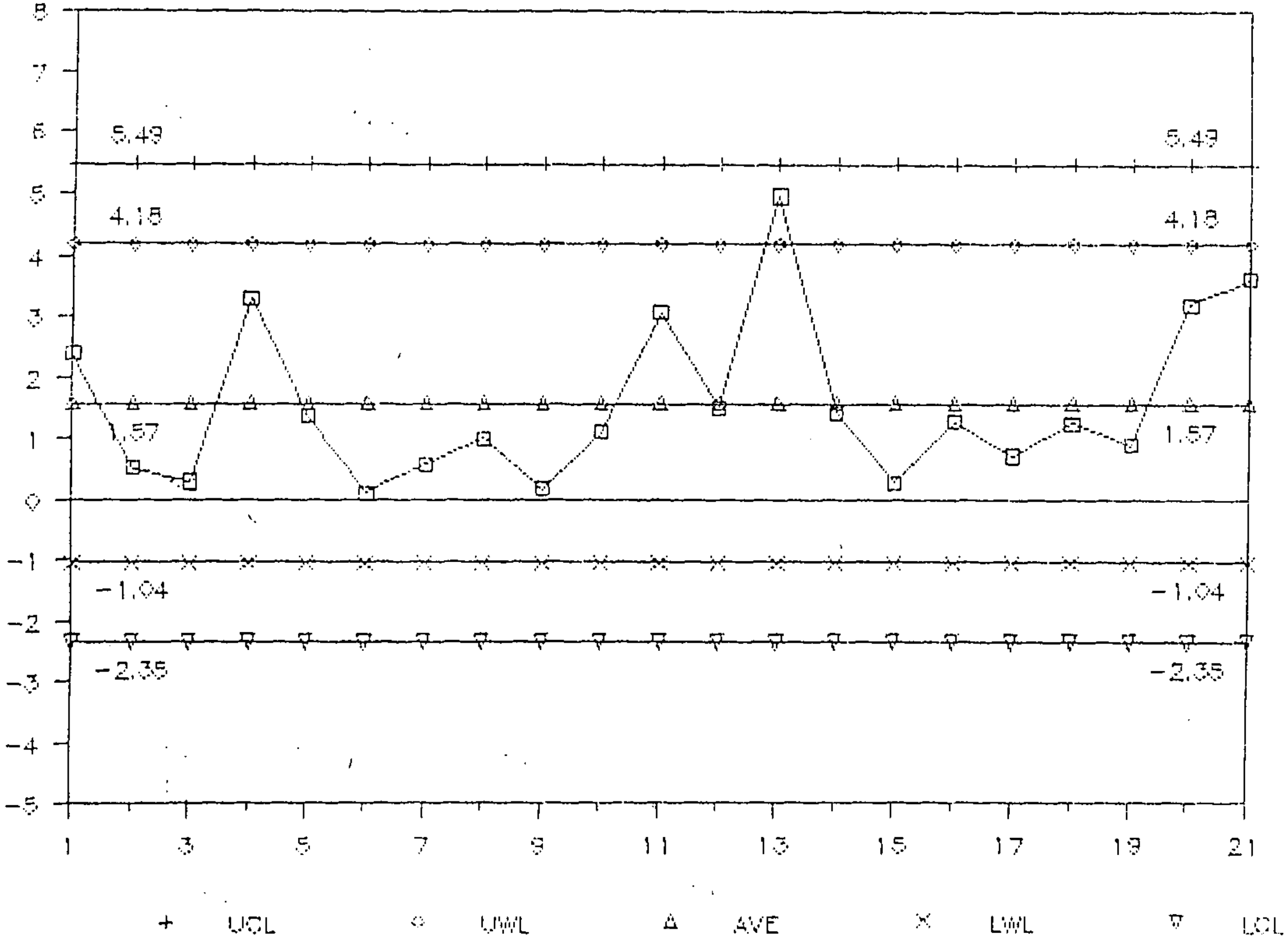


EXHIBIT 26

ANALYSIS:

RAW DATA SHEET

CLIENT NAME: ____________________
PROJECT NAME: ____________________
FILE #: ____________________
DATE COLLECTED: ____________________
DATE RECEIVED: ____________________

DATE ANALYZED ____________
ANALYZED BY: ____________
TIME: ____________
DATA REVIEWED BY: ____________
ENTERED BY: ____________

SAMPLE #	ANALYSIS			SAMPLE VOL (mls) A	RESULT OF DIL SAMPL B
	RESULTS	UNITS	COMMENTS		

A = SAMPLE VOLUME USED (mls)
B = RESULT OF DILUTED SAMPLE

EXHIBIT 27

SPIKE SUMMARY FORM

Soil Matrix TPH/BTX

Date			Benzene					Toluene					O-Xylene					TPH-L				
Y	M	D	S	SD	$\bar{P}$	R	$\bar{R}$	S	SD	$\bar{P}$	R	$\bar{R}$	S	SD	$\bar{P}$	R	$\bar{R}$	S	SD	$\bar{P}$	R	$\bar{R}$
98	4	▨																				
		▨																				
		3																				
		4	87	89		2		91	91		0		93	95		2		114	89		25	
		5	101	101		0		100	111		10		102	104		2		120	100		18	
		6	94	85		10		83	81		2		85	96		12		96	98		2	
		7																				
		▨																				
		▨																				
		10	92	101		9		120	100		18		94	92		2		75	77		3	
		11																				
		12																				
		13																				
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		25																				
		26																				
		27																				
		28																				
		▨																				
		▨																				
		31																				
			3 S_p = ±					3 S_p = ±					3 S_p = ±					3 S_p = ±				

S= Spike Recovery SD= Spike Dup. Recovery $\bar{P}$ = Average Recovery

R= Relative Deviation $\bar{R}$= Average Relative Deviation S_p= Stand. Deviation

D. CONTROL LIMITS

Control limits represent the 99% confidence interval and are equal to the mean value of the control sample, plus or minus three standard deviations (±3S). Exceeding these limits indicates that the analytical system is out-of-control. The QC manager or the supervisor shall be informed and corrective action shall be taken.

1. Method of Setting Limits

Control limits are established via statistical analysis, using QC sample results. Limits are determined for a parameter of each method as analyzed on a specific instrument.

The mean value (P) and the standard deviation (S) for each data set is calculated and the limits are set as:

Warning (WL) = P + 2S = 95% Confidence limit
Control (CL) = P + 3S = 99% Confidence limit

Where $P = \frac{X1 + X2 + X3 .... Xn}{n}$ x = Sample result

and $S = \sqrt{\frac{\Sigma(X - P)^2}{n-1}}$ n = Total # of results in set
P = mean value

The minimum number of results to be used for statistical calculation (n) is 15-20. Limits will generally be calculated from a data point set every thirty days, depending on the method. Updated limits are issued at the beginning of every month.

2. Utilization of Acceptance Limits

QC sample results must fall within the established warning limits (P ± 2S) for each parameter.

Results that fall outside of warning limits, but remain within the control limits (P ± 3S), are considered suspect. These results must be carefully examined for possible sources of error in the analysis, or justified as a matrix bias effect. All such results are recorded in a Discrepancy Report form/Corrective Action form (See Section XV).

Any three consecutive results outside of warning limits but within control limits is an out-of-control event which shall be documented and corrected.

Results that fall outside of control limits (P ± 3S) must be documented and corrective action taken.

E. COMPLETENESS

Data completeness can be quantified during data assessment. It is expected that laboratories should provide data, meeting QC acceptance criteria, for 90% or more of the requested determinations. It is incumbent for planners to identify any sample types, such as control or background locations, which require 100% completeness.

F. REPRESENTATIVENESS

Representativeness is a qualitative element that is related to the ability to collect a sample that reflects the characteristics of that part of the environment that is to be assessed. Sample representativeness is dependent on the sampling techniques used and is considered individually for each project. It is specifically addressed in each work plan.

G. COMPARABILITY

Comparability is also considered during preparation of the work plan. The objective of comparability is to ensure that results of similar activities conducted by different parties are comparable. For example, the use of EPA-approved, etc., methods and procedures ensure comparability with other data from previous or following studies.

XV. CORRECTIVE ACTION

If, as a result of audits or QC sample analyses, methods systems prove to be unsatisfactory, corrective action shall be implemented. The project manager, department manager, Quality Control manager, supervisor, and analyst may be involved in the corrective action. If previously reported data are affected by a situation requiring correction or if the corrective action impacts a project budget or schedule, the action will directly involve the project manager (and Quality Control manager).

For immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

1. Define the problem.
2. Assign responsibilities for problem investigation.
3. Investigate and determine the cause of the problem.
    a. Check all calculations
    b. Re-analyze the sample
    c. Verify the integrity of the spiking solution, laboratory control sample, or calibration standard.
    d. Check instrument and operating conditions to preclude the possibility of malfunctions or operator error.
4. Determine the corrective action(s) necessary to eliminate the problem.
5. Assign and accept responsibilities for implementing the corrective action.
6. Establish the effectiveness of the corrective action and implement the correction.
7. Verify and document that the corrective action has eliminated the problem (Exhibit #28).

    Depending upon the nature of a problem, the corrective action implemented may be formal or informal. In either case, occurrence of the problem, the corrective action employed, and verification that the problem has been eliminated must be documented.

    In addition, if the corrective action mandates the preparation of a new standard or calibration solution(s), a comparison study between the new solution versus the old solution will be performed. The results are supplied with the weekly QC submittal as verification of problem elimination.

EXHIBIT 28

CORRECTIVE ACTION

INSTRUMENT ______________

MONTH/YEAR ______________

DATE	PROBLEM	ACTION	INITIAL

XVI. QUALITY ASSURANCE REPORTS TO MANAGEMENT

A. OBJECTIVE

This section describes the methods used by PACE to store and retrieve quality assurance records and issue of appropriate reports.

B. REQUIREMENTS

Comprehensive records shall be maintained to provide evidence of the quality assurance activities. All charted QC values which indicate an out-of-control situation must be evaluated and explained. Any corrective actions and re-analysis of samples must be fully explained and documented.

C. IMPLEMENTATION

Procedures for recording all aspects of the Quality Assurance Program are written and filed.

D. REPORTS TO MANAGEMENT

Quarterly reports are provided by the Quality Control officer to the President, Vice President of Quality and Regional Director. This report addresses the quarterly quality assurance activities including details of corrective actions implemented, audit results, and QC summary information.

REFERENCES

1. Handbook for Analytical Quality Control in Water and Wastewater Laboratories, U.S. EPA 600/4-79-019, March, 1979.

2. Federal Register, 40 CFR Part 136, October 26, 1984.

3. Test Methods for Evaluating Solid Waste, U.S. EPA SW-846, September, 1987.

4. Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987.

5. Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WPCF: 16th Edition, 1985.

6. NIOSH Manual of Analytical Methods, U.S. Department of Health, Education, and Welfare; Second Edition, 1977.

7. Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079-C.

8. Methods for Chemical Analysis of Water, Wastes, EPA-600/4-79--020, 1983.

9. California Administration Code, Title 2, Chapter 30, Article II, "Criteria for Identification of Hazardous and Extremely Hazardous Wastes."

10. The Determination of Inorganic Anions in Water by Ion Chromotography - Method 300.0 Test Method, EPA-600/4-84-017. March, 1984.

11. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition, U.S. EPA, revised April, 1984.

APPENDIX J

HEALTH AND SAFETY PLAN

FORD RI/FS

CONESTOGA-ROVERS AND ASSOCIATES
SITE HEALTH & SAFETY PLAN

Fill in the blanks and attach supporting documents as necessary.

Ref#: 2853
Office: St. Paul
Anticipated start date: Fall 1990
Duration: Two Years

Written by: Jon Christofferson
Date: 8/01/90
Reviewed by:
Date:
Industrial Hygiene: Mitchell Bergner CIH
Date:
Site Engineer: J. Christofferson
Site Safety Officer: Chuck Ahrens

A. Work Location Description

1. Site Name: Ford Motor Company Twin Cities Assembly Plant

2. Location: 966 South Mississippi River Blvd., St. Paul, Minnesota

3. Site Type: HW Site ( ) Industrial (X) Active ( )
Spill ( ) Construction ( ) Inactive ( )
Other ( ) Describe

4. Status: * RI/FS in progress. This plan is for completion of RI activities and for matters related to the FS.

5. Anticipated Activities: Soil borings, well installation testing & sampling, soil gas monitoring
(See page 9)

6. Size: Site is approximately 126 acres.

7. Surrounding Population: Mississippi River is to the west. North, east and south of the site is light commercial/residential
Buildings/Homes/Industry

8. Protection of Neighboring Properties: * Action will not affect neighboring properties

9. Topography: Site is primarily roof tops and sloped parking lots. Surrounding topography is a terrace with the river bluff to the west.

10. Anticipated Weather: Fall/winter in Minnesota
(temperature etc.)

11. Limiting Weather: (by which the job will be stopped) Heavy rains or snow may affect drilling operations. Temperatures below freezing may cause work stoppage.

12. Unusual Features: * N/A

* Add additional data to the addendum if necessary

B. Hazard Description

1. Initial Site Safety Assessment Review Complete (X) Partial ( )
If partial, why? Attach Initial Review to Addendum

2. Hazard level: A( ) B( ) C( ) D(X) Unknown( )
Who determined the hazard level? How? CRA in previous studies.
Upgrade to level C will be determined by field monitoring.

If hazard level exceeds level D attach an additional sheet with explanation/justification.

3. Types of hazards:

Chemical	(X)	Inhalation	(X)	Cold Stress	( )
Biological	( )	Ingestion	(X)	Heat Stress	( )
Physical	( )	Skin Contact	(X)	Noise	( )
Radiation	( )			Confined Space Entry	( )
Oxygen Def.	( )				
Explosive	( )				

Describe

4. Source of Hazard:

(X)	Air	Describe: During drilling, Monitoring will be conducted. A higher degree of protection is not expected to be required beyond that indicated above.
(X)	Soil	Describe: During drilling operations. Protection is not expected to be beyond that selected above.
(X)	Surface Water	Describe: The Mississippi River has been sampled near the Site during prior investigations and is not expected to be any level of concern.
(X)	Groundwater	Describe: During monitoring, levels of VOCs & metals were present. These levels are not expected to be hazardous beyond the level of protection selected.
( )	Other	Describe:

5. Chemical and Physical Hazards of Concern

List the primary, identifyable, chemical and physical hazards.

Name	Concentrations (if known)	Primary Hazards	MSDS attached ?
Soil:			
cadmium	7.5 mg/kg	inhilation/digestion	NO
lead	3800 mg/kg	inhilation/digestion	NO
zinc	3500 mg/kg	inhilation/digestion	NO
ethylbenzene	100000 ug/kg	inhilation/skin contact	NO
total xylenes	980 ug/kg	inhilation/skin contact	NO
Groundwater:			
methylene chloride	230 ug/L	inhilation/skin contact	NO
1,1-dichloroethylene	43 ug/L	inhilation/skin contact	NO
benzene	510 ug/L	inhilation/skin contact	NO
ethylbenzene	3000 ug/L	inhilation/skin contact	NO

C. Personnel Protective Equipment

1. Level of Protection

Location	Job – Task	Level of Protection
	Well installation & soil borings	D
	Groundwater sampling	D
	Soil gas sampling	D
	Sampling of UST draintile sump	D
		A B C D
		A B C D
		A B C D
		A B C D
		A B C D
		A B C D
		A B C D

2. Protective Equipment

LEVEL A

Respiratory

( ) SCBA or Airline with escape bottle

( ) Other

( ) Other

Head, Eye, Ear Protection ( ) N/A

( ) Hard Hat

( ) Ear Muffs or Plugs

( ) Other

Foot Protection ( ) N/A

( ) Safety shoes

( ) Disposable Overboots

( ) Other

Clothing

( ) Fully Encapsulated Suit

( ) Chemically Resistant Splash Suit

(NA) Tyvek Coverall, Standard

(NA) Tyvek Coverall, Polyethylene

(NA) Tyvek Coverall, Saranex

( ) Coverall, other

Specify:

( ) Other

( ) Other

Hand Protection ( ) N/A

( ) Undergloves

Type:

( ) Gloves

Type:

( ) Overgloves

Type:

( ) Other

LEVEL B

Respiratory

( ) SCBA or Airline with escape bottle

( ) Full Face Resp.

Cartridge

( ) Other

( ) Other

Head, Eye, Ear Protection ( ) N/A

( ) Hard Hat

( ) Ear Muffs or Plugs

( ) Other

Foot Protection ( ) N/A

( ) Safety shoes

( ) Disposable Overboots

( ) Other

Clothing

( ) Fully Encapsulated suit

( ) Chemically Resistant Splash Suit

(NA) Tyvek Coverall, Standard

( ) Tyvek Coverall, Polyethylene

( ) Tyvek Coverall, Saranex

( ) Coverall, other

Specify:

( ) Other

( ) Other

Hand Protection ( ) N/A

( ) Undergloves

Type:

( ) Gloves

Type:

( ) Overgloves

Type:

( ) Other

2. Protective Equipment continued

LEVEL C

Respiratory

( ) Full Face Resp.

Cartridge

( ) Halfmask

Cartridge Organic Vapor, particulate

( ) Escape

Type

( ) Other

( ) Other

Head, Eye, Ear Protection ( ) N/A

( ) Hard Hat
( ) Goggles
( ) Safety Glasses w/ Sideshields
( ) Face Shield
( ) Chemical Goggles
( ) Ear Muffs or Plugs
( ) Other

Portable Eye Wash to be present.

Foot Protection ( ) N/A

( ) Safety shoes
( ) Disposable Overboots
( ) Other

Clothing ( ) N/A

(NA) Fully Encapsulated suit
( ) Chemically Resistant Splash Suit
( ) Tyvek Coverall, Standard
( ) Tyvek Coverall, Polyethylene
( ) Tyvek Coverall, Saranex
( ) Coverall, other

Specify:

( ) Other

( ) Other

Hand Protection

( ) Undergloves

Type:

( ) Gloves

Type: Standard Work Gloves

( ) Overgloves

Type:

( ) Other

LEVEL D

Respiratory (X) N/A

( ) Halfmask

Cartridge

( ) Escape

Type

( ) Other

( ) Other

Head, Eye, Ear Protection ( ) N/A

(X) Hard Hat
( ) Goggles
(X) Safety Glasses w/ Sideshields
( ) Face Shield
( ) Chemical Goggles
(X) Ear Muffs or Plugs*
( ) Other

* may be required during drilling

Foot Protection ( ) N/A

(X) Safety shoes
( ) Disposable Overboots
( ) Other

Clothing ( ) N/A

(X) Tyvek Coverall, Standard
( ) Tyvek Coverall, Polyethylene
( ) Tyvek Coverall, Saranex
( ) Coverall, other

Specify:

( ) Other

( ) Other

Hand Protection ( ) N/A

(X) Undergloves

Type: Surgical latex

(X) Gloves

Type: Cotton work gloves

( ) Overgloves

Type:

( ) Other

D. PERSONAL AIR MONITORING

Depending on the throughness of the Initial Site Survey and the hazard levels resulting from the survey, additional breathing zone air monitoring may be necessary to protect the health of site workers and verify the level of protection employees are utilizing. Applicibility of this section is subject to Industrial Hygiene review.

ADDITIONAL AIR MONITORING NECESSARY (X)

ADDITIONAL AIR MONITORING NOT NECESSARY ( )

( ) Attach employee air sampling requirements to addendum.

* HNu measurements to be taken as work proceeds to confirm appropriateness of Level D determination

E. ENVIRONMENTAL MONITORING REQUIREMENTS

Additional environmental site monitoring may or may not be necessary during the course of this investigation.

ADDITIONAL ENVIRONMENTAL MONITORING NECESSARY ( )

ADDITIONAL ENVIRONMENTAL MONITORING NOT NECESSARY (X)

	Frequency	Notes
HNU/OVA		
Combustible Gas Indicator		
Oxygen Monitor		
Colorimetric Tubes (state type)		
Other	If unknown wastes are contacted, exposure levels will have to be ascessed and changes to this plan made.	
Other		

( ) See addendum for additional notes / requirements

F. Personnel Decontamination

Attach diagram if required.

( ) Required (X) Not required

Equipment Decontamination

(X) Required ( ) Not required

If required, describe and list equipment:

Steam cleaning of drilling rig and augers prior to and after use on site. Clean augers to be used between borings for QA/QC purposes.

G. Personnel

All CRA field personnel are required to participate in training and medical management programs prior to field assignment and annually thereafter. Original copies of physical exams and training certifications are on file in the Minnesota Industrial Hygiene office.

PERSONNEL AUTHORIZED TO ENTER SITE

Name	Work Location Title/Task	Medical Current	Fit Test Current	Training Current
Rob Field		(X)	(X)	(X)
Chuck Ahrens		(X)	(X)	(X)
Jon Michels		(X)	(X)	(X)
		( )	( )	( )
		( )	( )	( )
		( )	( )	( )
		( )	( )	( )
		( )	( )	( )
		( )	( )	( )
		( )	( )	( )
		( )	( )	( )

Site Safety Coordinator ______________________________

H. Activities Covered Under This Plan

Task No.	Description	Preliminary Schedule
1.	Soil borings and sampling	On going
2.	Well installation and development	"
3.	Groundwater and surface water sampling, water levels	"
4.	Sample draintile sump at UST site	"
5.	Soil gas monitoring	"

I. Contingency Contacts

Agency	Contact	Phone #
Fire Department	City of St. Paul	911
Police Department	City of St. Paul	911
Health Department	Ron Koch	627-5146
Local Hospital		
Poison Control Center	N/A	
State Environmental Agency	J. Todd Goeks - MPCA	296-7710
EPA-Regional Office		
EPA-ERT ICOM		
Spill Contractor		
F A A		
On Site Coordinator	CRA St. Paul Office	639-0913
Site Telephone	Plant Engineering - John Kallaus	696-0585
Nearest Telephone	Plant Security	699-1321
CRA INDUSTRIAL HYGIENE	MITCHELL S. BERGNER CIH ROH	612-639-0913
Other		

J. Contingency Plans

attach additional information

ALL EMERGENCY ACTIONS ARE TO BE REPORTED TO INDUSTRIAL HYGIENE ASAP

Medical Emergency

Name of Hospital: Midway Hospital 641-5500

Address: 1700 University Ave. West Phone No.:

Name of Contact: Emergency Room 641-5700

Address: Phone No.:

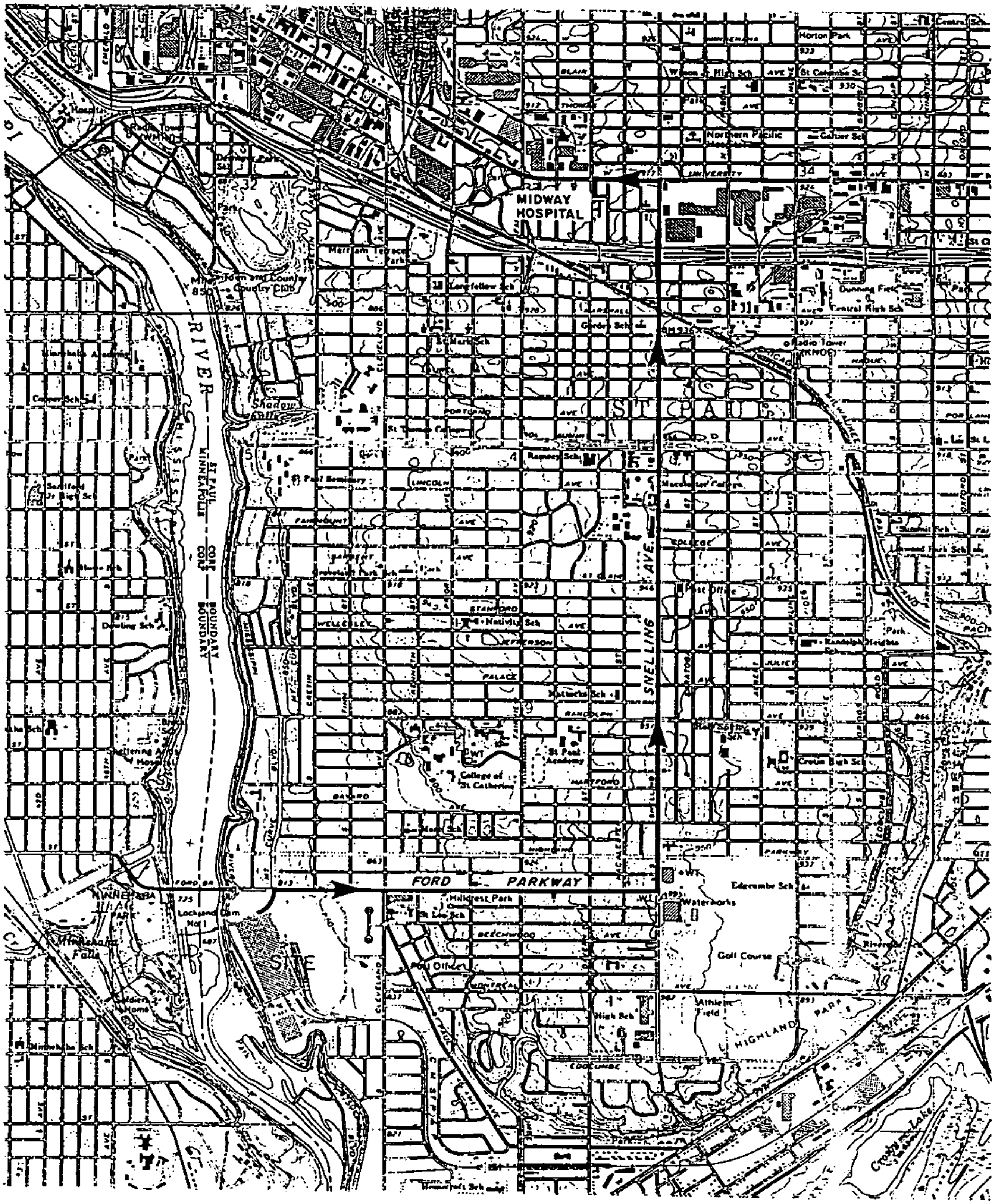
Route to Hospital (attach map) MAP ATTACHED

East on Ford Parkway to Snelling Ave. North on Snelling to University Ave.
West on University 3 blocks. Hospital on south side of University Ave.

Travel Time form Site (min.) 10

Distance to Hospital (Miles) 4.5

Name / Number 24 Hr. Ambulance Service 911



ROUTE TO HOSPITAL

NOT TO SCALE

EMERGENCY PLAN

Ford Motor Company

CRA

2853-20/08/90-M

L: Twin Cities

Minnesota Pollution Control Agency

RECEIVED
ENVIRONMENTAL
'93 JUL 12 P12:01

Jim Gibson – BAO
looks like you + plant
received copies. A rare
"success" – however,
we still have monitor-
ing to do and need to
continue to rely on
CRA to keep us in
compliance. Jerry

[illegible] (Black Stamped) by:	
RETAIN Record Copy (Red Stamped) Thru:	LIFE
Schedule Number:	

C+10

July 8, 1993

Mr. Jerome S. Amber
Principal Staff Engineer
Stationary Source Environmental
Control Office
Ford Motor Company
Commerce Park North
15201 Century Drive, Suite 608
Dearborn, Michigan 48120

Dear Mr. Amber:

RE: PLP De-listing Status, Ford Motor Company - Twin Cities Assembly Plant Site

The Minnesota Pollution Control Agency Board, at its June 22, 1993, meeting, approved the Board Item deleting Ford Motor Company-Twin Cities Assembly Plant site from the Permanent List of Priorities.

Rick Jolley and I have enjoyed working with you to complete this project. If you have any questions, please feel free to contact me at (612) 296-7710 or toll-free at 1-800-657-3864.

Sincerely,

J. Todd Goeks

J. Todd Goeks
Project Manager
Response Unit II
Site Response Section
Ground Water and Solid Waste Division

JTG:pk

cc: Jon Christofferson, Conestoga Rovers & Associates
John Kallaus, Ford Motor Company
Jim Gibbson, Ford Motor Company
Kathy Hofer, Ford Motor Company, Office of General Counsel

ARCADIS
Infrastructure, environment, buildings

ARCADIS
430 First Avenue North
Suite 720
Minneapolis
Minnesota 55401
Tel 612.339.9434
Fax 612.336.4538
www.arcadis-us.com

ENVIRONMENT

Certified Mail Receipt 7001 0320 0004 2633 4634

Ms. Shanna Schmitt and
Ms. Stacey Hendry-Van Patten
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

Date:
March 17, 2009

Contact:
Bryan Zinda

Phone:
612.373.0234

Email:
bryan.zinda@arcadis-us.com

Our ref:
MN000593.0003

Subject:
Tunnel Survey Report, Collapse Area with Buried Drums – Feature 150
Ford Twin Cities Assembly Plant, St. Paul, Minnesota
MPCA VIC Project Number VP23530
MPCA PBP Project Number PB3682

Dear Ms. Schmitt and Ms. Hendry-Van Patten:

On behalf of Ford Motor Company (Ford), ARCADIS has prepared this brief summary report describing the tunnel survey for the Collapse Area with Buried Drums – Feature 150 for the Twin Cities Assembly Plant (Site) in St. Paul, Minnesota. This survey work was completed in accordance with the requirements of the Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) Program and Petroleum Brownfields Program (PBP). The work was completed in accordance with discussions involving the MPCA.

Property Location and Description

The Site is located at 966 South Mississippi River Boulevard in St. Paul, Ramsey County, Minnesota at the approximate easting coordinate 484562.5 meters (m) and northing coordinate 4973822.5m. The Site is located in a mixed industrial, commercial, and residential use area on the eastern shore of the Mississippi River, along the east side of South Mississippi River Boulevard, south of Ford Parkway, and west of South Cleveland Avenue in St. Paul, Minnesota (see Figure 1). A network of tunnels underlies the site, and was described in the "*Phase I Environmental Site Assessment*" completed June 2007 by ARCADIS (Phase I).

Health and Safety

The survey of the tunnel was conducted according to the Health and Safety Plan (HASP) in accordance with Occupational Safety and Health Administration requirements as specified in the Code of Federal Regulations Title 29 Part 1910.120. The tunnels beneath the plant are a permitted confined space. All personnel that entered the tunnel were confined spaced trained prior to conducting the field work. Mid America Technical and Environmental Services of Maplewood, Minnesota provided the rescue teams for the work and the required permitting.

Survey of Feature 150 Collapse Area with Buried Drums

On October 3, 6 and 7, 2008 the tunnel leading to the Feature 150 was surveyed by Sunde Land Surveying (Sunde) of Bloomington, Minnesota. The tunnel location was surveyed to Ramsey County coordinate system [North American Datum of 1983 (NAD83)] and the elevation to vertical datum National Geodetic Vertical Datum of 1929 (NGVD 29). The location of the tunnel along with it terminus are presented on Figure 2.

The base of Feature 150 is located at an elevation of 711.0 feet mean sea level (MSL). The ground surface above the terminus of the tunnel is at an elevation of 772.9 feet MSL. The distance from the ground surface to the ceiling of the tunnel is approximately 56.7 feet. The end of the tunnel is located directly below the northeast corner of historical Disposal Area C, beneath the concrete parking area. A profile view of the terminus of the tunnel provided by Sunde is presented as Appendix A. Photographs of the tunnel and the location are presented in Appendix B.

Based on the location of the tunnel it is believed that the material encountered at the terminus is the consistent with material disposed of in the historical Disposal Area C. The description of the materials placed in Area C is consistent with the materials found at the end of the tunnel. As described in the Phase I the material at the terminus of the tunnel is concrete, wood chunks and paint sludge. Thus it is believed that the tunnel terminus has been filled from Disposal Area C materials and not a collapse of the tunnel.

Closing

Upon the closure of the TCAP the Feature 150 will be further evaluated. We appreciate your assistance with this project. If you have questions or need additional information, please call Bryan Zinda of ARCADIS at your convenience.

Sincerely,

ARCADIS

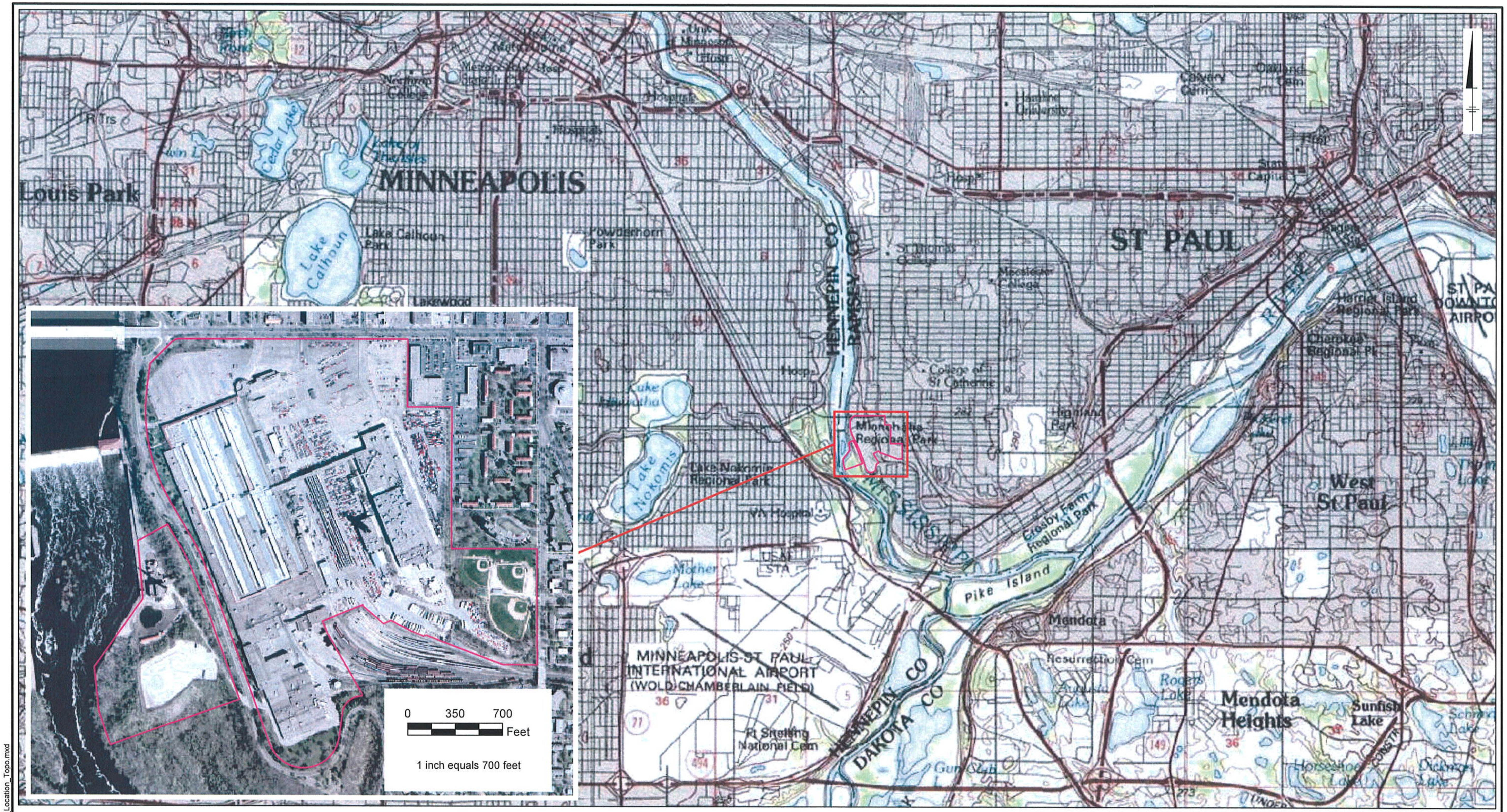
Bryan Zinda

Bryan Zinda, PE
Project Manager

Andrew Fiskness, PG
Staff Geologist

Copies:
Ms. Barbara Rusinowski, Ford Motor Company, Dearborn, Michigan
Mr. John Meyers, Ford Twin Cities Assembly Plant, St. Paul, Minnesota

Figures



LEGEND:

Ford Property Boundary

NOTES:

Imagery Source: United States Geological Survey
High Resolution Orthoimagery for the Minneapolis-St. Paul, Minnesota Urban Area

Topographic Map Source:
© 2007 National Geographic Society

0 1 2 Miles

1 inch equals 1 miles

Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Site Location / Property Layout

ARCADIS

FIGURE
1

CITY: Minneapolis, MN DB: MGress PM: BZinda
Project: MN000593
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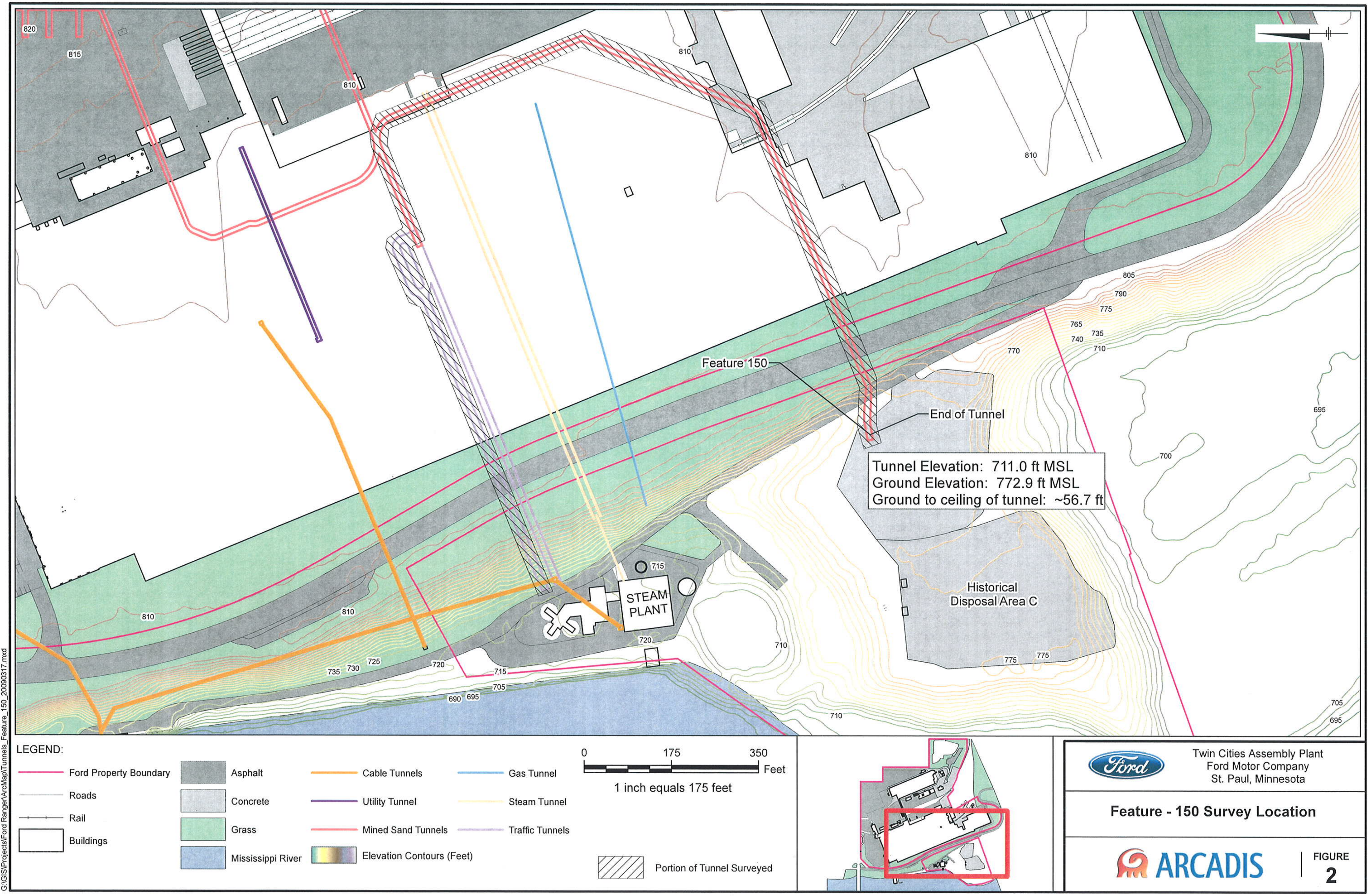


Tunnel Elevation: 711.0 ft MSL
Ground Elevation: 772.9 ft MSL
Ground to ceiling of tunnel: ~56.7 ft

Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

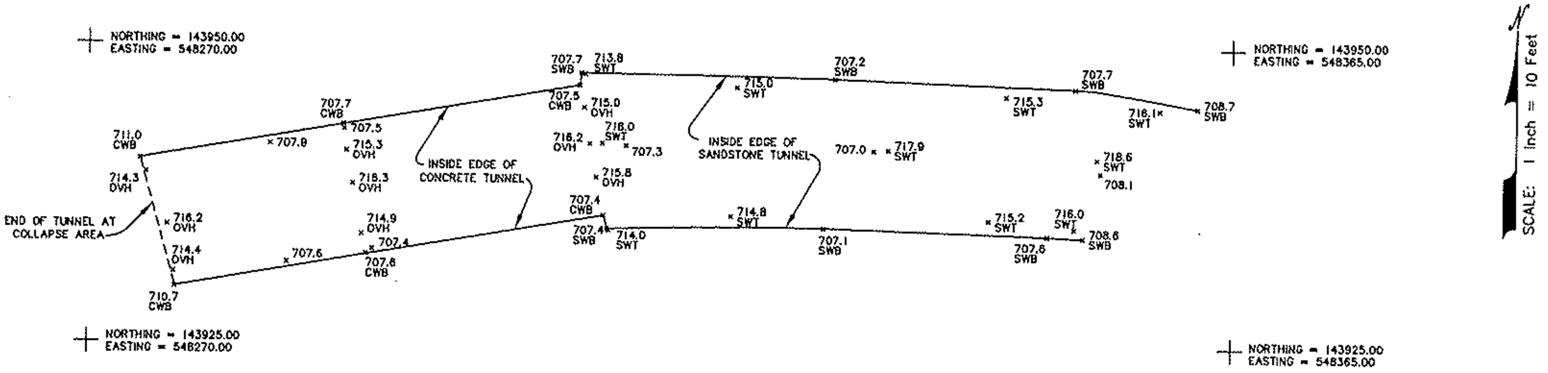
Feature - 150 Survey Location

ARCADIS

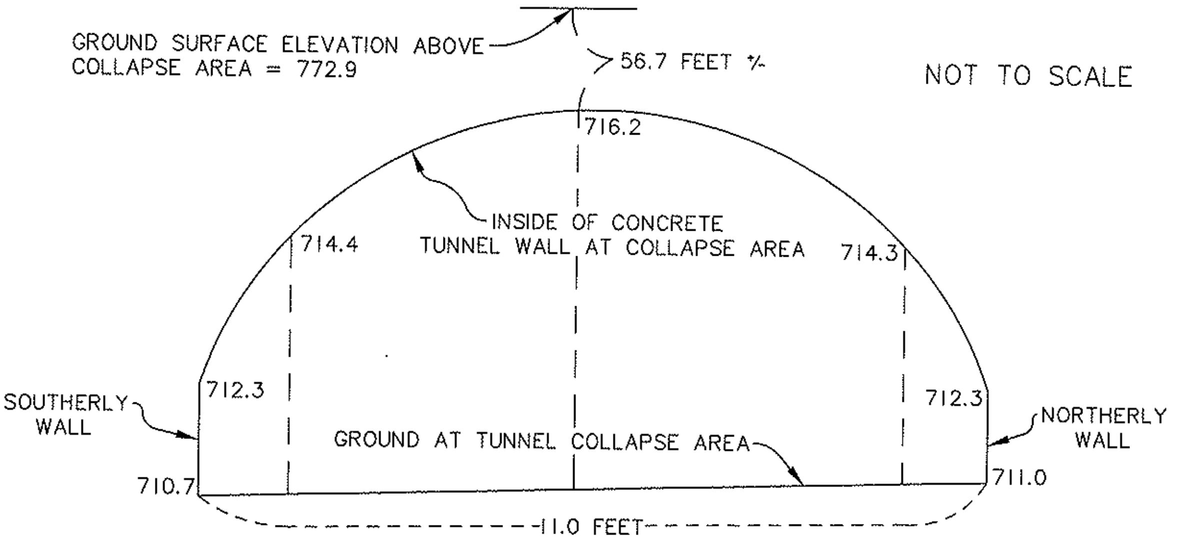
FIGURE
2

CITY: Minneapolis, MN DB: MGress PM: BZinda
Project: MN000593
G:\GIS\Projects\Ford Ranger\ArcMap\Tunnels_Feature_150_20090317.mxd

FORD MOTOR COMPANY (ST. PAUL, MINNESOTA PLANT)
TUNNEL COLLAPSE AREA SURVEY FOR:
ARCADIS U.S., INC.



PROFILE VIEW OF TUNNEL COLLAPSE AREA



LEGEND

CWB	Denotes concrete tunnel wall bottom
OVH	Denotes concrete tunnel wall top
SWB	Denotes sandstone tunnel wall bottom
SWT	Denotes sandstone tunnel wall top

NOTES

1.) Survey coordinate basis: Ramsey County (NAD83 1986)

2.) Vertical Datum: NGVD 29

I hereby certify that this sketch, plan, or report was prepared by me or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota.

Dated this 8th day of October, 2008

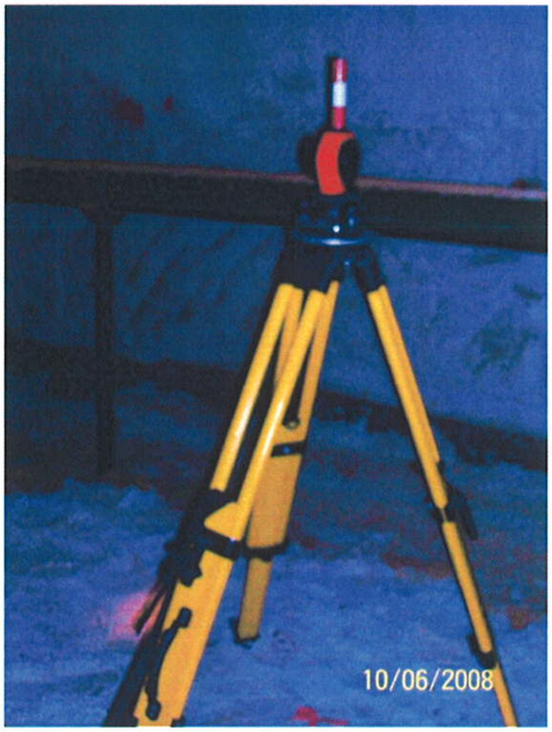
SUNDE LAND SURVEYING, LLC.

By: ______________________________

Mark S. Hanson, P.L.S. Minn. Lic. No. 15480

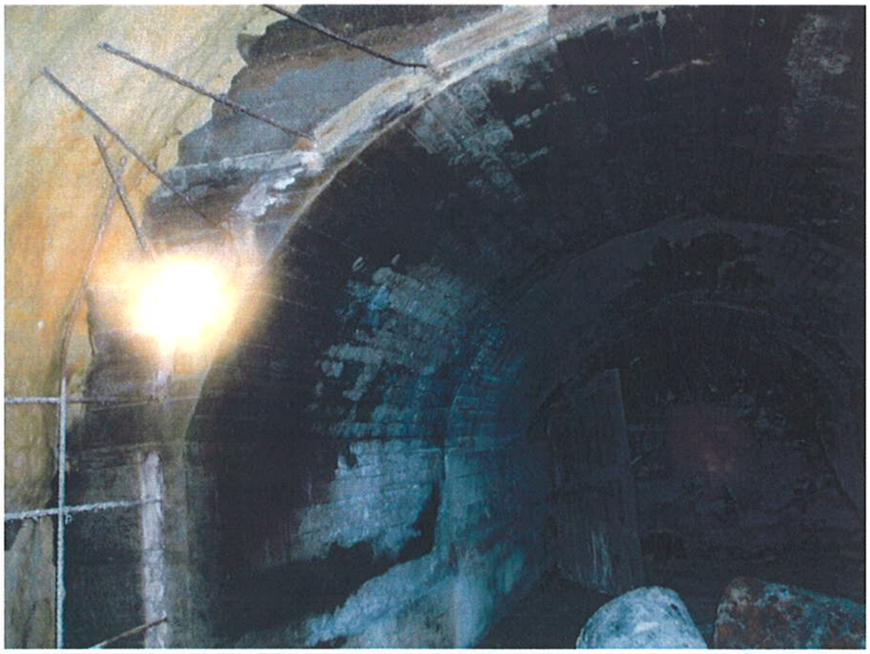
SUNDE
LAND SURVEYING
www.sunde.com
Main Office:
9001 East Bloomington Freeway (35W) • Suite 118
Bloomington, Minnesota 55420-3435
952-881-2455 (Fax: 952-888-9526)
North Office:
Brooklyn Park, Minn. 763-784-9346

2007-149 910/15 T.28, R.23, S.17 2007149003.dwg LLA

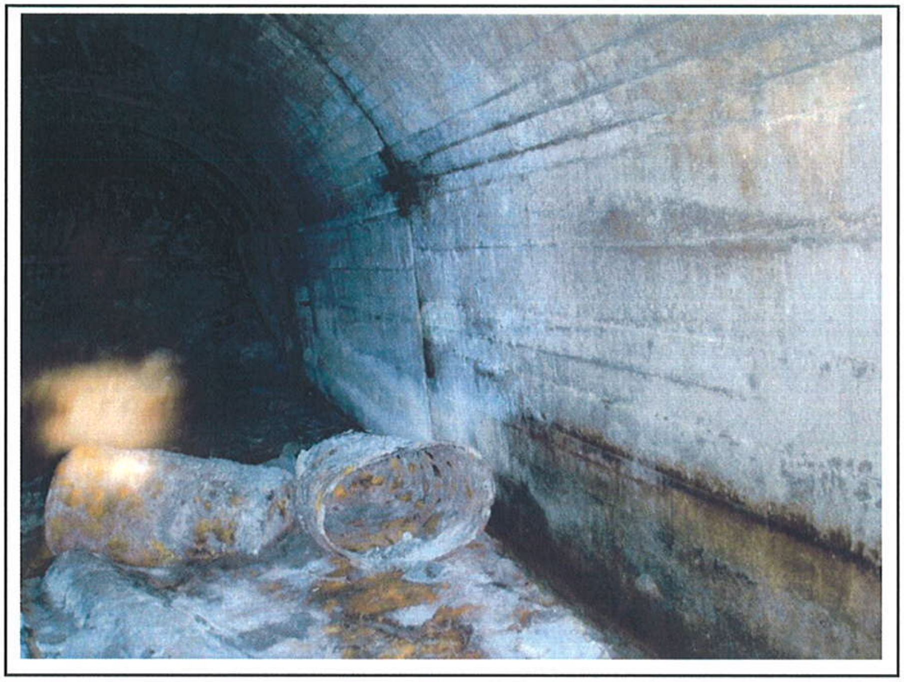


10/06/2008

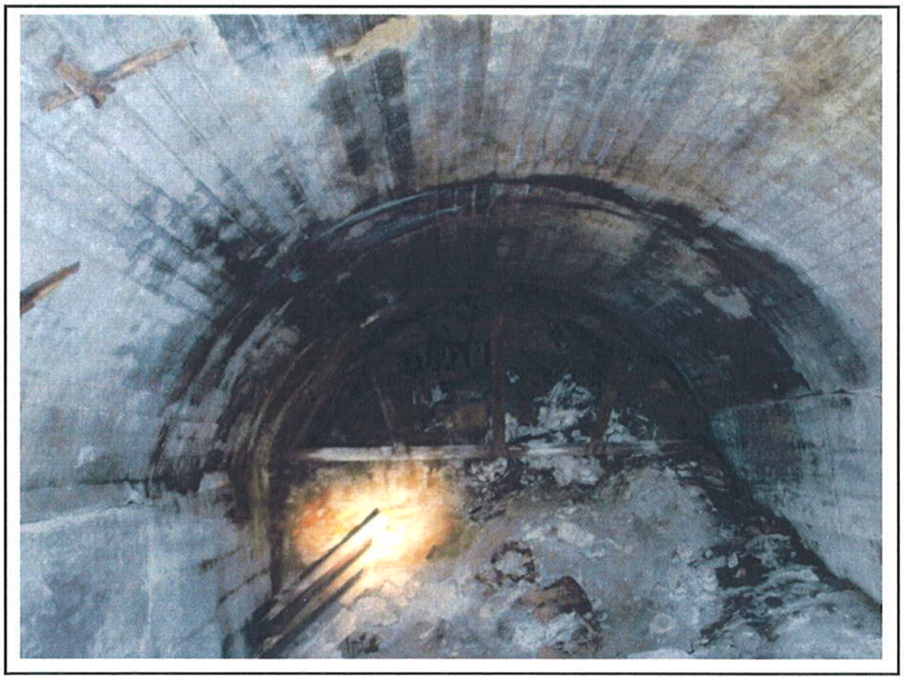
Survey equipment in tunnel.



Drum at Feature 150 at end of tunnel.

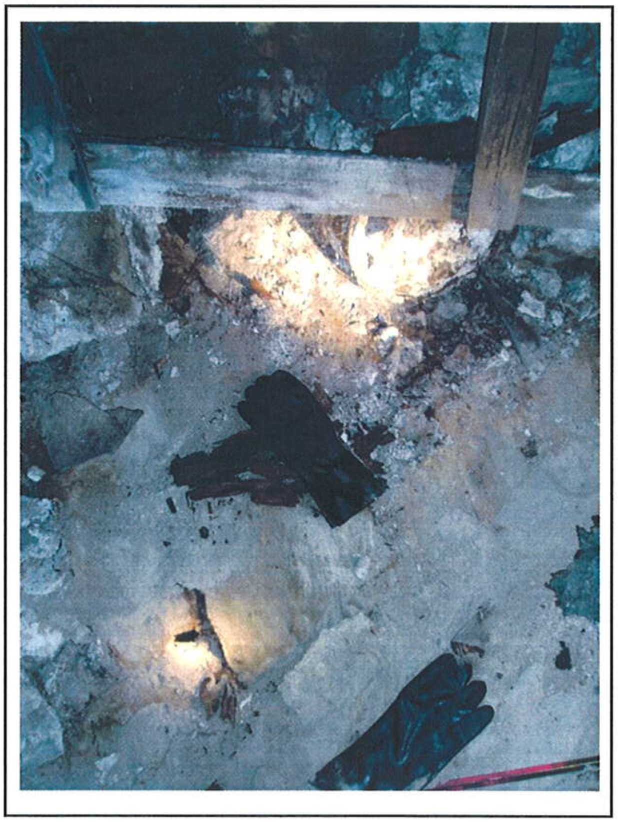


Drums at Feature 150 at the terminus of the tunnel.



Material at terminus of the tunnel.

Floor of tunnel at Feature 150 at the terminus of the tunnel.



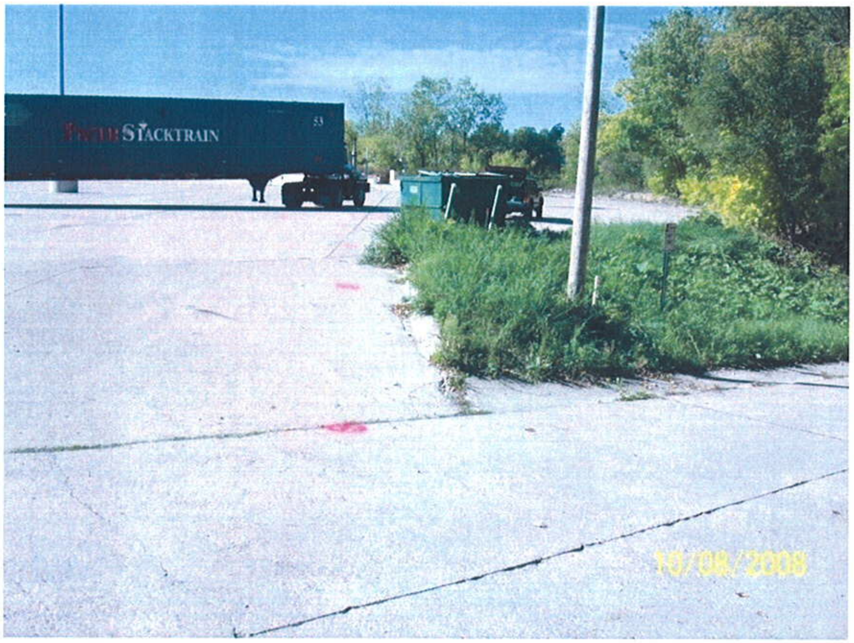
Close up of material at Feature 150 at the terminus of the tunnel.

Tunnel Survey Photos

Twin Cities Assembly Plant
(TCAP)
St. Paul, Minnesota

End of the tunnel marked in paint on the ground surface at historical Disposal Area C. Photograph looking to the southeast.

Tunnel marked in paint on the ground surface at historical Disposal Area C. Photograph looking to the southeast.



Location of south wall of tunnel marked with pink paint. Looking to the west.

ARCADIS
Infrastructure, environment, buildings

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Minneapolis
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www.arcadis-us.com

Certified Mail Receipt 7001 0320 0004 2633 4573

Ms. Shanna Schmitt and
Ms. Stacey Hendry-Van Patten
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

ENVIRONMENT

Subject:
Remedial Action Plan, 1A Tunnel Barrier Wall, Feature 150
Ford Twin Cities Assembly Plant, St. Paul, Minnesota
MPCA VIC Project Number VP23530
MPCA PBP Project Number PB3682

Date:
December 14, 2009

Contact:
Bryan Zinda

Phone:
612.373.0234

Email:
bryan.zinda@arcadis-us.com

Our ref:
MN000593.0003

Dear Ms. Schmitt and Ms. Hendry-Van Patten:

On behalf of Ford Motor Company (Ford), ARCADIS has prepared this Remedial Action Plan (RAP) for the 1A Tunnel to prevent direct contact with waste materials present near the terminus of the tunnel for the Twin Cities Assembly Plant (Site) in St. Paul, Minnesota. The Site location is depicted on Figure 1.

Background Information

The area referred to as Feature 150 at the Ford Twin Cities Assembly Plant is an accumulation of materials on the far southern end of the 1A Tunnel. On October 3, 6, and 7, 2008 the 1A Tunnel leading to Feature 150 was surveyed by Sunde Land Surveying (Sunde) of Bloomington, Minnesota. The tunnel location was surveyed to Ramsey County coordinate system [North American Datum of 1983 (NAD83)] and the elevation to vertical datum National Geodetic Vertical Datum of 1929 (NGVD 29). The location and extent of the tunnel are presented on Figure 2.

The base of Feature 150 is located at an elevation of 711.0 feet above mean sea level (MSL). The ground surface above Feature 150 is at an elevation of 772.9 feet above MSL and the distance from the ground surface to the ceiling of the tunnel is approximately 56.7 feet. Feature 150 is located directly below the northeast corner of historical Disposal Area C. Historical Disposal Area C is now a concrete parking area.

Response Action

The MPCA requested a plan for the installation of a barrier wall in the 1A Tunnel to isolate the impacted area within the tunnel at Feature 150 in a letter dated October 16, 2009. The barrier wall will be installed near the terminus of the 1A tunnel just east of the waste material. The barrier wall, in combination with the locks at the entrance of the tunnels will be sufficient to prevent direct contact with the waste materials.

The barrier will be constructed at a point in the tunnel which is several thousand feet away from the entry portal of the tunnel. Since all materials will have to be hand-carried into position, the design theme for the work is to use materials that are readily available, relatively lightweight, and easy to construct.

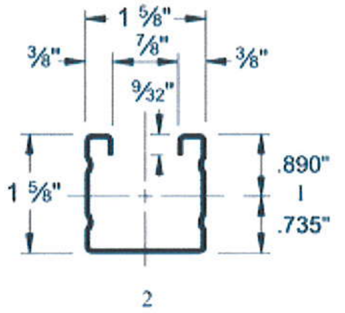
Unistrut framing is a strong proven product, is relatively lightweight and has pre-engineered connectors. The Unistrut will be used for the main skeletal framing with a chain-link fence fabric attached for additional security. The barrio wall detail is presented in Figure 3. The Unistrut framing will be secured to the tunnel walls by drilling into the sandstone rock and anchoring with a sand/cement grout.

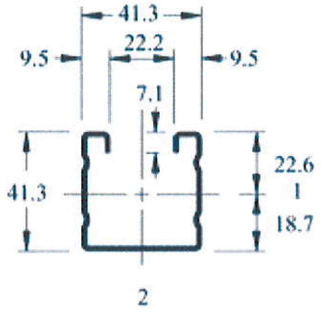
The general construction sequence will be as follows:

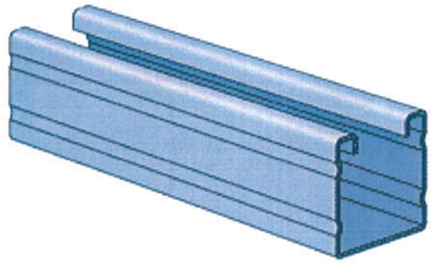
1. Bore 3-inch diameter holes in the tunnel floor to set the bottom portion of the P2000 Unistrut posts (shown below).
2. Bore matching holes in the tunnel ceiling for the upper portion of the posts to be installed.
3. Splice the upper and lower sections together with the P9200 tubing (shown below) and bolt in place.
4. Splice the horizontal sections together with the P9200 tubing (shown below) and bolt in place.
5. Install the horizontal Unistrut sections to the vertical sections using the P1045 connectors (shown below).
6. Attach the chain link fabric to the framing.
7. Mix sand/cement grout in approximate 2:1 proportions with water and fill the drilled holes in the tunnel floor with the grout mix.
8. Allow grout mix to cure before installing the chain link fabric (approximately 24 hours).

Unistrut Components

P2000 - 1-5/8" x 1-5/8", 16 Gauge, Solid



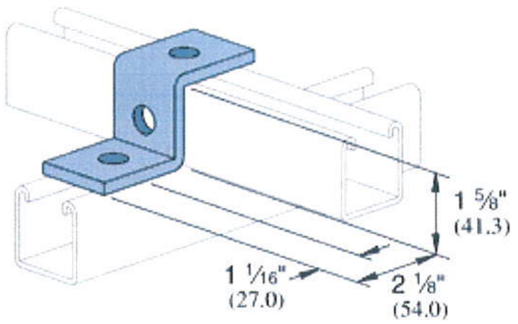




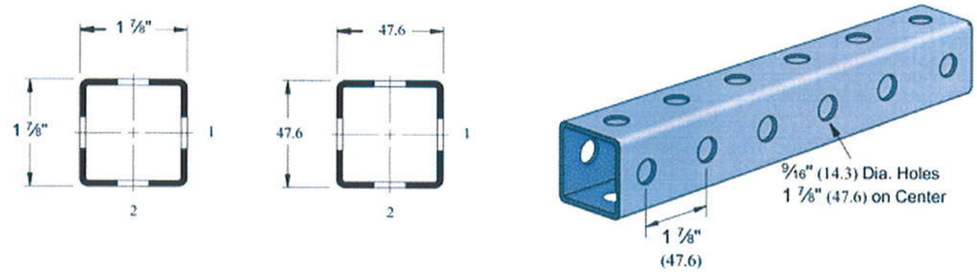
P1045 - Z Shape Fitting

Standard Dimensions:

- Hole Diameter: 9/16" (14.3mm)
- Hole Spacing (From End): 13/16" (20.6mm)
- Width: 1-5/8" (41mm)
- Thickness: 1/4" (6.4mm)



P9200 - 1 7/8" x 1 7/8" Telestrut Tubing



Schedule

Installation of the barrier wall will commence within two months of approval of the RAP by MPCA.

Closing

We appreciate the MPCA's understanding in this matter and look forward to receipt of your approval. If you have questions or need additional information, please call Bryan Zinda of ARCADIS at 612.373.0234 at your convenience.

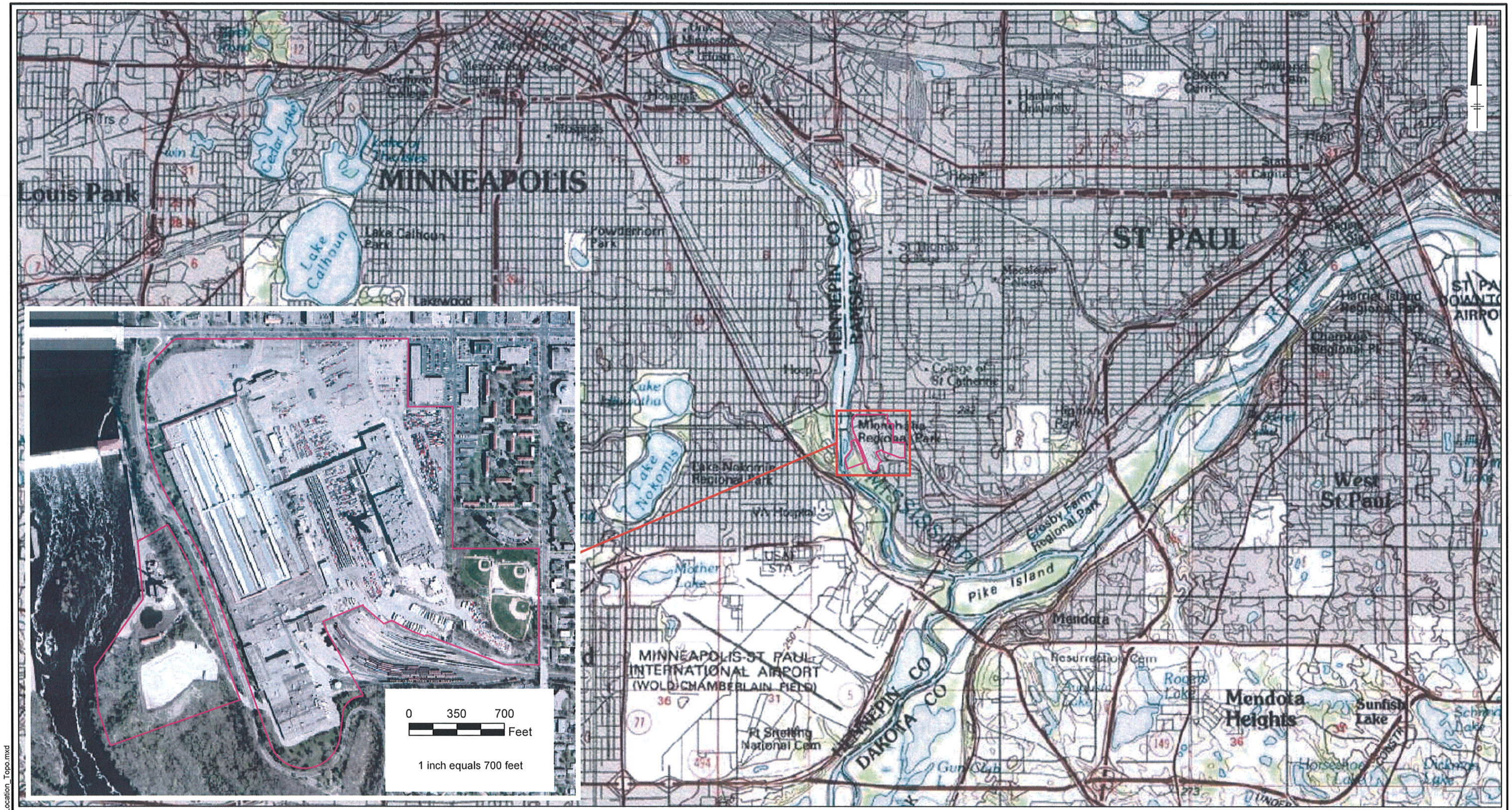
Sincerely,

ARCADIS

Bryan Zinda

Bryan Zinda, PE
Project Manager/Senior Engineer

Copies:
Ms. Barbara Rusinowski, Ford Motor Company, Dearborn, Michigan
Mr. John Meyers, Ford Twin Cities Assembly Plant, St. Paul, Minnesota



LEGEND:

Ford Property Boundary

NOTES:

Imagery Source: United States Geological Survey
High Resolution Orthoimagery for the Minneapolis-St. Paul, Minnesota Urban Area

Topographic Map Source:
© 2007 National Geographic Society

0 1 2
Miles

1 inch equals 1 miles

Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Site Location / Property Layout

ARCADIS

FIGURE
1

CITY: Minneapolis, MN DB: MGress PM: BZinda
Project: MN000593
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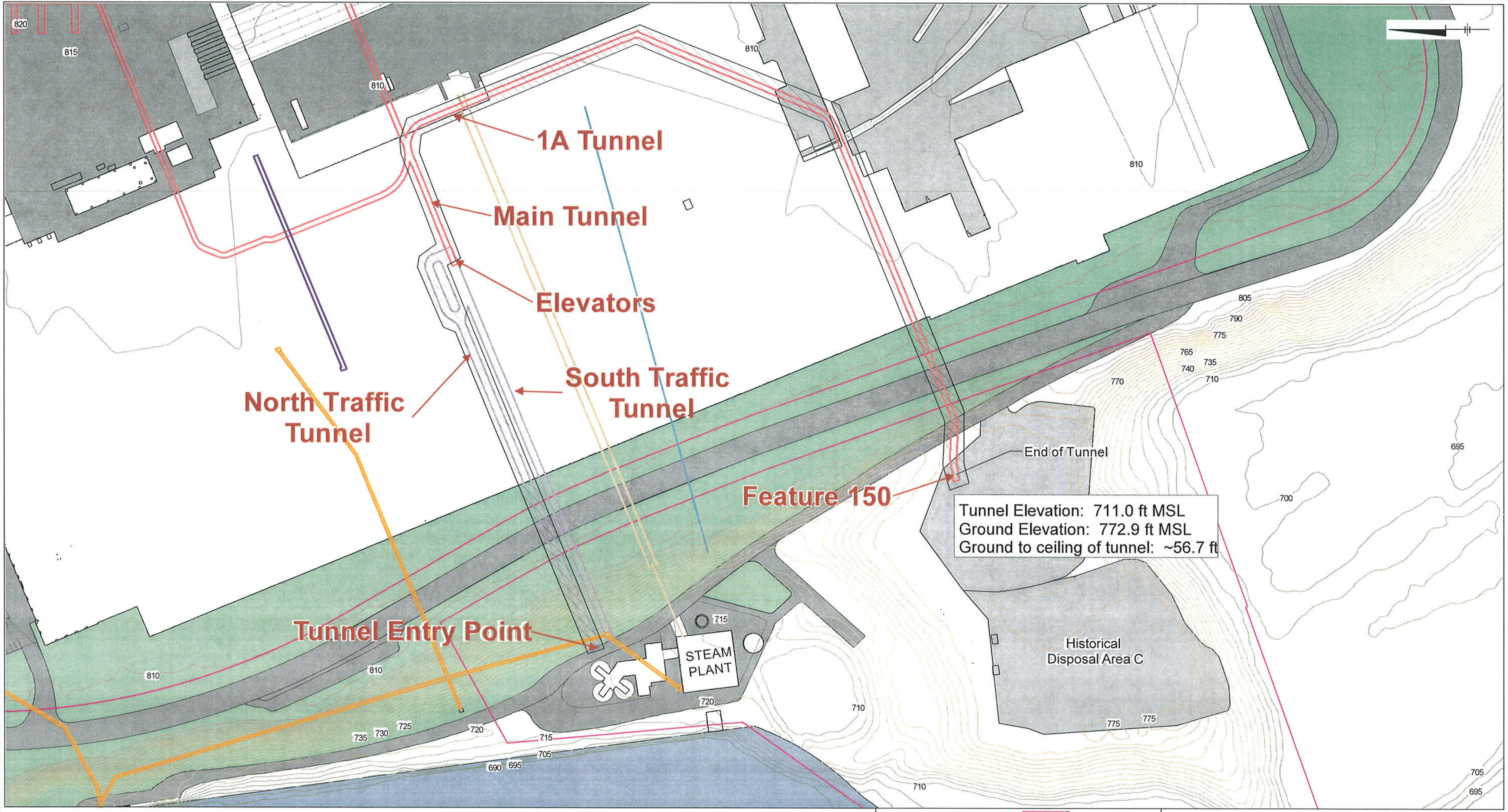


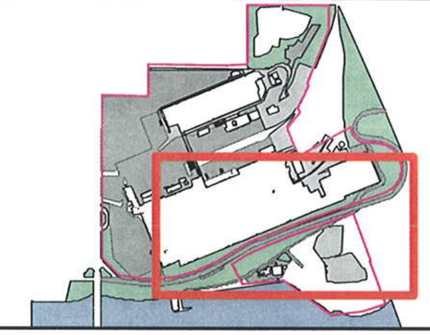
Tunnel Elevation: 711.0 ft MSL
Ground Elevation: 772.9 ft MSL
Ground to ceiling of tunnel: ~56.7 ft

LEGEND:

- Ford Property Boundary
- Roads
- Rail
- Buildings
- Asphalt
- Concrete
- Grass
- Mississippi River
- Cable Tunnels
- Utility Tunnel
- Mined Sand Tunnels
- Elevation Contours (Feet)
- Gas Tunnel
- Steam Tunnel
- Traffic Tunnels
- ▨ Portion of Tunnel Surveyed

0 175 350 Feet

1 inch = 175 feet



Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Tunnel Location Map

ARCADIS

FIGURE
2

CITY: Minneapolis, MN DB: MGress PM: BZinda
Project: MN000593
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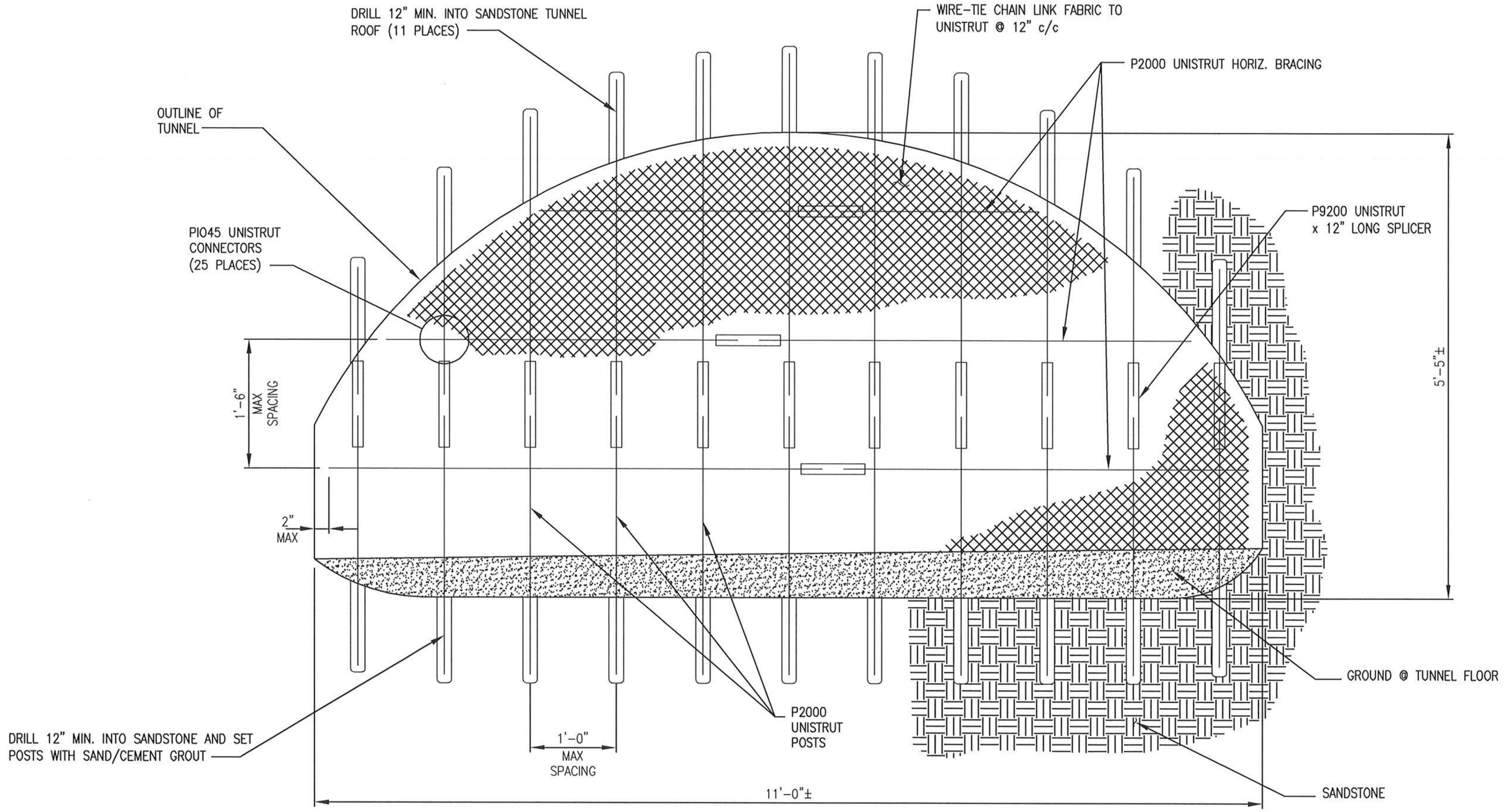


TWIN CITIES ASSEMBLY PLANT
FORD MOTOR COMPANY
ST. PAUL, MINNESOTA

1A TUNNEL BARRIER WALL DETAIL

ARCADIS

FIGURE
3

Infrastructure, environment, buildings

ARCADIS U.S., Inc.
430 First Avenue North
Suite 720
Minneapolis
Minnesota 55401
Tel 612.339.9434
Fax 612.336.4538
www.arcadis-us.com

ENVIRONMENT

Certified Mail Receipt 7001 0320 0004 2633 4399

Ms. Shanna Schmitt and
Ms. Stacey Hendry-Van Patten
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

Date:
January 11, 2011

Contact:
Bryan Zinda

Phone:
612.373.0234

Email:
bryan.zinda@arcadis-us.com

Our ref:
DE000380.0001

Subject:
Response Action Implementation Report, 1A Tunnel Barrier Wall, Feature 150
Ford Twin Cities Assembly Plant, St. Paul, Minnesota
MPCA VIC Project Number VP23530
MPCA PBP Project Number PB3682

Dear Ms. Schmitt and Ms. Hendry-Van Patten:

On behalf of Ford Motor Company (Ford), ARCADIS has prepared this Response Action Implementation Report (RAIR) for the 1A Tunnel to prevent direct contact with waste materials present near the terminus of the tunnel for the Twin Cities Assembly Plant (Site) in St. Paul, Minnesota. The Site location and property layout are depicted on Figure 1.

Background Information

The area referred to as Feature 150 at the Ford Twin Cities Assembly Plant is an accumulation of materials on the far southern end of the 1A Tunnel. On October 3, 6, and 7, 2008 the 1A Tunnel leading to Feature 150 was surveyed by Sunde Land Surveying (Sunde) of Bloomington, Minnesota. The tunnel location was surveyed to Ramsey County coordinate system [North American Datum of 1983 (NAD83)] and the elevation to vertical datum National Geodetic Vertical Datum of 1929 (NGVD 29). The location and extent of the tunnel are presented on Figure 2.

The base of Feature 150 is located at an elevation of 711.0 feet above mean sea level (MSL). The ground surface above Feature 150 is at an elevation of 772.9 feet above MSL and the distance from the ground surface to the ceiling of the tunnel is approximately 56.7 feet. Feature 150 is located directly below the northeast corner of historical Disposal Area C. Historical Disposal Area C is now a concrete parking area.

Remedial Action

A Remedial Action Plan (RAP) was submitted to the MPCA on December 14, 2009 and approved by the MPCA on February 24, 2010. The remedial action consisted of the installation of a barrier wall in the 1A Tunnel (Feature 150) to isolate the impacted area. The barrier wall was installed near the terminus of the 1A Tunnel just east of the waste material. Work was conducted on December 10, 2010 and December 13 through 15, 2010.

The barrier was constructed at Feature 150, which is several thousand feet away from the entry portal of the tunnel. All materials were hand-carried into position via a permit-required confined pace entry. Unistrut framing was utilized since it is a strong proven product, is relatively lightweight and has pre-engineered connectors. The Unistrut was used for the main skeletal framing with a chain-link fence fabric attached for additional security. The Unistrut framing was secured to the tunnel walls by drilling and anchoring into the concrete formed wall.

The general construction consisted of the following:

1. Install chain link fabric in place using existing rebar from the concrete formed wall.

2. Core into the concrete formed wall; install anchor bolts through the Unistrut and into the concrete.

3. Splice the upper and middle horizontal Unistrut sections together with the P9200 tubing and bolt in place.

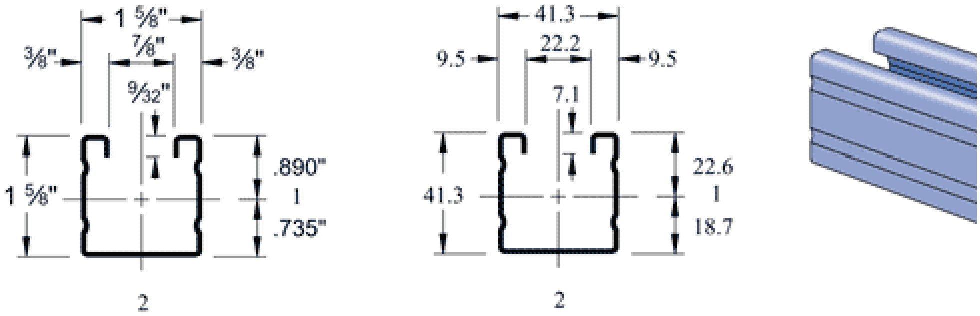
4. Fasten the vertical Unistrut sections to the horizontal sections.

5. Tie the chain link fabric to the Unistrut framing.

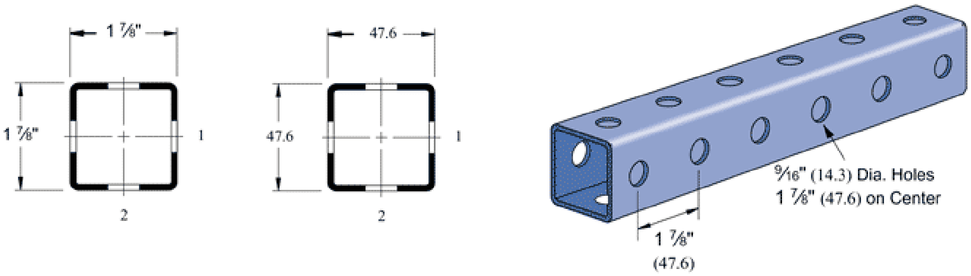
Photos of the barrier are shown on Figures 3, 4 and 5

Unistrut Components

P2000 - 1-5/8" x 1-5/8", 16 Gauge, Solid



P9200 - 1 7/8" x 1 7/8" Telestrut Tubing



Summary

The installed barrier wall, in combination with the locks at the entrance of the tunnels is sufficient to prevent direct contact with the waste materials located at the terminal end of the 1A Tunnel and by installing the barrier wall, Ford has fulfilled is obligation of preventing direct contact with the waste materials present.

If you have questions or need additional information, please call Bryan Zinda of ARCADIS at 612.373.0234 at your convenience.

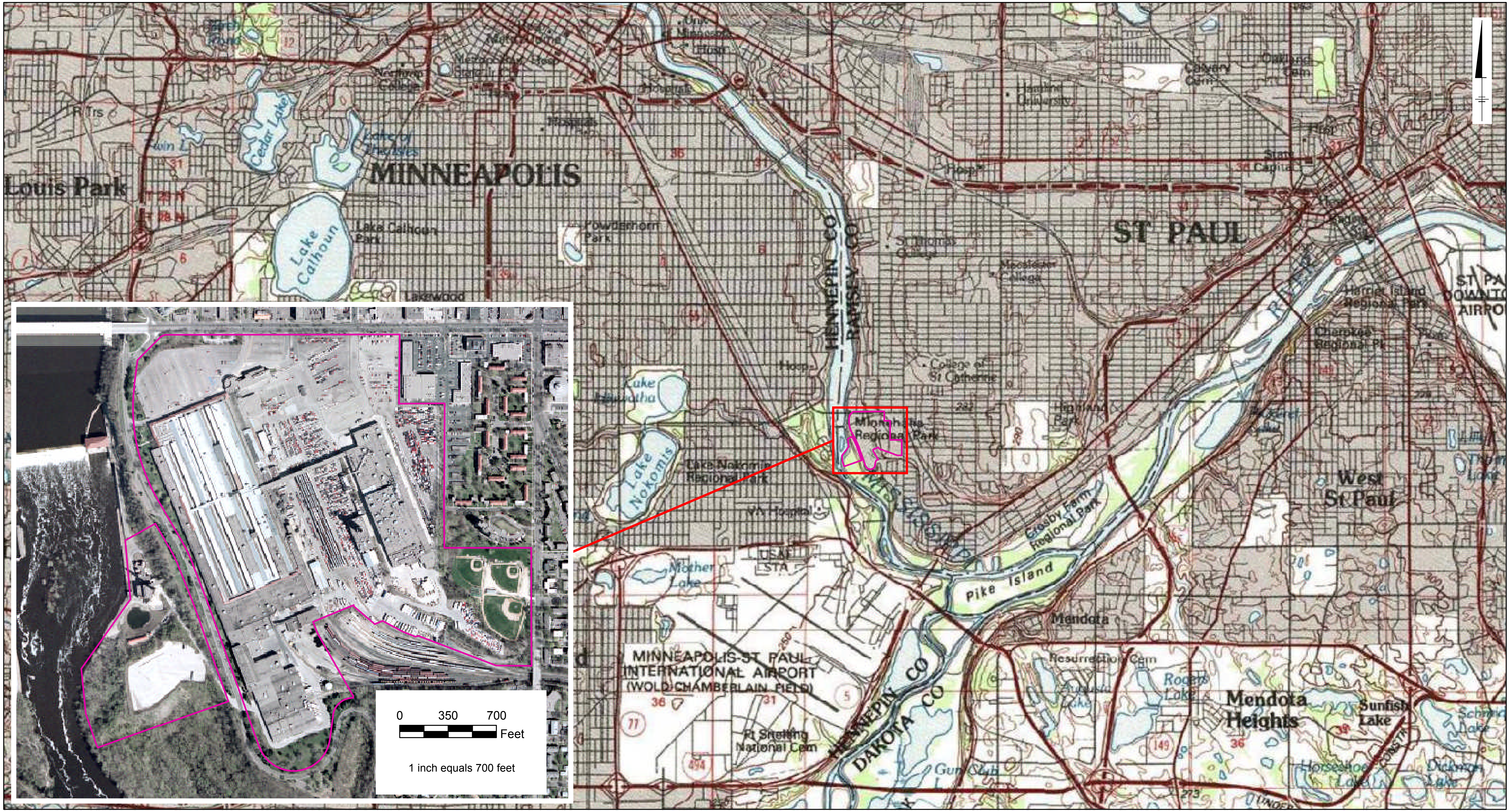
Sincerely,

ARCADIS U.S., Inc.

Bryan Zinda

Bryan Zinda, PE
Senior Engineer

Copies:
Ms. Barbara Rusinowski, Ford Motor Company, Dearborn, Michigan
Mr. John Meyers, Ford Twin Cities Assembly Plant, St. Paul, Minnesota



LEGEND:

Ford Property Boundary

NOTES:

Imagery Source: United States Geological Survey
High Resolution Orthoimagery for the Minneapolis-St. Paul, Minnesota Urban Area

Topographic Map Source:
© 2007 National Geographic Society

0 1 2
Miles

1 inch equals 1 miles

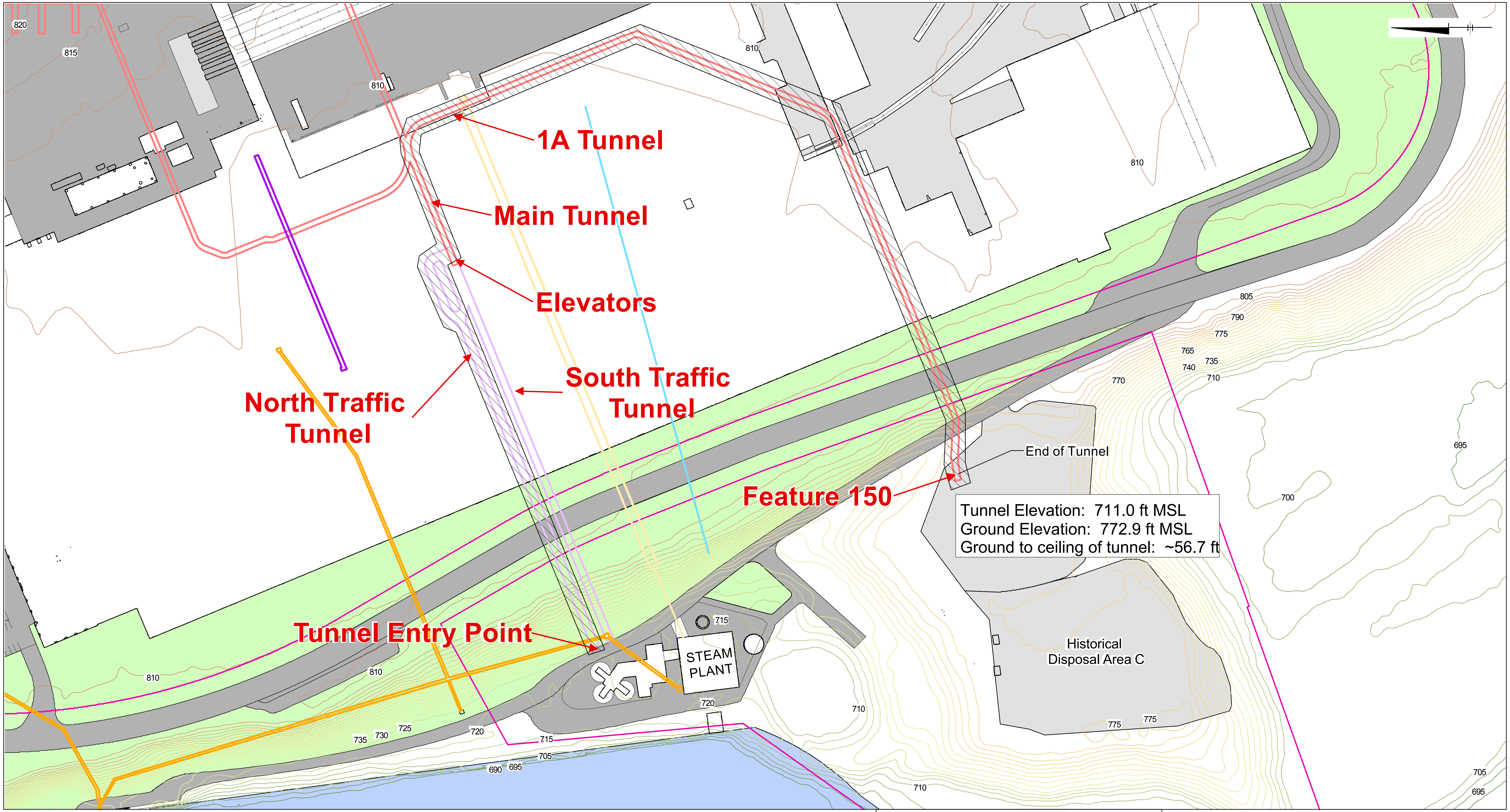
Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Site Location / Property Layout

ARCADIS

FIGURE
1

CITY: Minneapolis, MN DB: MGress PM: BZinda
Project: MN000593
G:\GIS\Projects\Ford Ranger\ArcMap\Fig1_Site_Location_Topo.mxd



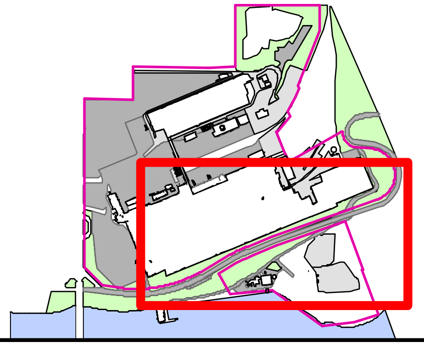
Tunnel Elevation: 711.0 ft MSL
Ground Elevation: 772.9 ft MSL
Ground to ceiling of tunnel: ~56.7 ft

LEGEND:

Ford Property Boundary	▨ Asphalt	Cable Tunnels	Gas Tunnel
Roads	▨ Concrete	Utility Tunnel	Steam Tunnel
Rail	🟩 Grass	Mined Sand Tunnels	Traffic Tunnels
☐ Buildings	🟦 Mississippi River	Elevation Contours (Feet)	▨ Portion of Tunnel Surveyed

0 175 350 Feet

1 inch = 175 feet



Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Tunnel Location Map

ARCADIS

FIGURE
2

CITY: Minneapolis, MN DB: MGress PM: BZinda
Project: MN000593
G:\GIS\Projects\Ford Ranger\ArcMap\Tunnel_Location_20090831.mxd

Figure 3.
Tunnel 1A – Barrier Wall Installation
Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Pre-Construction Photo.

Chain Link Fencing Installation.

Figure 4.
Tunnel 1A – Barrier Wall Installation
Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Close-Up of Securing the Chain Link Fencing to the Concrete Wall.

Securing the Chain Link Fencing to the Concrete Wall.

Figure 5.
Tunnel 1A – Barrier Wall Installation
Twin Cities Assembly Plant
Ford Motor Company
St. Paul, Minnesota

Unistrut Installation.

Barrier Wall Construction Completion.

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING SEALING RECORD

Minnesota Statutes, Chapter 103I

Minnesota Well and Boring Sealing No. **H** 39547

Minnesota Unique No. or W-series No. (Leave blank if not known) 4wells Unique #'s Unknown

WELL OR BORING LOCATION

County Name: Ramsey

Township Name	Township No.	Range No.	Section No.	Fraction (sm. · lg.)
St Paul	28N	23W	17	NE¼ ~~NE~~ ¼ SW¼

Date Sealed: 11/19/93

Approximate Date Well or Boring Constructed: 3wells 11/81 1well 4/90

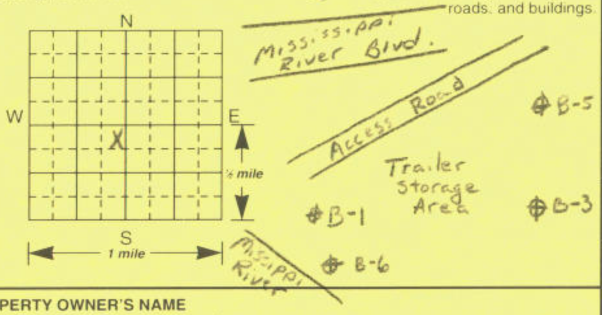
Numerical Street Address or Fire Number and City of Well or Boring Location: East of 966 S. Mississippi R. Blvd. and North and South of Current Ford. Co. Trailer Storage Area

Depth Before Sealing: 60.5, 24.5, 22.6 47 ft.

Original Depth: 60.5, 24.5, 22.6, 47 ft.

Show exact location of well or boring in section grid with "X".

Sketch map of well or boring location, showing property lines, roads, and buildings.



Static Water Level ☐ Accurate ☒ Approximate

46', 11.5', 10', 41.5' ft. X below ____ above land surface

☒ Single Aquifer ☐ Multiaquifer

CASING TYPE

1 ☑ Steel 3 ☑ Plastic ☐ Tile ☐ Other ____

Screen from B-1 B-3 B-5 B-6 to 60.5 24.5 22.6 37.0 – 47 ft. — Bottom Depth

Open Hole from ____ to ____ ft.

PROPERTY OWNER'S NAME

Ford Motor Co.

Mailing Address if different than property address indicated above.

966 So. Mississippi Blvd.
St. Paul, MN

OBSTRUCTION/DEBRIS/FILL

☐ Obstruction ☐ Debris ☐ Fill NA.

Type of debris/obstruction ____

Obstruction/Debris/Fill removed? ☐ Yes ☐ No

PUMP

☐ Removed ☒ Not Present ☐ Other ____

GEOLOGICAL MATERIAL	COLOR	HARDNESS OF FORMATION	FROM	TO
If not known, indicate estimated formation log from nearby well or boring.				
Sands, gravels, silts		md	0	60.5

CASING

4 wells

Diameter	Depth	Set in oversize hole?	Annular space initially grouted?
2 in.	from ____ to ____ ft.	☒ Yes ☐ No	☐ Yes ☐ No ☒ Unknown
____ in.	from ____ to ____ ft.	☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown
____ in.	from ____ to ____ ft.	☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE:

☒ No Annular Space Exists

☐ Annular space grouted with tremie pipe

☐ Casing Perforation/Removal

____ in. from ____ to ____ ft. ☐ Perforated ☐ Removed

____ in. from ____ to ____ ft. ☐ Perforated ☐ Removed

Type of perforator ____

☐ Other ____

GROUTING MATERIAL

	Grouting material	from	to	ft.	yards	bags
B-1	Neat Cement	0	60.5			
B-3	Neat Cement	0	24.5			
B-5	Neat Cement	0	22.6			
B-6	Neat Cement	0	47			

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

4 monitoring wells sealed on 11/19/93

2" Diameter casings filled with neat cement and cut off at grade.

B-1, B-3, B-5, B-6

UNSEALED WELLS AND BORINGS

Other unsealed well or boring on property? ☐ Yes ☒ No

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION

This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Braun Intertec Corp.
Contractor Business Name

M0109
License or Registration No.

Authorized Representative Signature

12/8/93
Date

Mike McWilliams
Name of Person Sealing Well or Boring

IMPORTANT—FILE WITH PROPERTY PAPERS—WELL OWNER COPY

H 39547

HE-01434-01

#2

STATE OF MINNESOTA DEPARTMENT OF HEALTH

ABANDONED WELL RECORD

MINNESOTA UNIQUE WELL NO. (leave blank if not known) ____

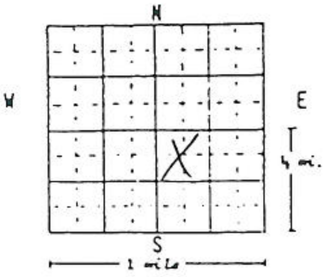
1. LOCATION OF WELL

County Name Ramsey

Township Name	Township Number N or S	Range Number E or W	Section No.	Fraction ¼ ¼ of ¼
	28 [✓ N]	23 [✓ W]	17	NW-SE

Numerical Street Address and City of Well Location or Distance from Road Intersection
500' from Mississippi Blvd, St. Paul, Mn

Show exact location of well (in section grid with "X")



Sketch map of well location
Ford Plant
enclosed site map

2. PROPERTY OWNER'S NAME
Ford Motor Company
966 S. Mississippi Blvd.
St. Paul, Mn

Mailing Address if different than property address indicated above

3. FORMATION LOG
If not known, indicate formation log from new well or nearby well.

FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
cobbles, boulders			0	7
gravel, sand	brown		7	13
sand	brown		13	25
sand-gravel	brown		25	44

4. WELL DEPTH (completed) 44.5 ft.

Date sealed 5-31-89

5. DRILLING METHOD (if known)
1☐ Cable tool 4☐ Reverse 7☐ Driven 10☐ Dug
2☐ Hollow Rod 5☐ Air 8☐ Bored 11☐ ____
3☐ Rotary 6☐ Jetted 9☒ Power Auger

6. OBSTRUCTIONS
Well obstructed ☐ Yes ☒ No
Obstructions removed ☐ Yes ☐ No If obstructions cannot be removed, contact MDH before sealing.

7. USE
1☐ Domestic 4☒ Monitoring 8☐ Heat Loop
2☐ Irrigation 5☐ Public 9☐ Industry
3☐ Test Well 6☐ Municipal 10☐ Commercial
7☐ Air Conditioning 11☐ ____

8. CASING(S)
1☐ Black 4☐ Threaded 7☒ ____
2☐ Galv. 5☐ Welded
3☒ Plastic 6☐ Stainless Steel Not Known
____ in. to ____ ft.
____ in. to ____ ft.

9. SCREEN
☒ Screened well from ____ ft. to Not Known ft. (If known)
☐ Open Hole from ____ ft. to ____ ft.

10. STATIC WATER LEVEL
29.5 ft. ☒ below ☐ above land surface Date Measured 11-18-81

11. WELLHEAD COMPLETION
1☐ Pitless Adapter 4☐ Found Buried N/A
2☐ Basement offset 5☐ ____
3☐ Well Pit

12. GROUTING INFORMATION
1☒ Neat Cement 2☐ Bentonite 3☒ cement
Grout material cement from 0 to 2 ft. cu. yds ____
neat cement 2 44.5 ____

13. NEAREST SOURCES OF CONTAMINATION
____ feet ____ direction ____ type
Well disinfected before sealing? ☐ Yes

14. PUMP ☐ Removed ☐ Not Present N/A
Type: 1☐ Submersible 3☐ L.S. Turbine 5☐ Reciprocating
2☐ Jet 4☐ Centrifugal 6☐ ____

15. EXISTING WELLS (Please sketch locations of abandoned and active wells in remarks section or on back.)
Other unused well(s) on property? ☐ Yes ☐ No
Abandoned: ☒ Permanent ☐ Temporary ☐ Not sealed

16. REMARKS, ELEVATION, SOURCE OF DATA - CASINGS REMOVED, CASINGS PERFORATED, ETC.
Enclosed site map.
Site mw #2

17. WATER WELL CONTRACTORS CERTIFICATION
This well was sealed under my jurisdiction and this report is true to the best of my knowledge and belief.

GME Consultants, Inc
Licensee Business Name License No.

Address 14000 21st Ave N. Mpls, Mn

Signed ____ Date ____
Tom Moore Date 6-9-89
Name of Driller

OFFICIAL ABANDONED WELL RECORD (May be used for Property Transfer)

IMPORTANT: FILE WITH DEED

#4

STATE OF MINNESOTA DEPARTMENT OF HEALTH

ABANDONED WELL RECORD

MINNESOTA UNIQUE WELL NO. (leave blank if not known) ☐

1. LOCATION OF WELL

County Name: Ramsey

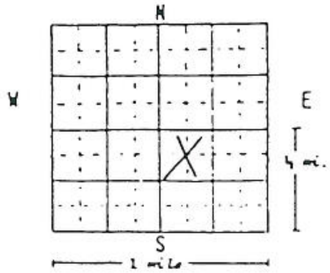
Township Name	Township Number	Range Number	Section No.	Fraction ¼ ¼ of ¼
	28 [✓ N] or S	23 E or [✓ W]	17	NW - SE

4. WELL DEPTH (completed): 29.5 ft.

Date sealed: 5-31-89

Numerical Street Address and City of Well Location or Distance from Road Intersection: 500' from Mississippi Blvd, St. Paul, Mn

Show exact location of well (in section grid with "X")



Sketch map of well location: Ford Plant Enclosed site map

5. DRILLING METHOD (if known)

1☐ Cable tool 4☐ Reverse 7☐ Driven 10☐ Dug
2☐ Hollow Rod 5☐ Air 8☐ Bored 11☐ ____
3☐ Rotary 6☐ Jetted 9☒ Power Auger

6. OBSTRUCTIONS

Well obstructed ☐ Yes ☒ No
Obstructions removed ☐ Yes ☐ No If obstructions cannot be removed, contact MDH before sealing.

7. USE

1☐ Domestic 4☒ Monitoring 8☐ Heat Loop
2☐ Irrigation 5☐ Public 9☐ Industry
3☐ Test Well 6☐ Municipal 10☐ Commercial
7☐ Air Conditioning 11☐ ____

2. PROPERTY OWNER'S NAME

Ford Motor Company
966 S. Mississippi Blvd.
St. Paul, Mn

Mailing Address if different than property address indicated above

8. CASING(S)

1☐ Black 4☐ Threaded 7☐ ____
2☐ Galv. 5☐ Welded
3☒ Plastic 6☐ Stainless Steel Not Known
____ in. to ____ ft.
____ in. to ____ ft.

3. FORMATION LOG

If not known, indicate formation log from new well or nearby well.

FORMATION LOG	COLOR	HARDNESS OF FORMATION	FROM	TO
clay	brown		0	1
sand	brown		1	2
sand-fill	black		2	7
sand	brown		7	29

9. SCREEN

☐ Screened well from ____ ft. to ____ ft. Not Known (If known)
☐ Open Hole from ____ ft. to ____ ft.

10. STATIC WATER LEVEL

19.5 ft. ☒ below ☐ above land surface Date Measured 11-19-81

11. WELLHEAD COMPLETION

1☐ Pitless Adapter 4☐ Found Buried N/A
2☐ Basement offset 5☐ ____
3☐ Well Pit

12. GROUTING INFORMATION

1☒ Neat Cement 2☐ Bentonite 3☐ ____
Grout material ____ from EOB to surface ft. cu. yds ____

13. NEAREST SOURCES OF CONTAMINATION

____ feet ____ direction ____ type
Well disinfected before sealing? ☐ Yes

14. PUMP ☐ Removed ☐ Not Present N/A

Type: 1☐ Submersible 3☐ L.S. Turbine 5☐ Reciprocating
2☐ Jet 4☐ Centrifugal 6☐ ____

15. EXISTING WELLS (Please sketch locations of abandoned and active wells in remarks section or on back.)

Other unused well(s) on property? ☒ Yes ☐ No
Abandoned: ☐ Permanent ☒ Temporary ☐ Not sealed

16. REMARKS, ELEVATION, SOURCE OF DATA - CASINGS REMOVED, CASINGS PERFORATED, ETC.

Enclosed site map.
Site MW #4

17. WATER WELL CONTRACTORS CERTIFICATION

This well was sealed under my jurisdiction and this report is true to the best of my knowledge and belief.

GME Consultants, Inc
Licensee Business Name License No.

Address 14000 21st Ave N. Mpls, Mn

~~Signed~~ ____ Date ____

Tom Moore Date 6-9-89
Name of Driller

OFFICIAL ABANDONED WELL RECORD (May be used for Property Transfer)

IMPORTANT: FILE WITH DEED

Minnesota Pollution Control Agency
520 Lafayette Road, Saint Paul, Minnesota 55155
Telephone (612) 296-6300

Celebrate
MINNESOTA 1990

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

April 9, 1990

Mr. Jerry Amber
Ford Motor Company
Environmental Control Office
Commerce Park North
15201 Century Drive, Suite 608
Dearborn, Michigan 48120

Dear Mr. Amber:

RE: Ford Motor Company-Twin Cities Assembly Plant

This letter is notification that the Minnesota Pollution Control Agency (MPCA) staff intends to recommend that the MPCA Board issue a Request for Response Action (RFRA) for the purpose of a Remedial Investigation and a Feasibility Study/Remedial Design and Response Actions to Ford Motor Company (Ford) for the Ford-Twin Cities Assembly Plant (Site) located at 966 South Mississippi River Boulevard, St. Paul, Minnesota. Ford has been identified by the MPCA staff as the Responsible Person (RP) under Minn. Stat. § 115B.03 for the release of hazardous substances from the Site. The detailed facts which have led MPCA staff to identify Ford as the RP, together with other pertinent statutory information, are found in the Site history provided in the enclosure to this letter.

All hazardous waste sites in the state of Minnesota are ranked by priority to target MPCA efforts most effectively. The ranking is done in accordance with criteria prescribed by the U.S. Environmental Protection Agency (EPA), called the Hazard Ranking Score (HRS) system. Following the scoring, the site may be included in the Minnesota Permanent List of Priorities (PLP) and/or included in the National Priorities List (NPL). The Site has been listed on the PLP, with a HRS score of 8.

The authority for the MPCA to issue the RFRA is found in Minn. Stat. §§ 115B.17 and 115B.18. The RFRA is a statutorily mandated MPCA request that a RP conduct an investigation of contamination, examine alternative response actions and conduct response actions at a specific site, following appropriate procedures. Should the RP choose not to undertake the required investigations and/or response actions, the statutes allow the MPCA to undertake these cleanup steps and recover the expenses incurred or request the Attorney General to bring a lawsuit to compel performance of the RFRA activities.

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The same statute imposes five determinations the MPCA Board must make before issuing RFRAs. The determinations are:

1. A facility exists or has been identified to have existed;

2. A release or threatened release has been identified;

3. The release or threatened release is or was from the identified facility;

4. The release or threatened release is or was of a hazardous substance and/or a pollutant or contaminant; and,

5. The person(s), to whom the RFRA is to be directed, is a RP.

Based on these five determinations, MPCA staff believes that sufficient evidence exists to support its decision to recommend that the MPCA Board issue a RFRA to Ford. The RFRA is expected to be presented to the MPCA Board at their May 22, 1990, Board meeting.

Should you feel that you have information you wish to have considered in the RFRA or Site history, please submit this information to the Project Manager within thirty (30) days of the date of this letter. Except in limited circumstances (e.g., new analytical data is generated or new information is obtained from record searches or depositions which indicates you may not be a responsible party) information provided after thirty (30) days of the date of this letter will not be considered for inclusion in the preparation of the RFRA and it is unlikely that the MPCA Board will consider that information at its May 22, 1990, meeting. Enclosed is a draft copy of the Site history.

The MPCA staff, in addition to soliciting any information you feel would be relevant to issuance of a RFRA, is hereby soliciting your preference to enter into or not to enter into negotiations of a Consent Order. A Consent Order is a negotiated contract between the MPCA and the Responsible Party. The Consent Order specifies the activities to be undertaken to clean up a site, specifies the order in which cleanup activities will occur and specifies the schedule for the cleanup activities. The MPCA staff will present your preference to the MPCA Board and if you indicate a preference to enter into Consent Order negotiations, a Consent Order negotiation period will be specified in the RFRA that the MPCA staff recommends to the MPCA Board.

Your written preference to either enter into or not to enter into Consent Order negotiations should also be submitted to the Project Manager within 30 days of the date of this letter.

For comments or questions on this letter or the proposed RFRA, please contact Mr. Todd Goeks, Project Manager, of my staff at (612) 296-7710.

Sincerely,

Gerald L. Willet

Gerald L. Willet
Commissioner

GLW:kkn

Enclosure

SITE HISTORY

In October 1980, the MPCA staff received a complaint reporting past waste disposal at the Ford Motor Company (Ford)-Twin Cities Assembly Plant Site (Site), located at 966 South Mississippi River Boulevard, St. Paul, Ramsey County, Minnesota. The complainant stated that, during the 1950's, Ford had dumped waste solvents and barreled paint wastes over the river bluff west of the assembly plant. The MPCA staff requested that Ford investigate and report on the company's past waste management practices.

In responses to the information request, Ford stated that unknown quantities of waste paint solvents and sludges had been disposed on-site during a period from early plant operation until approximately 1965.

In addition to the disposal area located over and along the base of the bluff west of Mississippi River Boulevard (Site C), Ford identified the locations of three other historical disposal areas. The first additional dump was located southeast of the main assembly plant. Used solvents and oils were burned and factory wastes were buried at this location during early years of plant operations. No information regarding waste quantities or years of operation was available for this dump. Reportedly, assembly plant engineering records indicate that during a 1962 parking lot expansion, materials from this area were excavated and relocated to Site C.

Another disposal area was located at the south end of an old test track located east of the assembly plant. Waste paint sludges and solvents were disposed of in this area during a period from 1943 to approximately 1960. Materials were reportedly excavated from this disposal area in 1966 during an expansion of the railroad "tri-level" car loading yard. Excavated materials were placed at Site C.

The third additional disposal area identified by Ford was located north of the steam plant. All waste materials from this location were excavated and transported to a permitted disposal facility in 1983. This excavation was conducted to facilitate construction of a wastewater treatment plant.

In addition to the excavated materials and wastes relocated from other dumps to Site C, waste paint solvents and sludges generated by the assembly plant continued to be disposed at Site C until approximately 1965. Site C received large quantities of demolition rubble and excavated soil generated during 1984 to 1986 from construction of the Ranger paint plant at the old test track location. Much of the past waste dump is now located under 30 feet of debris fill. Presently, a major portion of the filled area at Site C is paved with eight inches of concrete and is being used as a parking lot for truck trailers.

Ford has been in operation at the Site since 1915. Activities at the Site have included: auto glass manufacturing, automobile manufacturing, and automobile assembly and painting. Initially the plant was used exclusively for auto glass production. Later, the western half of the plant housed Model T manufacturing and painting. Glass manufacturing operations ceased in 1958.

The Site, including all areas discussed above, has been owned by Ford since the early 1900's. At MPCA staff's request, Ford initiated a hydrogeological investigation at Site C by installing a limited ground water monitoring program in December 1982 to determine whether wastes deposited at the Site had degraded ground water quality. Ground water samples collected and analyzed from Site C in 1982 indicated relatively low-level concentrations of contaminants including: 22 parts per billion (ppb) cis 1,2-dichloroethylene (DCE), 15 ppb trans 1,2-DCE, 59 ppb ethyl acetate, 5 ppb trichloroethylene (TCE), 2.1 ppb toluene, and 70 ppb tetrahydrofuran. Ground water analysis for metals indicated 20 ppb cadmium, 390 ppb chromium, and 220 ppb lead, each of which is above the Recommended Allowable Limit (RAL) for drinking water. Additional ground water samples collected and analyzed in 1989 indicated reduced levels of both metals and solvents; however, since two wells which were directly downgradient were abandoned prior to this sampling event, the samples collected were not completely representative of the ground water underlying the disposal site. Ford is presently conducting additional ground water investigations at Site C to accurately assess ground water quality underlying this disposal site.

At MPCA staff's request, Ford also initiated an investigation at the dump site located southeast of the main assembly plant in June 1989 to determine whether past waste management practices have impacted ground water quality. Soil and ground water samples were collected and analyzed, indicating the following maximum contaminant concentrations: 100,000 ppb ethyl benzene and 980 ppb total xylenes in soil; and 230 ppb methylene chloride, 43 ppb 1,1-DCE, 510 ppb benzene, and 3000 ppb ethyl benzene in ground water.

In October 1989, while investigating the possible sources of earlier reported releases, MPCA staff collected a ground water grab sample from an unlined sump adjacent to underground tanks used for waste solvent storage. Laboratory results indicated 13,000 ppb benzene, 1,920,000 ppb methylisobutyl ketone (MIBK), 16,000 ppb toluene, and 210,000 ppb ethyl benzene. The wastes stored in the tanks include: xylene, toluene, MIBK, methyl ethyl ketone, and small amounts of unspecified solvents.

The MPCA staff believes that the five determinations required before the MPCA can issue a RFRA have been met as follows:

1. The Site is a facility because hazardous substances were stored, deposited, disposed of, or placed at the Site. Waste solvents, including toluene, xylene, methyl ethyl ketone (MEK), and MIBK were stored and unknown quantities of unspecified waste paint solvents and sludges were disposed of at the Site. The Site is also a facility because it contains buildings, pipes or pipelines, storage containers, and landfills.

2. A release or threatened release of hazardous substances has been identified. MPCA staff has identified, through Ford's responses to information requests, that a release of hazardous substances occurred when waste paint solvents and sludges were disposed of at the Site. Releases of hazardous substances have also been identified by analysis of soil and ground water samples collected at the Site which revealed the presence of ethyl benzene and xylene in soil, and ethyl benzene, toluene, methylene chloride, benzene, cis 1,2-DCE, trans 1,2-DCE, 1,1-DCE, ethyl acetate, TCE, tetrahydrofuran, and MIBK in ground water.

3. The release or threatened release of hazardous substances is from the facility. Soil and ground water samples collected at the Site reveal the

presence of ethyl benzene and xylene in soil, and ethyl benzene, toluene, methylene chloride, benzene, cis 1,2-DCE, trans 1,2-DCE, 1,1-DCE, ethyl acetate, TCE, tetrahydrofuran, and MIBK in ground water.

4. The releases or threatened releases are hazardous substances. Toluene, ethyl benzene, methylene chloride, benzene, cis 1,2-DCE, trans 1,2-DCE, 1,1-DCE, ethyl acetate, TCE, tetrahydrofuran, xylene, and MIBK are hazardous substances because they are listed as hazardous wastes pursuant to 40 CFR 261.33 or Minn. Rules pt. 7045.0135, subp. 4.F.

5. Ford is a responsible person because it owned and operated the facility when the hazardous substances were placed or came to be located in or on the facility and during the time of the release or threatened release. Ford is also a responsible person because it owns the Site property and engaged in the business of generating, storing, and disposing of hazardous substances at the Site.