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FINAL

SOIL BORING INVESTIGATION REPORT

VAN WATERS & ROGERS INC.
2041 N. MOSLEY AVENUE
WICHITA, KANSAS

March 22, 1991

Prepared for:

VAN WATERS & ROGERS INC.
1600 Norton Building
801 Second Avenue
Seattle, Washington 98104

Prepared by:

GERAGHTY & MILLER, INC.
Environmental Services
900 Massachusetts, Suite 600
Lawrence, Kansas 66044
(913) 841-7641

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**SOIL BORING INVESTIGATION REPORT
VAN WATERS & ROGERS INC.
2041 N. MOSLEY AVENUE
WICHITA, KANSAS**

1.0 INTRODUCTION

Van Waters & Rogers Inc. (VW&R) contracted with Geraghty & Miller, Inc. to assess the chemical quality of subsurface soil at its Mosley Avenue distribution facility (the facility) in Wichita, Kansas (Figure 1). The purpose of this soil boring investigation was to assess the possible impact from a broken drain line on subsurface soil in a container rinsing elementary neutralization area (Figures 2 and 3).

Field activities at the facility included obtaining utility clearances, using a hollow-stem auger rig to drill three shallow soil borings adjacent to the elementary neutralization area, describing the lithology of the soil, and collecting five soil samples and three quality assurance/quality control (QA/QC) water samples for laboratory analysis. This report summarizes the results of these activities.

A Work Plan and a health and safety plan (HASP) were prepared for the investigation, and are included in Appendix A. Site activities were conducted in accordance with these project documents. Field activities were conducted at the facility on Monday, October 22, 1990, and were completed within one 12-hour period. Project staff and their responsibilities are shown on Figure 4. Bessie Lee, VW&R Senior Project Manager, was present on-site and observed the drilling and sampling activities.

2.0 SITE DESCRIPTION

The facility is located at 2041 N. Mosley Avenue in northern Wichita, Kansas (Figure 1). The facility is bounded by Mosley Avenue on the east, the Chicago, Rhode Island and Pacific railroad tracks to the west, and other businesses to the south and north.

2.1 History

VW&R purchased all but the southwest corner of the currently occupied property from McKesson Corporation in 1986. VW&R currently leases the southwest corner from Mr. Clint Litsey. McKesson Chemical Company, a division of McKesson Corporation, occupied the property from 1959 through 1986.

The facility operates primarily as a chemical distribution center. A variety of industrial and agricultural chemicals have been handled at the elementary neutralization area (the area under investigation), including trichloroethylene (TCE), hydrochloric acid (HCl), 1,1,1-trichloroethane (1,1,1-TCA), hexane, methanol, mineral spirits (naphtha), n-propyl alcohol, n-propyl acetate, and glycol ether EB.

The facility currently operates under a Resource Conservation and Recovery Act (RCRA) Part B permit as a temporary storage facility for containerized hazardous wastes. The Kansas Department of Health and Environment (KDHE) conducted a routine RCRA inspection of the facility on July 13, 1990. During the inspection a suspected break was discovered in the piping (Figure 3) that leads from the drum rinse area drain to the below-grade elementary neutralization

tank. Facility personnel later confirmed the broken line by sealing the neutralization tank drain and pouring water into the wash area drain. The water level in the wash area drain slowly declined, indicating a leak in the drain line.

2.2 Environmental Setting

2.2.1 Geology

The City of Wichita, and most of Sedgwick County, are located within the Arkansas River Lowlands section of the Central Lowlands physiographic province (Lane and Miller, 1965). The topography of the area is broad and flat in the river valley and rolling in the adjacent uplands. Topographic maps showing the VW&R facility indicate that the elevation of the facility is approximately 1310 feet (ft) above mean sea level. Within a one mile radius of the facility the relief is less than 20 ft.

The geology of the area near the Mosley Avenue facility consists of 10 to 15 ft of silt and clay underlain by unconsolidated sand and gravel deposits. These alluvial deposits average 45 ft in thickness and form the primary aquifer in the area. A shale unit, the Wellington Formation, underlies the alluvial deposits (Hart and Spruill, 1988).

2.2.2 Soil

The facility is situated on soil classified as the Elandco series (Soil Conservation Service, 1979). These are well drained silt loams that are moderately permeable. The Elandco soil,

which formed in silty and clayey alluvial sediments, is typically found on flood plains and low terraces in the area.

2.2.3 Surface Water

Regional surface-water drainage is to the south. Chisholm Creek flows primarily south through the north part of Wichita, but flows east approximately one block north of the Mosley Avenue facility (Figure 1). Both the Little Arkansas River and the Arkansas River are located within three miles to the west of the facility. The Little Arkansas River and Chisholm Creek drain into the Arkansas River.

2.2.4 Ground Water

The facility is located in the Arkansas River Valley in Sedgwick County, Kansas. Unconsolidated deposits underlying the Arkansas River Valley serve as the principal source of ground water in the area (Lane and Miller, 1965). Water from the underlying bedrock units is of limited use because of its generally poor quality (Lane and Miller, 1965). The depth to ground water near the facility area ranges from 10 to 15 feet below land surface (ft bls). The water table fluctuates between the surficial silt and clay and the underlying sand and gravel deposits. The general direction of ground-water flow in the unconsolidated materials is to the south (Hart and Spruill, 1988).

3.0 SITE INVESTIGATION

Soil samples were collected from three borings and analyzed to determine the possible chemical impact on soil by materials handled in the area where the break in the drain line occurred. The configuration of the drain line and the soil boring locations are shown on Figure 3.

3.1 Drilling Activities

Drilling at the facility was conducted on Monday October 22, 1990. Layne Western was the drilling subcontractor, and Geraghty and Miller supervised drilling activities. Facility personnel secured the necessary utility clearances prior to the start of drilling activities. A health and safety meeting was conducted by Clark Fulton, the Geraghty & Miller Field Coordinator, and Marc Linos, the facility Operations Manager. A health and safety meeting attendance sheet (Appendix A) was signed by the Layne Western drillers.

A hollow-stem auger drill rig was used to complete three soil borings to approximately 12 ft bls. Soil borings SB-1 and SB-2 were each drilled to a depth of 10 ft bls, and SB-3 was drilled at a depth of 11.5 ft bls. The water table was anticipated at 10 to 15 ft bls. Drilling was halted prior to encountering ground water. Completed sample/core logs are in Appendix B.

A 2-ft-long split spoon soil sampler with two 6-inch brass liners was used to collect the soil samples. All drill cuttings were contained on site in 55-gallon drums pending determination of appropriate disposal methods.

The boreholes were backfilled with bentonite chips to approximately 1 ft bls, and with cement grout to land surface. The borehole locations were marked with plastic traffic cones until the cement grout had set. No subsidence was noted at the boreholes at the end of the day that they were drilled. Borehole locations were measured with respect to existing facility structures (Figure 3).

3.2 Sampling Activities

Soil samples were collected at 1 ft intervals. The upper 6-inch brass liner was removed and sealed with a Teflon™ liner, tightly capped on both ends, and kept chilled in an ice-packed insulated container prior to selection for shipment to the laboratory. Soil from the lower brass liner was used to (1) conduct volatile organic compound (VOC) headspace screening using a photoionization detector (PID), (2) describe soil color and lithology, using the Munsell Color Chart and the Unified Soil Classification System, and (3) conduct field pH measurements. The PID and pH field screening results are listed in Table 1. Field screening methods are described in Appendix C.

Based on changes in lithology, results of the pH measurements, and the results of the headspace screening, one or two samples from each boring were selected for laboratory analysis. Two samples were selected for laboratory analysis from soil borings SB-1 and SB-3, and one was selected from SB-2. The laboratory samples were packed with ice in an insulated container and were shipped to the analytical laboratory via overnight courier delivery.

A completed Chain-of-Custody record (Appendix D) was placed inside the container and a Chain-of-Custody seal was affixed to the outside prior to shipment. A laboratory-prepared trip

blank of deionized water, an equipment rinsate sample, and a decontamination rinsate sample were included with the five soil samples that were shipped to the laboratory.

3.3 Decontamination Procedures

All drilling and sampling equipment was steam-cleaned by Layne Western prior to arrival at the facility. The equipment was steam-cleaned again at the facility and was thoroughly inspected by the Geraghty & Miller Field Coordinator, prior to initiating field activities. The sampling equipment was decontaminated between sampling events with a detergent wash followed by a double rinse with potable water and a final rinse with distilled water.

All decontamination water generated, by both steam-cleaning and hand washing methods, was contained in a 55-gallon drum and stored at the facility. A sample of this decontamination rinsate water was collected from the drum for chemical analysis to determine proper disposal procedures for the drummed water. An equipment rinsate sample of distilled water used to rinse the sampling equipment was also sent to the laboratory for analysis.

4.0 ANALYTICAL DATA

Soil samples were shipped to the Enseco-Rocky Mountain Analytical Laboratory (RMAL) in Arvada, Colorado. Enseco-RMAL is a Kansas-certified laboratory that follows rigorous, well documented QA/QC procedures. The analytical data was validated upon receipt from the laboratory, following United States Environmental Protection Agency (USEPA) and Geraghty & Miller procedures.

4.1 Analytical Procedures

Enseco-RMAL was instructed to analyze samples for the organic compounds that have been handled in the elementary neutralization area at the facility. The soil samples were analyzed by gas chromatography/mass spectrophotometry (GC/MS) for TCE, 1,1,1-TCA, and hexane using USEPA Method 8240. Methanol and n-propyl alcohol were analyzed by GC/flame ionization detector (FID) with direct aqueous injection (DAI). The soil samples were also analyzed for pH, using USEPA Method 9045, to determine if HCl or sodium hydroxide (NaOH) had impacted the soil. The QA/QC water samples were analyzed by GC/MS for TCE, 1,1,1-TCA, and hexane using USEPA Method 8240. The laboratory analytes for both soil and water samples, grouped according to USEPA analytical method number, are listed in Table 2. The Enseco-RMAL analytical report is provided in Appendix D.

4.2 Data Validation Procedures

Analytical results were reported following Geraghty & Miller Analytical Quality Assurance Level III requirements, which approximate Contract Laboratory Program reportables. Level III required that the laboratory provide results of sample-specific duplicates, matrix spikes, and matrix spike duplicates, analysis spikes, and initial and continuing calibration results, among other reportables. The field data, laboratory sample results, and laboratory QA/QC sample results were validated by Geraghty & Miller according to the general procedures listed in Appendix E.

4.2.1 Field Data Review

Geraghty & Miller reviewed the Sample Logs for all samples generated in the field, including five soil samples and two field blanks (one equipment rinsate blank and one decontamination rinsate blank), Laboratory Task Order number 1194, the Sampling Memorandum to Enseco-RMAL dated October 25, 1990, and the Chain-of-Custody form that Enseco-RMAL received with the samples on October 24, 1990. From this information it was verified that the Geraghty & Miller sample collection procedures met the objectives of the Work Plan.

4.2.2 Analytical Data Review

Geraghty & Miller reviewed the analytical results submitted by Enseco-RMAL and verified that:

- Results had been received for all eight submitted samples (including 1 trip blank included with the field samples in the shipping container sent to Enseco-RMAL).
- All five soil samples had been analyzed for four volatile organic constituents by USEPA Method 8240, two alcohols by GC/FID DAI, and pH by USEPA Method 9045, the methods specified in the Work Plan and requested on the laboratory task order, the sampling memorandum and the chain-of-custody forms.
- All three water samples had been analyzed for the four volatile organics requested by USEPA Method 8240.
- All requested detection limits, as listed in the October 25, 1990 Sampling Memorandum to Enseco-RMAL were met.
- All analyses were performed within acceptable holding times. Holding times for analysis of constituents were calculated given that the sample collection date

(October 22, 1990) was counted as day one. The samples and the accompanying Chain-of-Custody record were received by Enseco-RMAL on October 24, 1990.

Geraghty & Miller found that Enseco-RMAL had not reported the results of USEPA Method 8240 analyses on a dry weight basis. The laboratory resubmitted the results to Geraghty & Miller, reporting all samples on a dry weight basis.

Through the review process it was verified that Enseco-RMAL had completed the analyses as requested on the Geraghty & Miller Laboratory Task Order and the October 25, 1990 Sampling Memorandum.

4.2.3 Laboratory QA Data Review

The QA information submitted with the analytical results by Enseco-RMAL were reviewed to ensure that the method control limits were consistent with QA accuracy and precision criteria developed for each method by USEPA (1988a,b). Geraghty & Miller reviewed the following laboratory QA documentation:

- Instrument tuning and calibration results
- Method blank results
- Matrix spike and spike duplicate results
- Surrogate spike results

QA results for all analyses were within limits specified for each method by USEPA (1988a,b). Therefore, the analytical results are considered usable and representative of actual conditions.

5.0 SUMMARY AND FINDINGS

The analytical results for soil and water samples collected during the facility soil boring investigation are presented in Table 3. Quantitative laboratory pH values for the soil ranged from 6.6 to 7.0 pH units. Qualitative field pH measurements ranged from 5.5 to 7.5 pH units. Both quantitative and qualitative measurements reflect near neutral pH conditions, and are within the range of pH values (6.6 to 8.4) for Elandco soil (Soil Conservation Service, 1979).

Five soil samples were analyzed for six organic compounds that were known to have been handled at the facility. TCE was the only analyte reported above detection limits, and was present in four of the five soil samples at concentrations that ranged from 20 to 97 micrograms per kilogram ($\mu\text{g}/\text{kg}$). Based on discussions with KDHE personnel, current internal State of Kansas guidelines indicate that 1.4 milligrams per kilogram (mg/kg) or 1,400 $\mu\text{g}/\text{kg}$ of total TCE may be present in soil before it is considered hazardous (KDHE, 1990). Therefore, Geraghty & Miller recommends that the drummed soil be disposed of as non-hazardous waste. KDHE personnel also reported (KDHE, 1990) that 1.4 mg/kg of TCE is also the state cleanup level. The data collected indicate that the analytes detected in the elementary neutralization area soil are present below KDHE cleanup levels. Therefore, no further action is required or recommended.

None of the analytes were detected in any of the QA/QC samples. Therefore, the drummed water may be disposed of in the facility sanitary sewer.

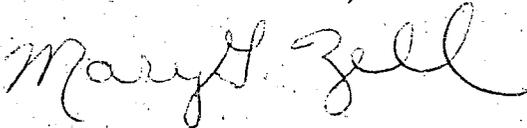
Data validation was performed on the QA/QC information provided by Enseco-RMAL by Geraghty & Miller. Since the QA/QC results for all analyses were within control limits for

each analytical method specified by USEPA, the analytical results are considered usable and representative of actual facility conditions.

The evaluations and recommendations presented in this report are based exclusively on information provided by VW&R, published reports, independent laboratory analyses, and field observations made by Geraghty & Miller personnel. In performing this investigation, Geraghty & Miller accepts as true the information provided by these entities.

The site conditions described in this report are indicated by the data collected. We have accepted the accuracy of the analyses provided by the independent laboratory (Enseco-RMAL) for the investigation. Geraghty & Miller warrants that the services performed during the investigation were performed in a competent professional manner in accordance with sound consulting practices and procedures.

Respectfully submitted,
GERAGHTY & MILLER, INC.



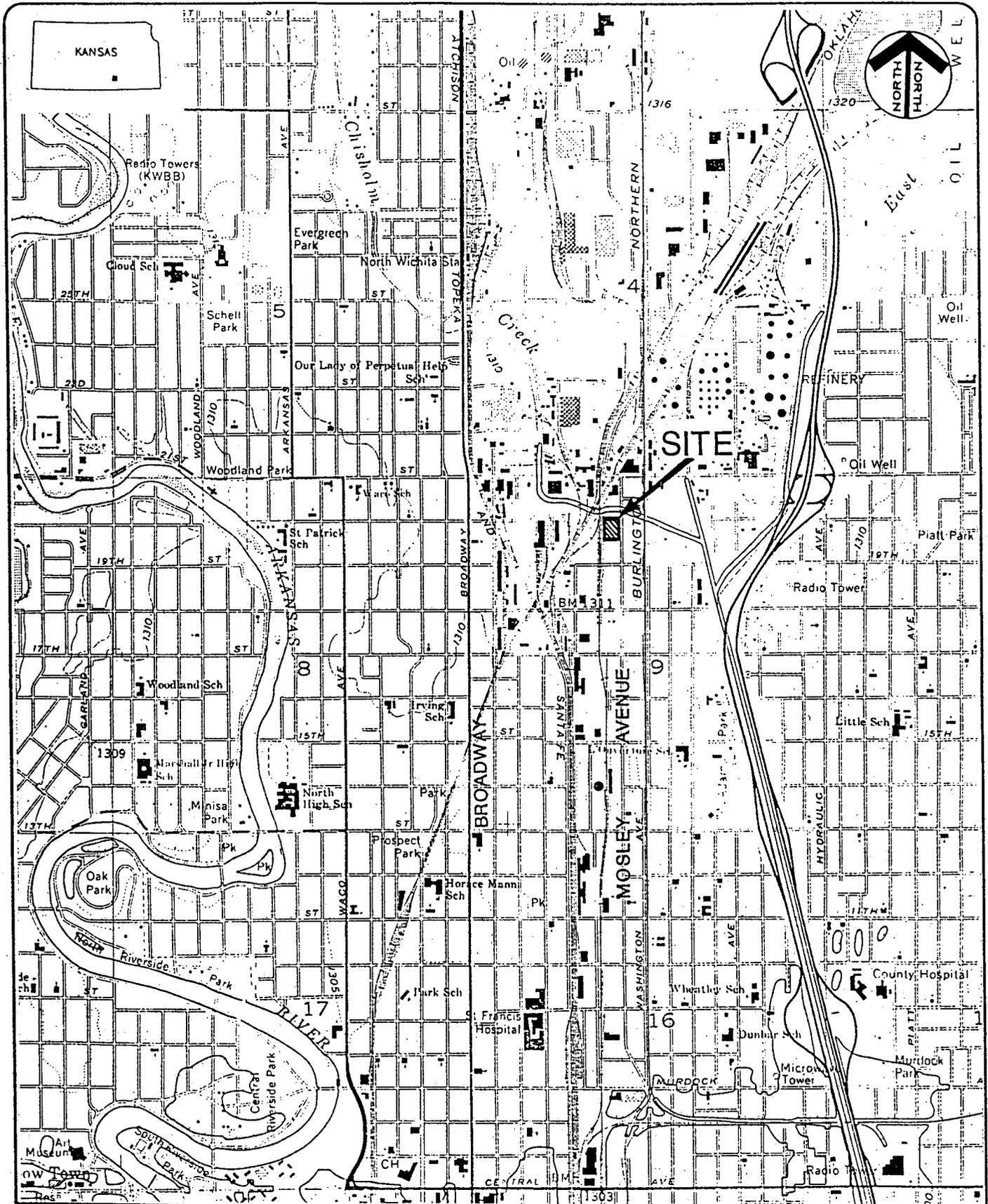
Mary G. Zell
Staff Scientist



Kathleen C. Duchac
Office Manager/Associate

6.0 REFERENCES

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- United States Environmental Protection Agency (USEPA). 1988a. Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses. USEPA--Hazardous Site Evaluation Division. July 1, 1988.
- _____. 1988b. Laboratory Data Validation Guidelines for Evaluating Organics Analyses. USEPA--Hazardous Site Evaluation Division. February 1, 1988.



2000 1000 0 2000 Scale 1" = 2000'

GERAGHTY & MILLER, INC.
Environmental Services

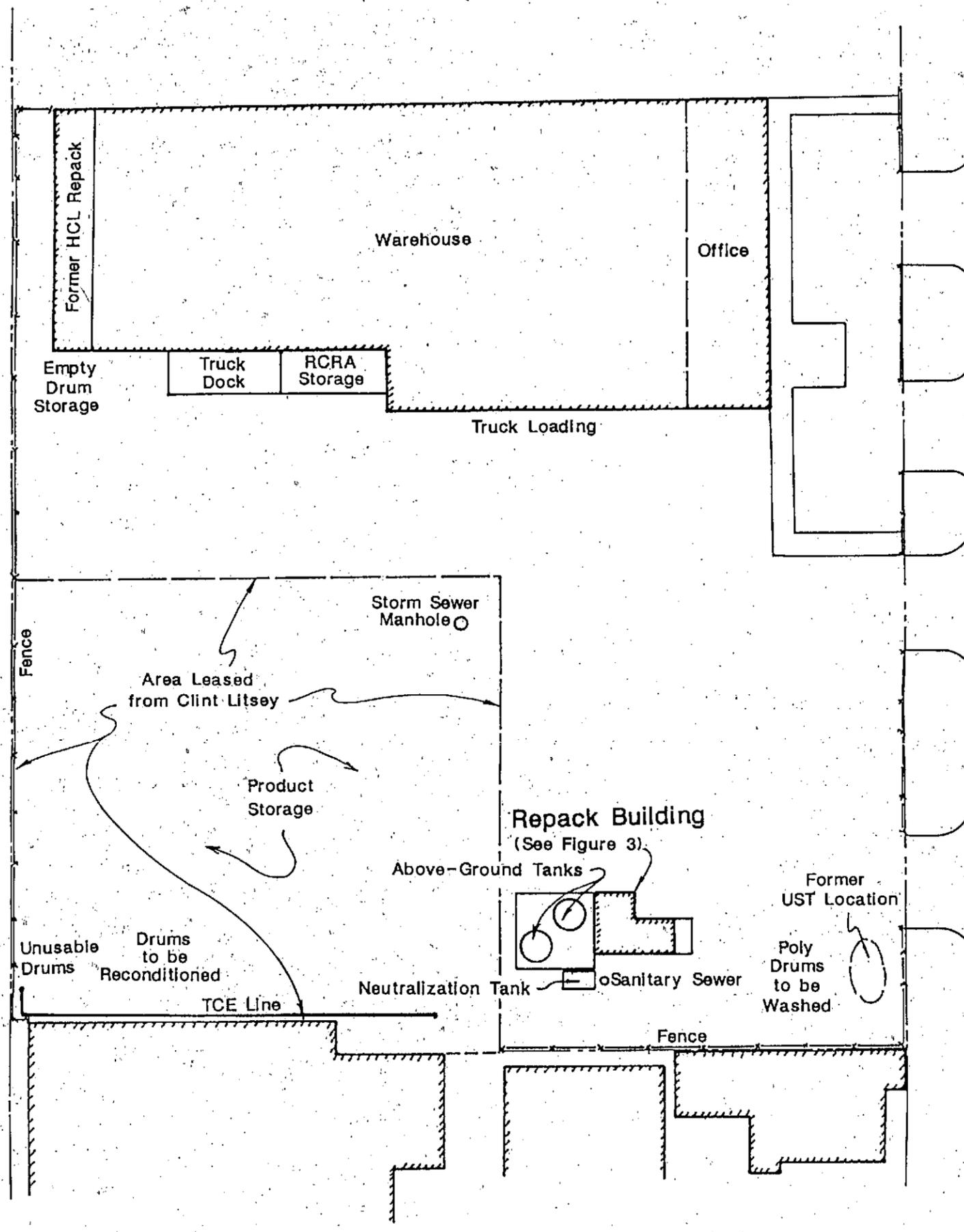
SITE LOCATION MAP
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS
 BASED ON 1982 REV. USGS 7.5' QUADRANGLE, WICHITA, EAST, KS
 SOIL BORING INVESTIGATION

FIGURE
1



CHICAGO, ROCK ISLAND & PACIFIC RR

Siding
Railroad



AVENUE

MOSLEY

Scale 1" = 40'
40 20 0 40



FACILITY MAP

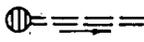
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

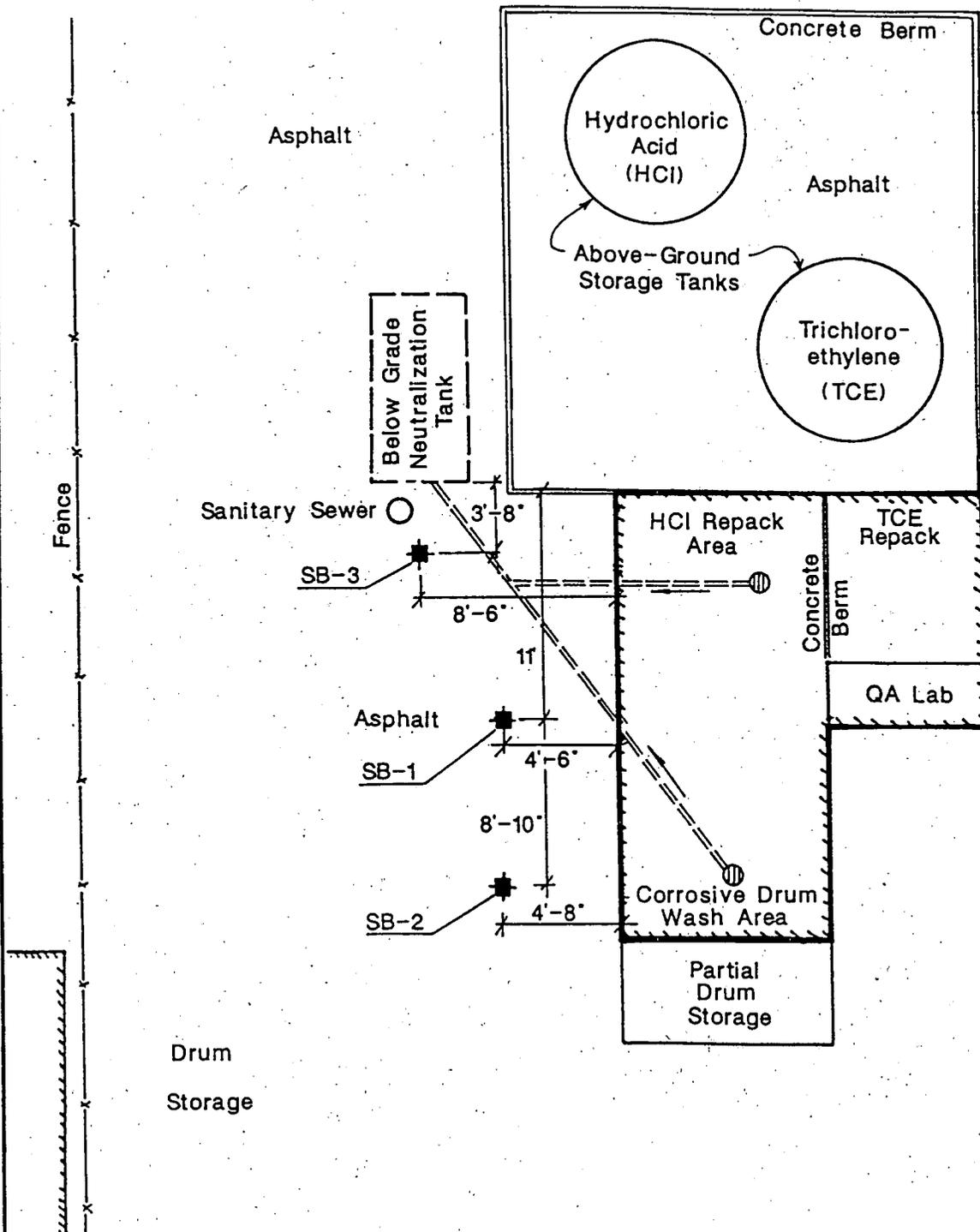
FIGURE

2

SOIL BORING INVESTIGATION

EXPLANATION OF SYMBOLS

-  Building
-  Floor Drain and Underground Piping to Neutralization Tank
-  Soil Boring



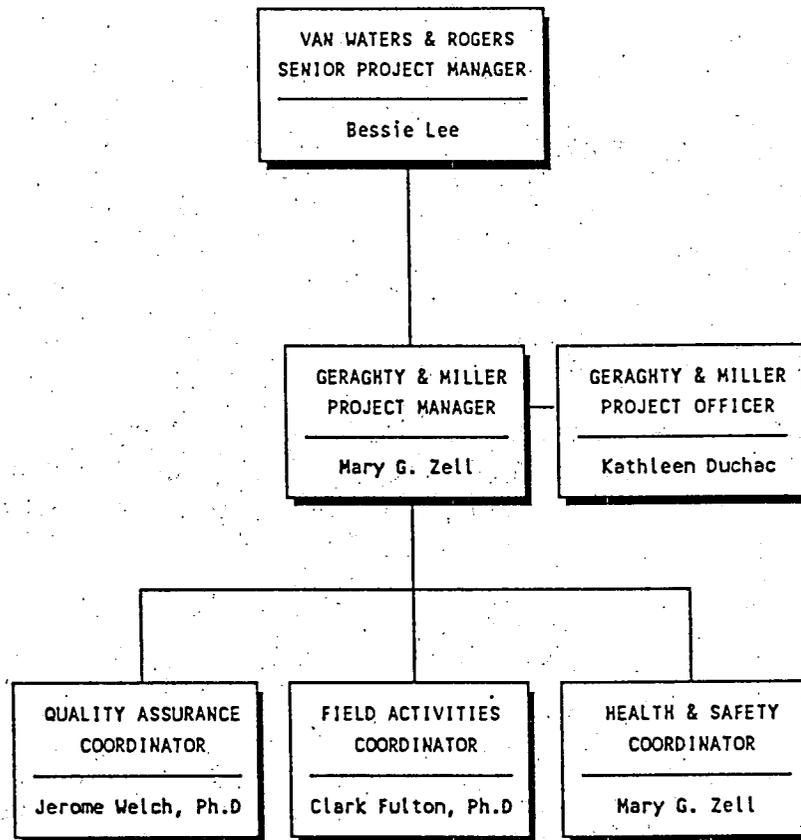
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SOIL BORING LOCATIONS
 VW&R MOSLEY AVENUE FACILITY
 WICHITA, KANSAS

FIGURE

3



PROJECT ORGANIZATION CHART
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

FIGURE

4

TABLE 1

FIELD SCREENING RESULTS

VW&R Mosley Avenue Facility
Wichita, Kansas

Borehole Number	Soil Sample Depth (ft bls) ²	PID ¹ Reading (ppm) ³	pH (pH Units)
SB-1	2.5 - 3.5	30	6.9
	3.5 - 4.5	17	5.5
	4.5 - 5.5*	16	5.5
	5.5 - 6.5	8	7.0
	6.5 - 7.5	10	6.0
	7.5 - 8.5*	10	6.0
	8.5 - 9.5	9	6.0
	9.5 - 10.5	8	6.0
	10.5 - 11.5	3.5	6.0
SB-2	1 - 2	3	7.0
	2 - 3	4.5	7.0
	3 - 4	5	7.0
	4 - 5*	4	6.5
	5 - 6	3	6.0
	6 - 7	2	6.0
	7 - 8	0.5	6.5
	8 - 9	1	6.0
	9 - 10	1	6.0
SB-3	1 - 2	12	7.0
	2 - 3	10	7.5
	3 - 4*	22	7.0
	4 - 5	13	7.0
	5 - 6	7	6.0
	6 - 7	11	5.5
	7 - 8*	12	6.0
	8 - 9	13	6.0
		9 - 10	6

¹ PID = photoionization detector Readings were taken with an HNu equipped with a 10.2 eV probe.

² ft bls = feet below land surface

³ ppm = parts per million, calibrated to isobutylene

* Soil samples selected for laboratory analyses

TABLE 2

LABORATORY METHODS AND ANALYTES, SOIL AND WATER SAMPLES

VW&R Mosley Avenue Facility
Wichita, Kansas

A. Soil Samples

<u>Method</u>	<u>Analyte</u>
USEPA Method 8240 (GC/MS)	Trichloroethylene 1,1,1-Trichloroethane Hexane n-propyl acetate
GC/FID	Methanol n-propyl alcohol
USEPA Method 9045	pH

B. QA/QC Water Samples

<u>Method</u>	<u>Analyte</u>
USEPA Method 8240	Trichloroethylene 1,1,1-Trichloroethane Hexane n-propyl acetate

TABLE 3
ANALYTICAL RESULTS FOR SOIL AND GROUND-WATER SAMPLES
 VW&R Mosley Avenue Facility
 Wichita, Kansas

A. Soil Samples

<u>Borehole Number</u>	<u>Sampling Date</u>	<u>Depth (ft bls)</u>	<u>TCE (ug/kg)</u>	<u>Sample TCA (ug/kg)</u>	<u>HEX (ug/kg)</u>	<u>ACT (ug/kg)</u>	<u>MTL (mg/kg)</u>	<u>ALC (mg/kg)</u>	<u>pH (pH Units)</u>
SB-1	10/22/90	4.5 - 5.5	24	ND (6.0)	ND (12)	ND ¹	ND (1.2)	ND (1.2)	7.0
SB-1	10/22/90	7.5 - 8.5	ND (5.7)	ND (5.7)	ND (11)	ND	ND (1.1)	ND (1.1)	6.6
SB-2	10/22/90	4.0 - 5.0	31	ND (6.1)	ND (12)	ND	ND (1.2)	ND (1.2)	7.0
SB-3	10/22/90	3.0 - 4.0	120	ND (6.1)	ND (12)	ND	ND (1.2)	ND (1.2)	6.7
SB-3	10/22/90	7.0 - 8.0	35	ND (5.9)	ND (12)	ND	ND (1.2)	ND (1.2)	7.0

B. QA/QC Water Samples

<u>Sample ID</u>	<u>TCE (ug/L)</u>	<u>TCA (ug/L)</u>	<u>HEX (ug/L)</u>	<u>ACT (ug/L)</u>
Equipment Rinsate	ND (5.0)	ND (5.0)	ND (10)	ND
Decontamination Rinsate ²	ND (250)	ND (250)	ND (500)	ND
Trip Blank	ND (5.0)	ND (5.0)	ND (10)	ND

See page 2 of 2 for notes

TABLE 3

ANALYTICAL RESULTS FOR SOIL AND GROUND-WATER SAMPLES

VW&R Mosley Avenue Facility
Wichita, Kansas

TCE	Trichloroethylene
TCA	1,1,1-Trichloroethane
HEX	Hexane
ACT	n-propyl acetate
MTL	Methanol
ALC	n-propyl alcohol

ft bls	Feet below land surface
$\mu\text{g}/\text{kg}$	Micrograms per kilogram
mg/kg	Milligrams per kilogram
$\mu\text{g}/\text{L}$	Micrograms per liter

ND () Not detected at the given reporting limit

¹ No reporting limit is specified because the method indicated presence or absence of the compound.² Sample was soapy and therefore was diluted by Enseco-RMAL personnel; detection limits are higher for this sample.

Appendix A

Work Plan and Health and Safety Plan

WORK PLAN
FOR
SOIL BORING INVESTIGATION

VAN WATERS & ROGERS INC.
2041 N. MOSLEY AVENUE
WICHITA, KANSAS

October 19, 1990

Prepared for:

VAN WATERS & ROGERS INC.
1600 Norton Building
801 Second Avenue
Seattle, Washington 98104

Prepared by:

GERAGHTY & MILLER, INC.
Environmental Services
900 Massachusetts, Suite 600
Lawrence, Kansas 66044

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FIGURES

- 1 Site Location Map
- 2 Facility Map
- 3 Proposed Soil Boring Locations
- 4 Project Organization Chart

APPENDIX

- A Health and Safety Plan

**WORK PLAN
FOR
SOIL BORING INVESTIGATION**

**VAN WATERS & ROGERS INC.
2041 N. MOSLEY AVENUE
WICHITA, KANSAS**

1.0 INTRODUCTION

Van Waters & Rogers Inc. (VW&R), a subsidiary of Univar, has contracted with Geraghty & Miller, Inc. (G&M) to assess the condition of on-site soil at the Mosley Avenue distribution facility (the "facility") in Wichita, Sedgwick County, Kansas. The facility is located at 2041 N. Mosley Avenue in northern Wichita, Kansas and is bounded by Mosley Avenue on the east, the Chicago, Rhode Island and Pacific railroad tracks to the west, and other businesses to the south (Figure 1).

VW&R purchased all but the southwest corner of the currently occupied property from McKesson Chemical Company (McKesson) in 1986. VW&R currently leases the southwest corner from Mr. Clint Litsey. McKesson occupied the property from 1959 through 1986.

The facility operates primarily as a chemical distribution and repackaging center. A variety of industrial and agricultural chemicals have been handled at the repack area, (the area under investigation) including trichloroethene (TCE), hydrochloric acid (HCl), 1,1,1-trichloroethane (1,1,1-TCA), hexane, methanol, mineral spirits (naphtha), n-propyl alcohol, n-propyl acetate, and glycol ether EB.

The Mosley Avenue facility currently operates under a Resource Conservation and Recovery Act (RCRA) Part B permit as a treatment, storage, and disposal facility. In anticipation of the RCRA permit renewal in 1994, the Kansas Department of Health and Environment conducted a RCRA Facility Assessment (RFA) of the Mosley Avenue plant on July 13, 1990. During the inspection, a suspected leak was discovered in the piping that leads from the drain in the repack building to the neutralization tank (Figures 2 and 3). Facility personnel later confirmed the leak by sealing the neutralization tank drain and pouring water into the wash area drain. The water level in the wash area drain slowly declined, indicating a leak in the drain line. The purpose of this investigation is to assess the impact of the leak on the surrounding soils.

2.0 SCOPE OF WORK

This Work Plan and the accompanying Health and Safety Plan (HASP) (Appendix A) were designed specifically for the investigative activities proposed for the facility. Included in the scope of work are the following tasks:

- o Ensure that utility clearances have been obtained prior to drilling at the facility.
- o Drill three shallow soil borings adjacent to the repack facility drain (Figures 2 and 3). The borings will be drilled using hollow-stem augers.
- o Collect three soil samples from the repack area and two quality assurance (QA) samples for laboratory analysis.

- o Describe, using the Unified Soil Classification System, the lithology of soil collected from each borehole.
- o Validate the laboratory data upon receipt of analytical results.
- o Document findings and analytical results in a written report.

All site activities will be conducted in accordance with G&M field protocol and the project HASP. Findings and laboratory results will be presented in a written report submitted to VW&R.

3.0 PROJECT ORGANIZATION

Project staff and their responsibilities are shown on Figure 3. Bessie Lee is the VW&R Senior Project Manager for these investigative activities at the Mosley Avenue facility. She will be present on-site when drilling and sampling activities are performed. The G&M project manager is Mary G. Zell. She will also function as the project Health and Safety Coordinator. The Project Officer is Kathleen Duchac, who is the Office Manager of the Lawrence, Kansas G&M office. Jerome Welch, the Lawrence G&M QA Manager, will be the Project Quality Assurance Coordinator. Field activities will be coordinated and conducted by Clark Fulton. Layne-Western, a nationwide drilling subcontractor, will provide a qualified, experienced driller and helper. Soil samples will be shipped to the Enseco Rocky Mountain Analytical Laboratory (RMAL) in Arvada, Colorado. Enseco-RMAL is a Kansas-certified laboratory that follows rigorous, well documented quality control procedures and USEPA Contract Laboratory Program (CLP) methods.

4.0 ENVIRONMENTAL SETTING

4.1 Geology

The City of Wichita, and most of Sedgwick County, are located within the Arkansas River Lowlands section of the Central Lowlands physiographic province (Lane and Miller, 1965). The topography of the area is broad and flat in the river valley and rolling in the adjacent uplands. Topographic maps of the VW&R Mosley Avenue facility indicate that the elevation of the plant is approximately 1310 feet (ft) above mean sea level. Within a one mile radius of the facility the relief is less than 20 ft.

Regional surface-water drainage is to the south. Chisholm Creek flows primarily south through the north part of Wichita, but flows east just north of the Mosley Avenue facility (Figure 1). Both the Little Arkansas and the Arkansas Rivers are located within three miles to the west of the facility. The Little Arkansas River and Chisholm Creek drain into the Arkansas River.

The geology of the area near the Mosley Avenue facility consists of 10 to 15 ft of silt and clay underlain by unconsolidated sand and gravel deposits. These alluvial deposits average 45 ft in thickness and form the primary aquifer in the area. A shale unit, the Wellington Formation, underlies the alluvial deposits (Hart and Spruill, 1988).

4.2 Soil

The Mosley Avenue facility is situated on soils that are classified in the Elandco series (Soil Conservation Service, 1975). These are well drained silt loams that are moderately

permeable. Elandco soils are formed in silty alluvial sediments and are typically found on flood plains and low terraces.

4.3 Ground Water

The Mosley Avenue facility is located in the Arkansas River Valley in Sedgwick County, Kansas. Unconsolidated deposits underlying the Arkansas River Valley serve as the principal source of ground water in the area (Lane and Miller, 1965). Water from the underlying bedrock units is of limited value because of its generally poor quality (Lane and Miller, 1965). The depth to ground water near the facility generally ranges from 10 to 15 ft below land surface. The water table fluctuates between the surficial silt and clay and the underlying sand and gravel layer. The direction of ground-water flow in the unconsolidated materials is generally to the south (Hart and Spruill, 1988).

5.0 SITE INVESTIGATION

Soil samples will be collected and analyzed to assess the possible impact of leaking fluids on soils surrounding the pipe leak. Three soil borings will each be drilled with a hollow-stem auger rig to an approximate depth of 10 ft below land surface. Soil samples will be collected at 1 ft increments using either a 1.5 ft or a 2 ft split spoon soil sampler with 6-inch brass liners. One of the brass liners from each 1 ft increment of sample will be selected for laboratory analysis. The selected sample will be sealed with TeflonTM caps, labeled, and kept chilled in a cooler. The selection of the soil sample submitted for laboratory analysis will be based on the results of the on-site headspace screening with a photoionization detector (PID), field conditions, and visual observations. Final determination of the samples

selected will be made in the field by the representatives of G&M and VW&R. The soil sample from the remaining liners will be used to describe the soil, perform a field pH analysis, and screen the headspace for volatile organic compounds (VOCs). Soil lithology and grain size will be described by a qualified geologist using the United Soil Classification System and Munsell Soil Color Charts.

Upon completion of drilling and sampling activities, the laboratory samples will be packed in an insulated container with ice or cold packs and shipped to the Kansas-certified analytical laboratory via Federal Express overnight delivery. A Chain-of-Custody seal will be attached to the container and a completed Chain-of-Custody form placed inside. A laboratory-prepared deionized water trip blank will also accompany the soil samples to the laboratory.

All drilling and sampling equipment will be steamed cleaned prior to arrival at the facility. The equipment will be steam cleaned again upon arrival at the site to minimize the possibility of sample contamination. The equipment will be thoroughly inspected by the G&M field coordinator prior to drilling. The sampling equipment will be decontaminated between sampling events either by steam cleaning or with a detergent wash followed by a triple rinse with distilled water. A sample of the equipment rinsate will be collected for analysis to determine the effectiveness of decontamination procedures.

All drill cuttings and decontamination water will be contained on site in 55-gallon drums pending determination of appropriate disposal methods. A sample of the decontamination water will be submitted with the QA/QC samples for laboratory analysis. Responsibility for on-site drum placement and ultimate drum disposal will be undertaken by VW&R. The drill holes will be backfilled with bentonite chips and the tops of the holes will be filled with either asphalt or concrete. Once the boreholes have been grouted,

distances to buildings or other semipermanent markers will be made to locate their precise positions.

6.0 SAMPLE ANALYSES

The soil samples will be shipped to Enseco-RMAL in Arvada, Colorado. The samples will be analyzed by gas chromatography/mass spectrophotometry (GC/MS) (USEPA Method 8240) for TCE, 1,1,1-TCA, hexane, and n-propyl acetate. Methanol and n-propyl alcohol will be analyzed by gas chromatography/flame ionization detector with direct aqueous injection. USEPA Method 9045 (pH analysis) will also be run on the soils. The QA water samples will be analyzed by GC/MS (USEPA Method 8240) for TCE, 1,1,1-TCA, hexane, and n-propyl acetate.

The results of the field sample analyses will be reported by Enseco-RMAL on their standard forms. Laboratory QA/QC results will be reported on CLP forms. G&M personnel will use the laboratory QA/AC results to (1) validate the results of laboratory analyses for each field sample, and (2) ensure that the laboratory followed analytical methods properly. Documentation records, such as field sampling forms, will also be reviewed to ensure that prescribed G&M procedures were followed during the investigation.

7.0 REPORT PREPARATION

The final written report will include the following:

- o Project background/history,
- o Project staffing,
- o Regional geologic and hydrologic setting,
- o Field methods and results,
- o Laboratory analyses and data validation results, and
- o Findings.

Also included in the final report will be all analytical results, figures showing the borehole locations and soil boring logs.

8.0 SCHEDULE

Field activities have been scheduled for Monday October 22, 1990. It is anticipated that it will take approximately one day to complete the drilling and sampling. The standard Enseco-RMAL turnaround time for laboratory samples is approximately four weeks. The final report will be issued by G&M within eight weeks of receipt of laboratory analytical data.

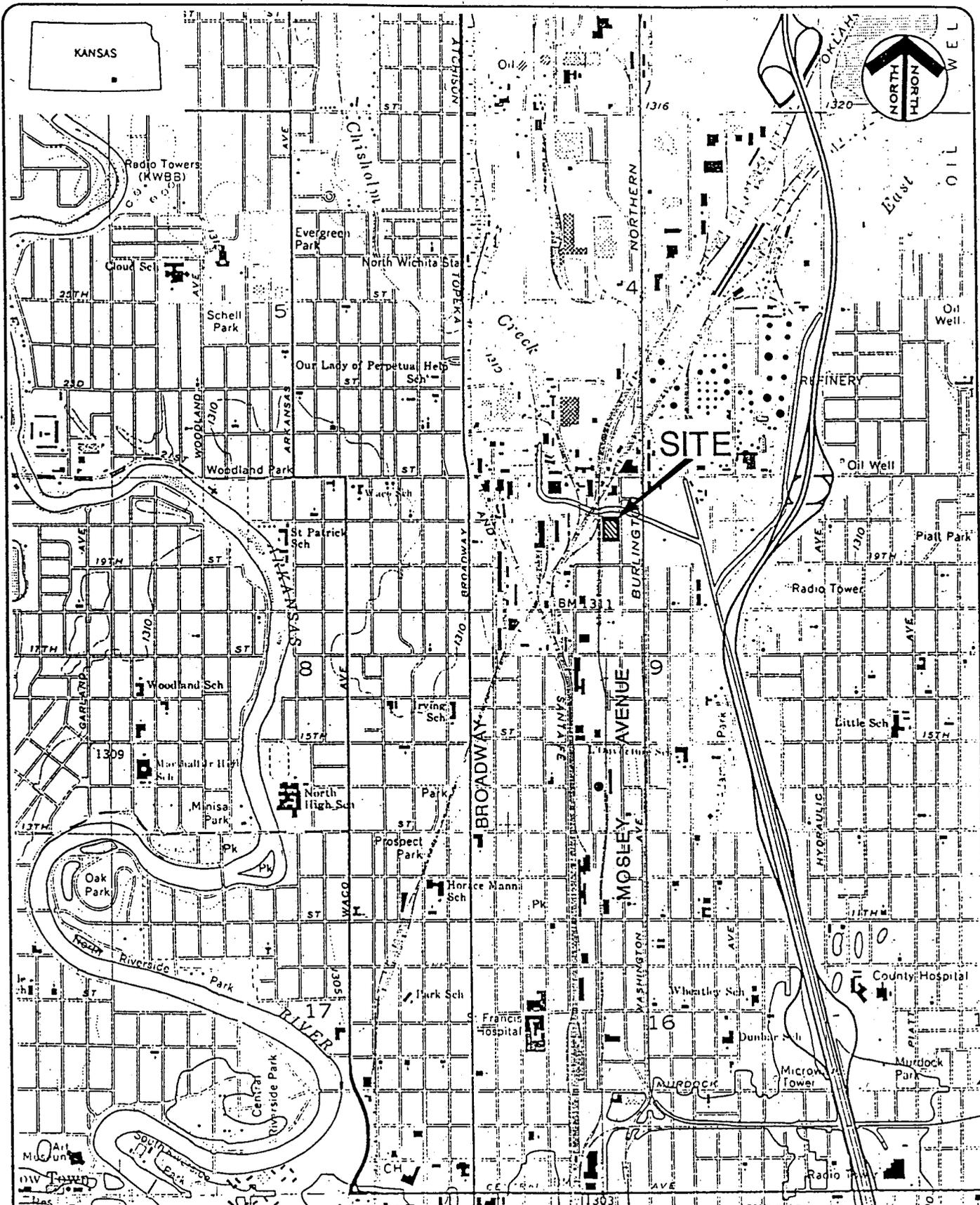
Respectfully submitted,
GERAGHTY & MILLER, INC.

Mary G. Zell
Project Manager

Kathleen C. Duchac
Office Manager/Associate

9.0 REFERENCES

- Hart, R.J. and T.B. Spruill. 1988. Description and hydrogeologic evaluation of nine hazardous waste sites in Kansas. U.S. Geological Survey Water Resources Investigation Report 88-4105.
- Kansas Department of Health & Environment. 1989. Consent Settlement, North Wichita Industrial District. 11 pp.
- Lane, C.W. and D.E. Miller. 1965. Geohydrology of Sedgwick County, Kansas. U. S. Geological Survey/State Geological Survey of Kansas Bulletin 176, 100 pp.
- Soil Conservation Service. 1975. Soil Survey of Sedgwick County, Kansas. U. S. Department of Agriculture Soil Conservation Service/Kansas Agricultural Experimentation Station, 126 pp.



Scale 1" = 2000'

2000 1000 0 2000

GERAGHTY & MILLER, INC.
Environmental Services

SITE LOCATION MAP
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

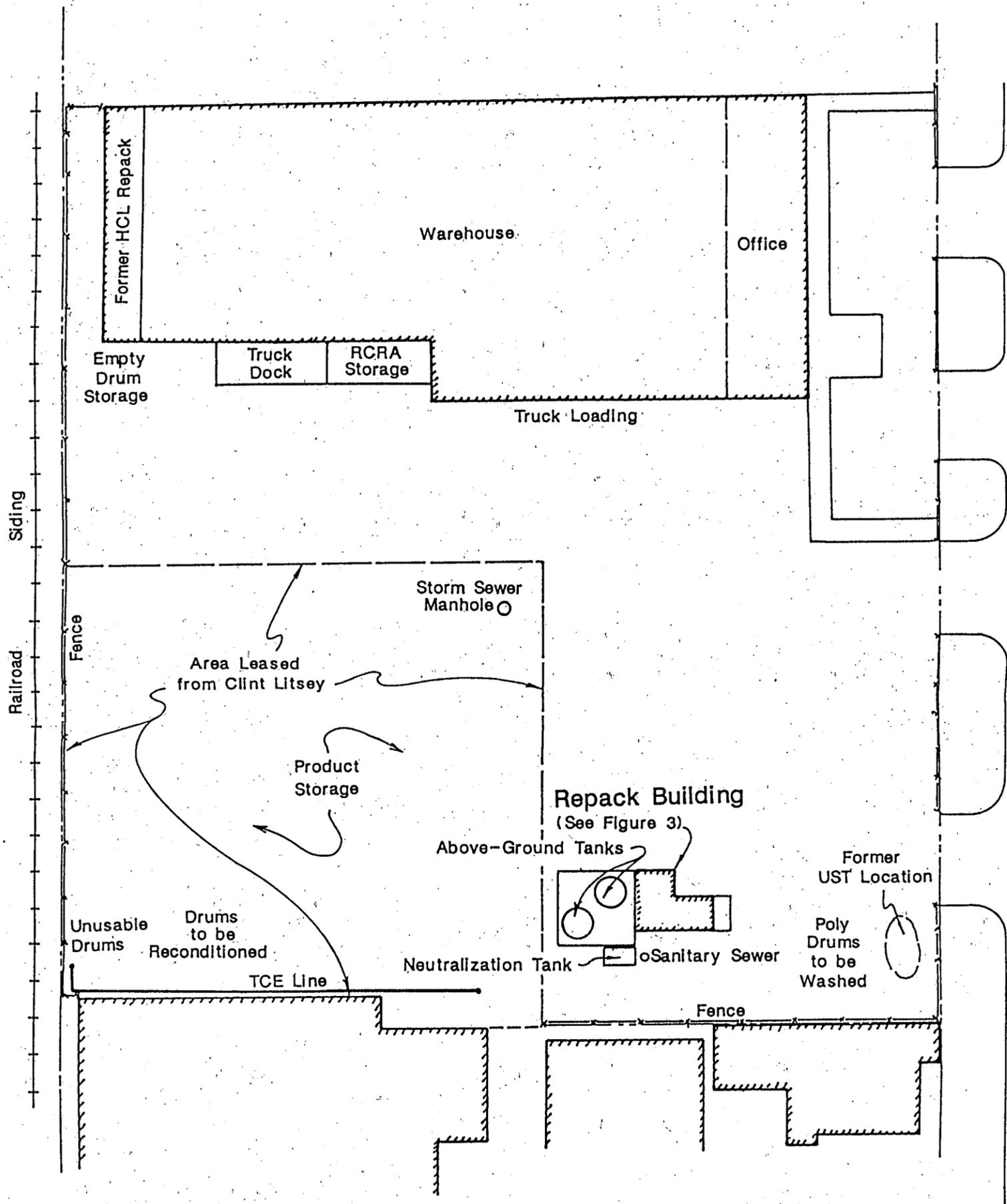
BASED ON 1982 REV. USGS 7.5' QUADRANGLE, WICHITA, EAST, KS

FIGURE
1

WORK PLAN



CHICAGO, ROCK ISLAND & PACIFIC RR



AVENUE

MOSLEY

Scale 1" = 40'
40 20 0 40



FACILITY MAP

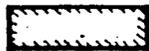
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

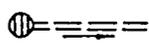
FIGURE

2

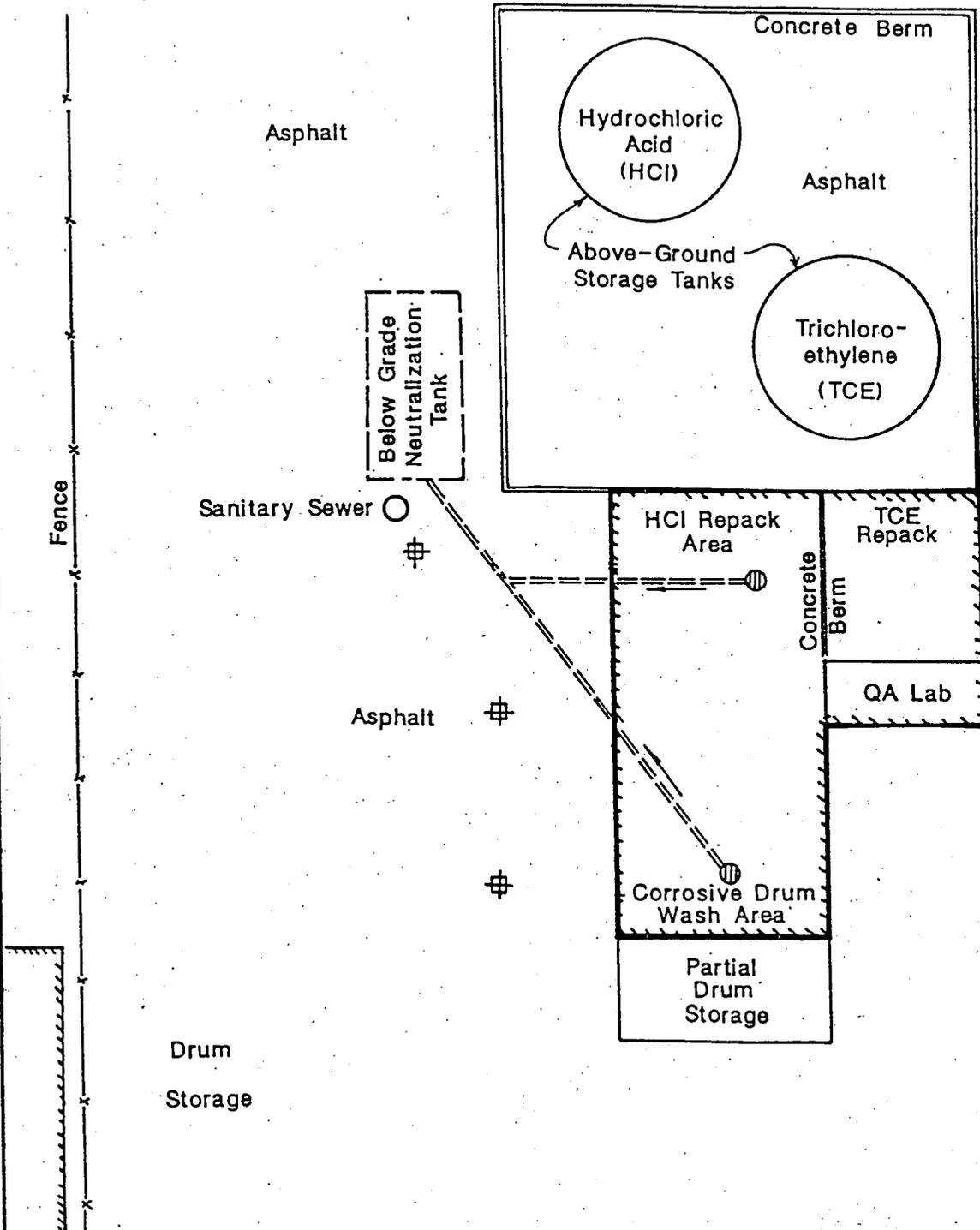
WORK PLAN

EXPLANATION OF SYMBOLS

 Building

 Floor Drain and Underground Piping to Neutralization Tank

 Proposed Soil Boring



NOT TO SCALE

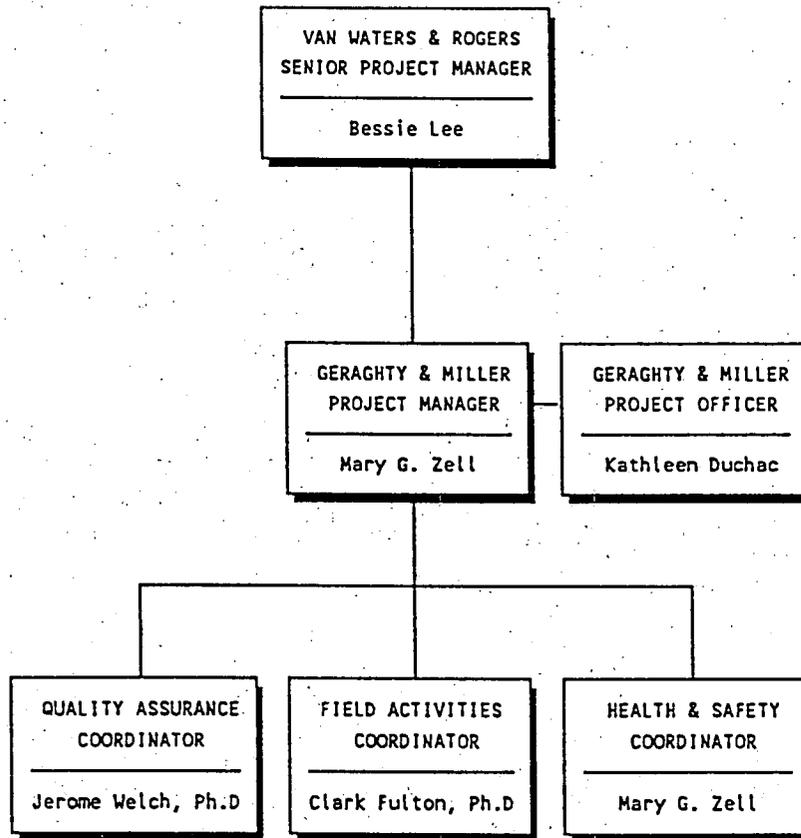


**PROPOSED
SOIL BORING LOCATIONS**
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

FIGURE

3

WORK PLAN



PROJECT ORGANIZATION CHART
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

FIGURE

4

SITE HEALTH & SAFETY PLAN
FOR
SOIL BORING INVESTIGATION

VAN WATERS & ROGERS INC.
2041 N. MOSLEY AVENUE
WICHITA, KANSAS

October 19, 1990

Prepared for:

VAN WATERS & ROGERS INC.
1600 Norton Building
801 Second Avenue
Seattle, Washington 98104

Prepared by:

GERAGHTY & MILLER, INC.
Environmental Services
900 Massachusetts Street, Suite 600
Lawrence, Kansas 66044

**GERAGHTY & MILLER, INC.
HEALTH & SAFETY PLAN (HASP)**

PROJECT NUMBER: KS02104

PROJECT NAME: Van Waters & Rogers Inc.

SITE LOCATION: 2041 North Mosley Avenue, Wichita, KS
(316) 267-6292

DESCRIPTION OF WORK: Drill three soil borings and collect samples for analysis

CLIENT CONTACT: Bessie Lee (408) 435-8700

PRIME CONTRACTOR: Geraghty & Miller, Inc. (G&M)

G&M CONTACTS: Kathleen Duchac, Mary G. Zell (913) 841-7641

G&M HEALTH & SAFETY COORDINATOR: Mary G. Zell

ON-SITE HEALTH & SAFETY COORDINATOR: Clark Fulton

SITE DESCRIPTION: The Mosley Avenue facility is located in the northern portion of Wichita, Kansas. The facility is bounded by Mosley Street to the east, the Chicago, Rhode Island and Pacific railroad tracks to the west, and other businesses to the south.

BACKGROUND: Van Waters & Rogers (VW&R) purchased all but the southwest corner of the currently occupied property from McKesson Chemical Company (McKesson) in 1986. The southwest portion is currently leased.

McKesson occupied the property from 1959 through 1986. The facility operates as a chemical distribution center and TCE and hydrochloric acid (HCl) repack area, and has handled a variety of industrial and agricultural chemicals. The Mosley Avenue plant currently operates under a RCRA B permit as a treatment, storage, and disposal facility. In anticipation of the RCRA permit renewal in 1994, the Kansas Department of Health and Environment conducted a RCRA Facility Assessment (RFA) of the Mosley Avenue plant on July 13, 1990. A suspected leak was discovered in the piping that leads from the HCl repack and wash area drain to the neutralization tank. Facility personnel later confirmed the leak. The purpose of this investigation is to assess the possible impact of the leak on the surrounding soils.

PLANNED ACTIVITIES: One 6-hour day of field work has been scheduled for the week of October 22, 1990. Site activities will include the following:

- 1) Drill 3 shallow soil borings using hollow-stem augers.
- 2) Collect 3 surface soil samples, and 3 quality assurance samples for laboratory analysis.
- 3) Decontaminate equipment. Containerize soil cuttings and decontamination waters.
- 4) Describe the lithology of the soils collected.

CHEMICAL HAZARDS: The known chemical hazards are the chemicals that have been repackaged in this area of the site. These include TCE, HCl, 1,1,1-trichloroethane (1,1,1-TCA), mineral spirits, hexane, methanol, glycol ether EB, n-propyl alcohol, and n-propyl acetate. Because of the possible contact hazard when sampling, workers will wear goggles and two layers of gloves. If fluids are

encountered or soils are damp, poly-coated coveralls will also be worn when sampling.

COMPONENT	LOCATIONS	MEDIA	PEL/TLV TWA*	STEL**
Glycol ether EB	All	S,W,A	25 ppm	NA
Hexane	All	S,W,A	50 ppm	NA
Hydrochloric Acid	All	S,W,A	5 ppm	5 ppm (5 min)
Methanol	All	S,W,A	200 ppm	250 ppm
Mineral Spirits	All	S,W,A	300 ppm	400 ppm
n-Propyl Acetate	All	S,W,A	200 ppm	250 ppm
n-Propyl Alcohol	All	S,W,A	200 ppm	250 ppm
1,1,1-TCA	All	S,W,A	350 ppm	450 ppm
Trichloroethene	All	S,W,A	50 ppm	200 ppm

S = soil W = water A = air NA = Not available

* Values from the American Conference of Governmental Industrial Hygienists or the Occupational Safety and Health Administration, whichever is most stringent. The Threshold Limit Value (TLV) is the time-weighted average (TWA) concentration for a forty-hour work week, to which all workers may be repeatedly exposed without adverse effect. The PEL is the OSHA permissible exposure limit, and is also a TWA.

** The Short-Term Exposure Limit (STEL) is the concentration at which workers can be continuously exposed for a short period of time. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than four times in an eight-hour period. There should be at least one hour between each 15 minute exposure at the STEL.

REQUIRED HEALTH AND SAFETY PROCEDURES: Caution must be used in working near the drill rig or other heavy equipment. A safe distance, as determined by the on-site safety coordinator, will be maintained between the work

area and public areas. Safety cones will be used to delimit the work area. Underground utility lines will be identified and marked prior to drilling or excavating. Heavy equipment will only be operated by authorized and qualified persons.

Appropriate personal protective equipment will be worn by all site workers at all times. No smoking will be allowed except in designated areas. Access to the work area will be restricted to personnel trained in accordance with OSHA 29 CFR 1910.120. Workers will be notified of locations of and given emergency access to eyewash stations, fire extinguishers and first aid facilities inside the building.

REQUIRED PERSONAL PROTECTIVE EQUIPMENT: The following protective equipment is required for all workers engaged in drilling, sampling, testing and associated activities:

1. Hard hat
2. Safety goggles with side protection
3. Protective nitrile gloves worn over surgical gloves
4. Boots (steel toes preferred)
5. Sleeved shirts and pants, or coveralls. Poly-coated Tyvek™ or equivalent disposable coveralls will be worn if soils are moist or fluids are encountered.
6. Air-purifying respirator (APR) with organic vapor cartridges (see below for guidelines)
7. Hearing protection

AIR MONITORING:

Methods and Action Levels: Prior to beginning field activities, up-wind air monitoring will be conducted to determine a baseline (ambient) air quality value. Glycol ether EB, hexane and TCE have the lowest action levels of the known compounds used at the plant. Full-face APRs equipped with organic vapor cartridges will be worn by investigative workers when sustained (5 minute) levels

of 25 ppm above background are recorded in the breathing zone by the photoionization detector (PID). Should sustained breathing zone levels of 200 ppm be recorded by the PID, personnel will exit the work area until levels decrease. Methanol and n-propyl alcohol each have action levels of 200 ppm, and each require supplied air respiratory protection.

Frequency: The PID readings will be taken in the breathing zone and at the borehole at least once every half hour. Ambient readings will be taken once per day. Monitoring frequencies listed are minimum intervals. More frequent readings may be taken at the request of any worker.

Recordkeeping: All readings will be recorded in the appropriate Health & Safety Log Book for the project.

CONTINGENCY PLANS: Work will be discontinued and the work area evacuated as directed by the Geraghty & Miller Site Safety Coordinator in the event of a chemical release from the facility. Work will resume when the vapor level, as measured at the work area perimeter, drops below the action level, or after fluids are contained. If vapor levels continue to meet or exceed action levels, work will cease and the work area will be secured and evacuated. Work shall not continue until the HASP is appropriately revised to meet the new conditions.

Should safety hazards, accident, or fire occur, appropriate immediate action will be taken (e.g., extinguishing the fire, administering first aid or CPR). Emergency personnel will first be notified, followed by the Geraghty & Miller Health and Safety Coordinator.

DECONTAMINATION PROCEDURES: Geraghty & Miller personnel will be responsible for decontaminating G&M personal protective and sampling equipment outside of the work area. Care will be taken to ensure that contaminated materials are not released to clean areas. Drilling personnel will be responsible for

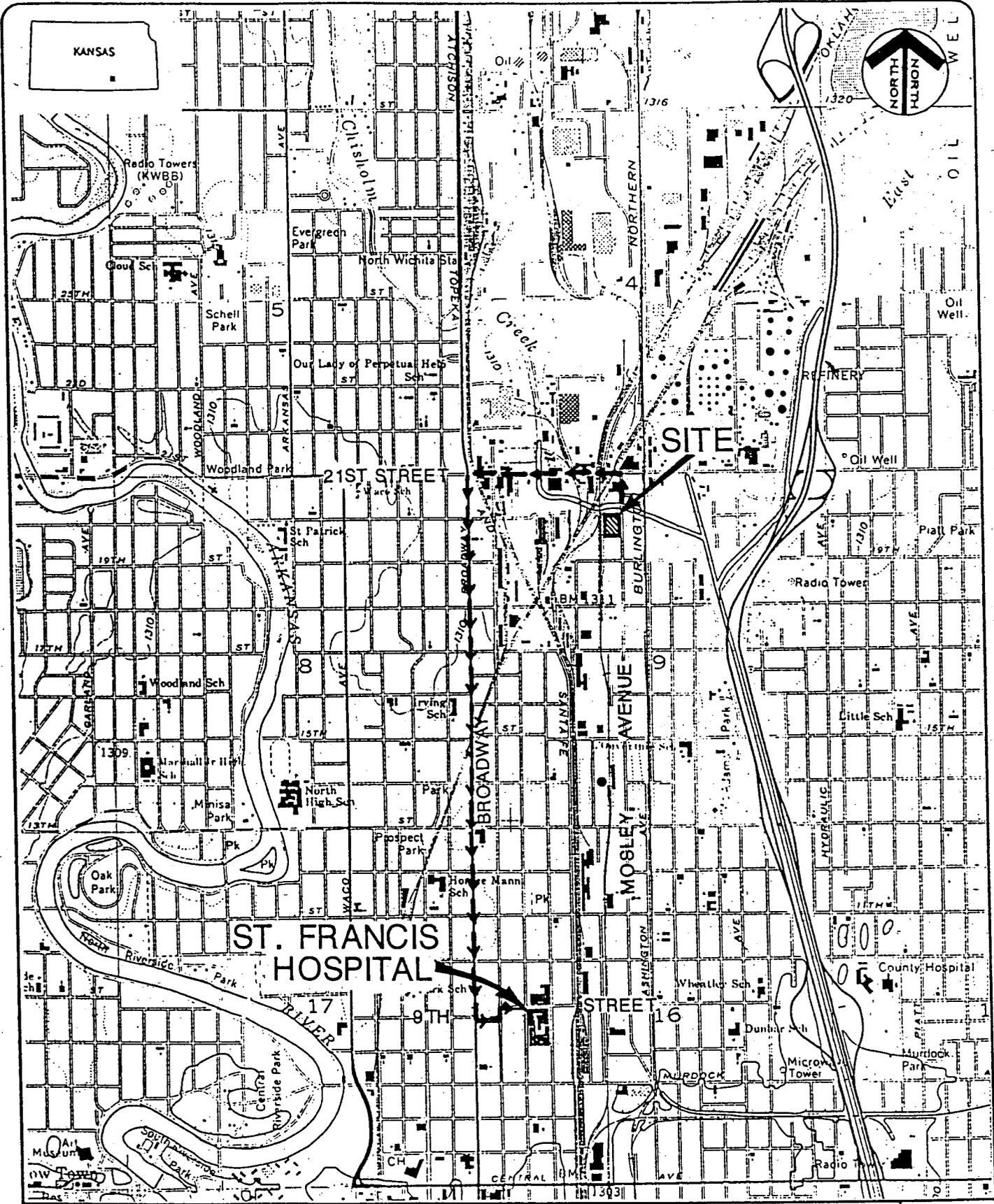
decontaminating auger flights and any other drilling apparatus, as well as their personal protective gear.

EMERGENCY CONTACTS AND PROCEDURES: Skin or eye contact with chemicals should be immediately treated by washing the area at an eyewash station and providing appropriate medical attention, if necessary. Should any situation or unplanned occurrence require outside or support services, the appropriate agency from the following list should be contacted.

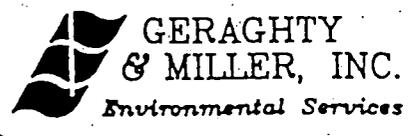
<u>Agency</u>	<u>Telephone Number</u>
FIRE DEPARTMENT:	911
POLICE:	911
ST. FRANCIS REGIONAL MEDICAL CENTER:	
Emergency	(316) 268-5050
PoisIndex	(316) 263-9999
G&M HEALTH & SAFETY COORDINATOR:	
Mary G. Zell	(913) 841-7641

ROUTE TO HOSPITAL: St. Francis Hospital is located at 929 N. St. Francis in Wichita. From the Mosley facility, proceed south on Mosley to 17th Street and turn right (west). At Broadway turn left and proceed south to 9th Street. Turn left (east) to the hospital.

MEDICAL SURVEILLANCE AND TRAINING: All Geraghty & Miller personnel are covered by a corporate medical surveillance program and have attended training programs that comply with OSHA 29 CFR 1910.120 requirements. The



Scale 1" = 2000'
 2000 1000 0 2000



ROUTE TO THE HOSPITAL
VW&R MOSLEY AVENUE FACILITY
WICHITA, KANSAS

BASED ON 1982 REV. USGS 7.5' QUADRANGLE, WICHITA, EAST, KS

HEALTH & SAFETY PLAN

FIGURE

1

Appendix B

Sample/Core Logs

SAMPLE/CORE LOG

Boring/Well SB-1 Project/No. Van Waters & Rogers/KS02104 Page 1 of 1

Site Wichita, KS-Mosley Ave Drilling Started 10:15 10/22/90 Drilling Completed 12:00 10/22/90

Total Depth Drilled 11.5 feet Hole Diameter 8 inches Type of Sample/
Coring Device Splitspoon

Length and Diameter of Coring Device 1.5" X 2" with 1.5" X 6" Sampling Interval 1 feet
Except 1st 2 ft

Land-Surface Elev. _____ feet Surveyed Estimated Brass Liners Datum _____

Drilling Fluid Used None Drilling Method Auger-Hollowstem

Drilling Contractor Layne-Western Driller Bill Smith Helper Jeff Gould

Prepared By C. Fulton Hammer Weight _____ Hammer Drop _____ inches

Sample/Core Depth (feet below land surface)		Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
From	To			
1.5	3.5	1.4	2,3,4,5	Silty clay, Black (10YR 2/1), sl-mod plastic, 1-2% V.F. sand, soft, moist, alluvium (CL)
3.5	4.5	1.0	2,4	Same as above
4.5	5.5	1.0	4,5	Same as above
5.5	6.5	1.0	6,7	Same as above
6.5	7.5	1.0	5,6	V.F. silty, clayey sand, DK Brown (10YR 3/3), soft, moist, alluvium (ML)
7.5	8.5	1.0	5,5	F. silty sand, DK Brown (10YR 3/3), soft crumbly, moist (ML) alluvium
8.5	9.5	1.0	6,5	Same as above
9.5	10.5	.5	6,7	Same as above
10.5	11.5	1.0	3,4	F-M silty sand, Brown-DK Brown (10YR 4/3) crumbly, moist, alluvium (SP)
				Total Depth = 11.5'
				No ground water was encountered during drilling.



SAMPLE/CORE LOG

Boring/Well SB-2 Project/No. Van Waters & Rogers/KS02104 Page 1 of 1

Site Location Wichita, KS-Mosley Ave Drilling Started 1:05 p.m. Drilling Completed 3:00 p.m.

Total Depth Drilled 10 feet Hole Diameter 8 inches Type of Sample/
Coring Device Splitspoon

Length and Diameter of Coring Device 1.5" X 2' with 1.5" X 6" Brass Liners Sampling Interval 1 feet

Land-Surface Elev. _____ feet Surveyed Estimated Datum _____

Drilling Fluid Used None Drilling Method Hollowstem Auger

Drilling Contractor Layne-Western Driller Bill Smith Helper Jeff Gould

Prepared By C. Fulton Hammer Weight _____ Hammer Drop _____ inches

Sample/Core Depth (feet below land surface)		Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
From	To			
0	1	-	-	Asphalt & gravelly black soil, auger cuttings only
1	2	.8	2,6	Silty clay or clayey silt, Black (10YR 2/1) 1-2% V.F. sand, Sl-Mod plasticity, soft, moist, alluvium (CL)
2	3	1.0	7,9	Same as above except 2-5% V.F. sand
3	4	1.0	4,6	Same as above except 2-3% V.F. sand
4	5	.8	2,4	Same as above except 1-2% V.F. sand
5	6	.9	3,7	Same as above except 5-10% V.F. sand
6	7	.9	6,7	Silty, F.-V.F. sand, V. Dk grayish Brown (10YR 3/2), 5-10% silt & clay, crumbly, soft, moist, alluvium (SM)
7	8	1.0	3,7	F.-M. sand, Dk yellowish Brown (10YR 3/4) trace silt, crumbly, soft, moist, alluvium (SP)
8	9	1.0	4,5	Same as above
9	10	1.0	3,7	VF-F sand, Dk Brown (10YR 3/3), trace, silt crumbly, moist, alluvium (SM)
				No ground water was encountered during drilling.
				Total Depth = 10'

SAMPLE/CORE LOG

Boring/Well SB-3 Project/No. Van Waters & Rogers/KS02104 Page 1 of 1

Site Location Wichita, KS-Mosley Drilling Started 3:45 p.m. Drilling Completed 4:50 p.m.

Total Depth Drilled 10 feet Hole Diameter 8 inches Type of Sample/
Coring Device Splitspoon

Length and Diameter of Coring Device 1.5"x2' with 1.5"x6" brass liners Sampling Interval 1 feet

Land-Surface Elev. _____ feet Surveyed Estimated Datum _____

Drilling Fluid Used None Drilling Method Hollow Stem Auger

Drilling Contractor Layne-Western Driller Bill Smith Helper Jeff Gould

Prepared By C. Fulton Hammer Weight _____ Drop _____ inches

Sample/Core Depth (feet below land surface)	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
From	To		

0	1		Asphalt & black gravelly Soil. Auger cuttings only.
1	2	1.0 4,5	Silty clay or clayey silt, Black (10YR 2/1) 1-2% V.F. sand, Sl-Mod plasticity, soft, moist, Alluvium (CL)
2	3	1.0 7,8	Same as above except 3-5% sand
3	4	1.0 5,6	Same as above except 3-5% sand
4	5	.8 4,10	Same as above except 5-10% sand
5	6	.7 5,7	V.F. silty sand, V. Dk Brown (10YR 2/2) crumbly, moist, alluvium (ML)
6	7	.7 5,6	Same as above
7	8	.9 4,6	F-M.F. sand, Dk Brown (10YR 3/3) crumbly, moist alluvium (SM)
8	9	1.0 7,8	Same as above
9	10	1.0 3,4	F-M sand, Dk yellowish' Brown (10YR 4/4), crumbly, moist, alluvium, (SP)
Total Depth = 10'			
No ground water was encountered during drilling.			

Appendix C

Field Screening Methods

APPENDIX C

Field Screening Measurements

Soil samples were collected by advancing brass tubes into the ground at one-foot vertical increments. The lower six inches of each one foot sample was used for PID and pH field measurements, and to describe the lithology of the soil.

Soil PID Field Measurements

A photoionization detector (PID) used for field measurements used a 10.2 eV lamp and was calibrated with isobutylene at the beginning of the day.

A portion of each sample was removed from the brass liner for PID analysis. The sample was immediately placed in a clean plastic bag and sealed. Each bag was labeled with the soil boring number and the sample depth. After each soil boring was completed, the samples in the plastic bags were transferred to new, clean Mason jars. The jars were immediately covered with aluminum foil. Each jar was labeled with the soil boring number and the sample depth. The jars were exposed to sunlight for 30 to 60 minutes prior to analysis.

The volatile organic compound (VOC) concentration in the headspace above each soil sample was measured by piercing the aluminum foil on the Mason jars with the probe of the PID. The maximum PID reading for each sample was recorded.

Van Waters & Rogers Inc.
2041 N. Mosley Avenue
Wichita, Kansas
Soil Boring Investigation
March 22, 1991
Page C-2

Soil pH Field Measurements

Several grams of soil from each sample were placed in a compartment of a clean plastic ice cube tray. Distilled water was added to each sample. The samples were disaggregated and dispersed in the distilled water and were allowed to stand for 10 to 60 minutes. Each sample was stirred prior to measuring the pH. The pH of each soil sample was measured with pH paper and the value recorded.

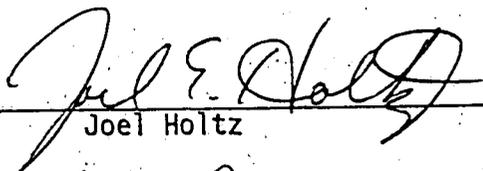
Appendix D
Chain-of-Custody Form
and
Enseco - RMAL Laboratory Report

ANALYTICAL RESULTS
FOR
GERAGHTY & MILLER
ENSECO-RMAL NO. 011960

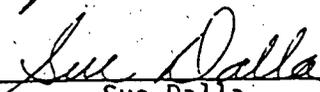
Enseco

NOVEMBER 28, 1990

Reviewed by:



Joel Holtz



Sue Dalla

Introduction

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

- o Sample Description Information
- o Analytical Test Requests
- o Analytical Results
- o Quality Control Report

The DAI analysis for samples 011960-0001 through -0005 was performed at Enseco-East and the associated project number is 10318.

Sample 011960-0007 was originally analyzed at 5 mL purge for Method 8240. Due to the physical characteristics of the sample matrix, foaming occurred during the analysis causing problems. The sample was run at 0.5 mL purge and finally at 100 uL purge. Foaming still occurred at these levels of dilution and the final dilution of 100 uL was reported.

Sample Description Information

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique six digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the six digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

Analytical Test Requests

The Analytical Test Requests lists the analyses that were performed on each sample. The Custom Test column indicates where tests have been modified to conform to the specific requirements of this project.

SAMPLE DESCRIPTION INFORMATION
for
Geraghty & Miller, Inc.

Lab ID	Client ID	Matrix	Sampled Date	Time	Received Date
011960-0001-SA	SB1-4.5'-5.5'	SOIL	22 OCT 90		24 OCT 90
011960-0002-SA	SB1-7.5'-8.5'	SOIL	22 OCT 90		24 OCT 90
011960-0003-SA	SB2-4.0'-5.0'	SOIL	22 OCT 90		24 OCT 90
011960-0004-SA	SB3-7.0'-8.0'	SOIL	22 OCT 90		24 OCT 90
011960-0005-SA	SB3-3.0'-4.0'	SOIL	22 OCT 90		24 OCT 90
011960-0006-SA	EQUIPMENT RINSATE	AQUEOUS	22 OCT 90		24 OCT 90
011960-0007-SA	DECONTAMINATION RINSATE	AQUEOUS	22 OCT 90		24 OCT 90
011960-0008-SA	TRIP BLANK	AQUEOUS			24 OCT 90

SAMPLE DESCRIPTION INFORMATION
for
Geraghty & Miller, Inc.

Lab ID	Client ID	Matrix	Sampled Date	Time	Received Date
010318-0001-SA	SB1-4.5'-5.5'	SOIL	22 OCT 90		24 OCT 90
010318-0002-SA	SB1-7.5'-8.5'	SOIL	22 OCT 90		24 OCT 90
010318-0003-SA	SB2-4.0'-5.0'	SOIL	22 OCT 90		24 OCT 90
010318-0004-SA	SB3-7.0'-8.0'	SOIL	22 OCT 90		24 OCT 90
010318-0005-SA	SB3-3.0'-4.0'	SOIL	22 OCT 90		24 OCT 90

ANALYTICAL TEST REQUESTS
for
Geraghty & Miller, Inc.

Lab ID: 011960	Group Code	Analysis Description	Custom Test?
0001 - 0005	A	Water Miscible Solvents pH Percent Water TCL Volatile Organics GC Screen For Low Level Soils	Y N N Y N
0006 - 0008	B	Volatile Organics Target Compound List (TCL) Screen - Volatile Organics	Y Y N

Analytical Results

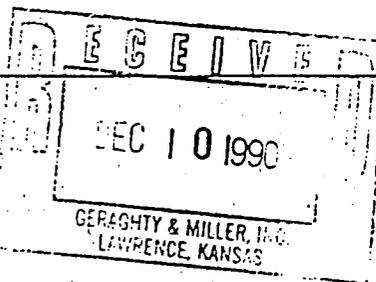
The analytical results for this project are presented in the following data tables. Each data table includes sample identification information, and when available and appropriate, dates sampled, received, authorized, prepared, and analyzed. The authorization data is the date when the project was defined by the client such that laboratory work could begin.

Data sheets contain a listing of the parameters measured in each test, the analytical results and the Enseco reporting limit. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis, i.e. no correction is made for moisture content.

Enseco-RMAL is no longer routinely blank-correcting analytical data. Uncorrected analytical results are reported, along with associated blank results, for all organic and metals analyses. Analytical results and blank results are reported for conventional inorganic parameters as specified in the method. This policy is described in detail in the Enseco Incorporated Quality Assurance Program Plan for Environmental Chemical Monitoring, Revision 3.3, May, 1989.

The results from the Standard Enseco QA/QC Program, which generates data which are independent of matrix effects, is provided subsequently.

TCL Volatile Organics
Method 8240



Client Name: Geraghty & Miller, Inc.
 Client ID: SB1-4.5'-5.5'
 Lab ID: 011960-0001-SA
 Matrix: SOIL
 Authorized: 24 OCT 90

Sampled: 22 OCT 90
 Prepared: 28 OCT 90
 Received: 24 OCT 90
 Analyzed: 30 OCT 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
1,1,1-Trichloroethane	ND	ug/kg	6.0
Trichloroethene	24	ug/kg	6.0
Hexane	ND	ug/kg	12
n-Propyl acetate	ND	ug/kg	--
Surrogate	Recovery		
Toluene-d8	106	%	--
4-Bromofluorobenzene	95	%	--
1,2-Dichloroethane-d4	103	%	--

Percent Moisture is 16.4%. All results and limits are reported on a dry weight basis.

ND = Not detected
 NA = Not applicable

Reported By: Keith Beauvais

Approved By: Jeff Lowry

TCL Volatile Organics

Method 8240

Client Name: Geraghty & Miller, Inc.

Client ID: SB1-7.5'-8.5'

Lab ID: 011960-0002-SA

Matrix: SOIL

Authorized: 24 OCT 90

Sampled: 22 OCT 90

Prepared: 28 OCT 90

Received: 24 OCT 90

Analyzed: 30 OCT 90

Parameter	Result	Dry Weight Units	Reporting Limit
1,1,1-Trichloroethane	ND	ug/kg	5.7
Trichloroethene	ND	ug/kg	5.7
Hexane	ND	ug/kg	11
n-Propyl acetate	ND	ug/kg	--
Surrogate	Recovery		
Toluene-d8	103	%	--
4-Bromofluorobenzene	90	%	--
1,2-Dichloroethane-d4	104	%	--

Percent Moisture is 12.0%. All results and limits are reported on a dry weight basis.

ND = Not detected

NA = Not applicable

Reported By: Keith Beauvais

Approved By: Jeff Lowry

TCL Volatile Organics

Method 8240

Client Name: Geraghty & Miller, Inc.

Client ID: SB2-4.0'-5.0'

Lab ID: 011960-0003-SA

Matrix: SOIL

Authorized: 24 OCT 90

Sampled: 22 OCT 90

Prepared: 28 OCT 90

Received: 24 OCT 90

Analyzed: 30 OCT 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
1,1,1-Trichloroethane	ND	ug/kg	6.1
Trichloroethene	31	ug/kg	6.1
Hexane	ND	ug/kg	12
n-Propyl acetate	ND	ug/kg	--
Surrogate	Recovery		
Toluene-d8	108	%	--
4-Bromofluorobenzene	88	%	--
1,2-Dichloroethane-d4	101	%	--

Percent Moisture is 18.2%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Keith Beauvais

Approved By: Jeff Lowry

TCL Volatile Organics

Method 8240

Client Name: Geraghty & Miller, Inc.

Client ID: SB3-7.0'-8.0'

Lab ID: 011960-0004-SA

Matrix: SOIL

Authorized: 24 OCT 90

Sampled: 22 OCT 90

Prepared: 28 OCT 90

Received: 24 OCT 90

Analyzed: 30 OCT 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
1,1,1-Trichloroethane	ND	ug/kg	5.9
Trichloroethene	35	ug/kg	5.9
Hexane	ND	ug/kg	12
n-Propyl acetate	ND	ug/kg	--
Surrogate	Recovery		
Toluene-d8	104	%	--
4-Bromofluorobenzene	93	%	--
1,2-Dichloroethane-d4	104	%	--

Percent Moisture is 15.3%. All results and limits are reported on a dry weight basis.

ND = Not detected

NA = Not applicable

Reported By: Keith Beauvais

Approved By: Jeff Lowry

TCL Volatile Organics**Method 8240**

Client Name: Geraghty & Miller, Inc.

Client ID: SB3-3.0'-4.0'

Lab ID: 011960-0005-SA

Matrix: SOIL

Authorized: 24 OCT 90

Sampled: 22 OCT 90

Prepared: 28 OCT 90

Received: 24 OCT 90

Analyzed: 02 NOV 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
1,1,1-Trichloroethane	ND	ug/kg	6.1
Trichloroethene	120	ug/kg	6.1
Hexane	ND	ug/kg	12
n-Propyl acetate	ND	ug/kg	--
Surrogate	Recovery		
Toluene-d8	119	%	--
4-Bromofluorobenzene	87	%	--
1,2-Dichloroethane-d4	96	%	--

Percent Moisture is 17.6%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Michael Blades

Approved By: Jeff Lowry

Volatile Organics
Target Compound List (TCL)
Method 8240

Client Name: Geraghty & Miller, Inc.
Client ID: EQUIPMENT RINSATE
Lab ID: 011960-0006-SA
Matrix: AQUEOUS
Authorized: 24 OCT 90

Sampled: 22 OCT 90
Prepared: 28 OCT 90

Received: 24 OCT 90
Analyzed: 29 OCT 90

Parameter	Result	Units	Reporting Limit
Hexane	ND	ug/L	10
n-Propyl acetate	ND	ug/L	--
1,1,1-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Surrogate	Recovery		
Toluene-d8	93	%	--
4-Bromofluorobenzene	101	%	--
1,2-Dichloroethane-d4	101	%	--

ND = Not detected
NA = Not applicable

Reported By: Steve Siegel

Approved By: Jeff Lowry

Volatile Organics
Target Compound List (TCL)
Method 8240

Client Name: Geraghty & Miller, Inc.

Client ID: DECONTAMINATION RINSATE

Lab ID: 011960-0007-SA

Matrix: AQUEOUS

Authorized: 24 OCT 90

Sampled: 22 OCT 90

Prepared: 28 OCT 90

Received: 24 OCT 90

Analyzed: 04 NOV 90

Parameter	Result	Units	Reporting Limit
Hexane	ND	ug/L	500
n-Propyl acetate	ND	ug/L	--
1,1,1-Trichloroethane	ND	ug/L	250
Trichloroethene	ND	ug/L	250
Surrogate	Recovery		
Toluene-d8	103	%	--
4-Bromofluorobenzene	91	%	--
1,2-Dichloroethane-d4	84	%	--

ND = Not detected
NA = Not applicable

Reported By: Cesar Rojas

Approved By: Jeff Lowry

Volatile Organics
Target Compound List (TCL)
Method 8240

Client Name: Geraghty & Miller, Inc.

Client ID: TRIP BLANK

Lab ID: 011960-0008-SA

Matrix: AQUEOUS

Authorized: 24 OCT 90

Sampled: Unknown
Prepared: 28 OCT 90

Received: 24 OCT 90
Analyzed: 29 OCT 90

Parameter	Result	Units	Reporting Limit
Hexane	ND	ug/L	10
n-Propyl acetate	ND	ug/L	--
1,1,1-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Surrogate	Recovery		
Toluene-d8	96	%	--
4-Bromofluorobenzene	100	%	--
1,2-Dichloroethane-d4	99	%	--

ND = Not detected
NA = Not applicable

Reported By: Steve Siegel

Approved By: Jeff Lowry

Water Miscible Solvents

Enseco
A Coming Company

Method DAI/GC/FID

Client Name: Geraghty & Miller, Inc.

Client ID: SB1-4.5'-5.5'

Lab ID: 010318-0001-SA Enseco ID: 3039280

Matrix: SOIL Sampled: 22 OCT 90

Authorized: 26 OCT 90 Prepared: 05 NOV 90

Received: 24 OCT 90

Analyzed: 05 NOV 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
Methanol	ND	mg/kg	1.2
1-Propanol	ND	mg/kg	1.2

Percent Moisture is 16%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Greg Manalo

Approved By: Dan Segal

Water Miscible Solvents

Method DAI/GC/FID

Client Name: Geraghty & Miller, Inc.

Client ID: SB1-7.5'-8.5'

Lab ID: 010318-0002-SA

Enseco ID: 3039283

Matrix: SOIL

Sampled: 22 OCT 90

Received: 24 OCT 90

Authorized: 26 OCT 90

Prepared: 05 NOV 90

Analyzed: 05 NOV 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
Methanol	ND	mg/kg	1.1
1-Propanol	ND	mg/kg	1.1

Percent Moisture is 12%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Greg Manalo

Approved By: Dan Segal

Water Miscible Solvents

Enseco
A Corning Company

Method DAI/GC/FID

Client Name: Geraghty & Miller, Inc.

Client ID: SB2-4.0'-5.0'

Lab ID: 010318-0003-SA

Matrix: SOIL

Authorized: 26 OCT 90

Enseco ID: 3039286

Sampled: 22 OCT 90

Prepared: 05 NOV 90

Received: 24 OCT 90

Analyzed: 05 NOV 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
Methanol	ND	mg/kg	1.2
1-Propanol	ND	mg/kg	1.2

Percent Moisture is 17%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Greg Manalo

Approved By: Dan Segal

Water Miscible Solvents

Enseco
A Corning Company

Method DAI/GC/FID

Client Name: Geraghty & Miller, Inc.

Client ID: SB3-7.0'-8.0'

Lab ID: 010318-0004-SA

Enseco ID: 3039287

Matrix: SOIL

Sampled: 22 OCT 90

Received: 24 OCT 90

Authorized: 26 OCT 90

Prepared: 05 NOV 90

Analyzed: 05 NOV 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
Methanol	ND	mg/kg	1.2
1-Propanol	ND	mg/kg	1.2

Percent Moisture is 15%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Greg Manalo

Approved By: Dan Segal

Appendix E
Data Validation Procedures

APPENDIX E

Data Validation Procedures

A review of quality assurance information for all samples was performed by G&M to validate the Enseco-RMAL analytical data. Components of the data validation procedures included the following:

- 1) Verifying that the laboratory completed the analyses as requested on the Laboratory Task Order, Sampling Memorandum, and Chain-of-Custody form
- 2) Verifying that the QA objectives specified in the project Work Plan were met
- 3) Determining the usability of the data, in accordance with the specified analytical methods and the USEPA Laboratory Data Validation Functional Guidelines For Evaluating Inorganics and Organics Analyses (USEPA, 1988a,b).

The validation procedure consisted of reviewing the field data package, sample results, and QA results. The field data package includes the soil sample logs, the Laboratory Task Order, the Sampling Memorandum, and the Chain-of-Custody forms. These documents were reviewed to verify that the sample collection and sample analysis objectives of the Work Plan were met.

The following specific items were checked to verify the sample analyses reported by the laboratory:

- Results were received for all submitted samples.

- All samples were analyzed for the requested parameters.
- All samples were analyzed by the methods specified in the Work Plan and requested on the Laboratory Task Order, the Sampling Memorandum and the Chain-of-Custody forms.
- All requested detection limits were met.
- All analyses were performed within acceptable holding times.

The review of the QA samples consisted of checking sample results for blanks generated in the field and QA information generated during analyses. Two field blanks (one equipment rinsate blank and one decontamination rinsate blank) and one trip blank were collected in the field. These samples were checked for the presence of analytes to determine if field decontamination methods may have contributed to the concentration of analytes in the samples.

The analytical laboratory is required to report certain QA information and to perform analyses within acceptable method control limits. The method control limits must be consistent with QA accuracy and precision criteria developed for each method by USEPA. The required information includes:

- instrument tuning and calibration results
- method blank results
- matrix spike and spike duplicate results
- surrogate spike results

The results of the review of the QA information were used to qualify the data with regard to their usability. If criteria were met, the data were determined to be usable and quantitative. If criteria were not met, the samples involved were flagged as either qualitative or unusable.

The QA/QC information provided by Enseco-RMAL and the sample logs, Chain-of-Custody, Laboratory Task Order, and Sampling Memorandum generated by Geraghty & Miller were validated. Through the data validation process, Geraghty & Miller verified the following:

- Geraghty & Miller procedures for collecting five soil samples and two field blank samples had met the QA objectives specified in the project Work Plan.
- Enseco-RMAL completed the analyses of five soil samples and three aqueous samples (including one trip blank) as requested on Laboratory Task Order number 1194, the October 25, 1990 Sampling Memorandum, and the Chain-of-Custody form received with the samples on October 24, 1990.
- Enseco-RMAL performed all QA/QC measures required by USEPA for Methods 8240, GC/FID DAI and 9045.
- All QA/QC measures conducted by Enseco-RMAL for the analyses of the five soil samples and three blank samples were within control limits specified by USEPA (1988a,b) for all seven parameters.

Therefore, the analytical results for the five soil samples are considered usable and are representative of actual facility conditions.

Water Miscible Solvents

Enseco
A Corning Company

Method DAI/GC/FID

Client Name: Geraghty & Miller, Inc.

Client ID: SB3-3.0'-4.0'

Lab ID: 010318-0005-SA

Matrix: SOIL

Authorized: 26 OCT 90

Enseco ID: 3039288

Sampled: 22 OCT 90

Prepared: 05 NOV 90

Received: 24 OCT 90

Analyzed: 05 NOV 90

Parameter	Result	Dry Weight Reporting	
		Units	Limit
Methanol	ND	mg/kg	1.2
1-Propanol	ND	mg/kg	1.2

Percent Moisture is 18%. All results and limits are reported on a dry weight basis.

ND = Not detected
NA = Not applicable

Reported By: Greg Manalo

Approved By: Dan Segal

General Inorganics

Client Name: Geraghty & Miller, Inc.

Client ID: SB1-4.5'-5.5'

Lab ID: 011960-0001-SA

Matrix: SOIL

Authorized: 24 OCT 90

Sampled: 22 OCT 90

Prepared: See Below

Received: 24 OCT 90

Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
pH	7.0	units	--	9045	NA	07 NOV 90

ND = Not detected
NA = Not applicable

Reported By: Toni Stovall

Approved By: Will Pratt

General Inorganics

Client Name: Geraghty & Miller, Inc.
Client ID: SBI-7.5'-8.5'
Lab ID: 011960-0002-SA
Matrix: SOIL
Authorized: 24 OCT 90

Sampled: 22 OCT 90
Prepared: See Below

Received: 24 OCT 90
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
pH	6.6	units	--	9045	NA	07 NOV 90

ND = Not detected
NA = Not applicable

Reported By: Toni Stovall

Approved By: Will Pratt

General Inorganics

Client Name: Geraghty & Miller, Inc.
Client ID: SB2-4.0'-5.0'
Lab ID: 011960-0003-SA
Matrix: SOIL
Authorized: 24 OCT 90

Sampled: 22 OCT 90
Prepared: See Below

Received: 24 OCT 90
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
pH	7.0	units	--	9045	NA	07 NOV 90

ND = Not detected
NA = Not applicable

Reported By: Toni Stovall

Approved By: Will Pratt

General Inorganics

Client Name: Geraghty & Miller, Inc.
 Client ID: SB3-7.0'-8.0'
 Lab ID: 011960-0004-SA
 Matrix: SOIL
 Authorized: 24 OCT 90

Sampled: 22 OCT 90
 Prepared: See Below

Received: 24 OCT 90
 Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
pH	7.0	units	--	9045	NA	07 NOV 90

ND = Not detected
 NA = Not applicable

Reported By: Toni Stovall

Approved By: Will Pratt

General Inorganics

Client Name: Geraghty & Miller, Inc.
Client ID: SB3-3.0'-4.0'
Lab ID: 011960-0005-SA
Matrix: SOIL
Authorized: 24 OCT 90

Sampled: 22 OCT 90
Prepared: See Below

Received: 24 OCT 90
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
pH	6.7	units	--	9045	NA	07 NOV 90

ND = Not detected
NA = Not applicable

Reported By: Toni Stovall

Approved By: Will Pratt

Quality Control Results

The Enseco laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid, legally defensible data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

In addition, the Enseco laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. Enseco - Rocky Mountain Analytical Laboratory is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

The standard laboratory QC package is designed to:

- 1) establish a strong, cost-effective QC program that ensures the generation of scientifically valid, legally defensible data
- 2) assess the laboratory's performance of the analytical method using control limits generated with a well-defined matrix
- 3) establish clear-cut guidelines for acceptability of analytical data so that QC decisions can be made immediately at the bench, and
- 4) provide a standard set of reportables which assures the client of the quality of his data.

The Enseco QC program is based upon monitoring the precision and accuracy of an analytical method by analyzing a set of Duplicate Control Samples (DCS) at frequent, well-defined intervals. Each DCS is a well-characterized matrix which is spiked with target compounds at 5-100 times the reporting limit, depending upon the methodology being monitored. The purpose of the DCS is not to duplicate the sample matrix, but rather to provide an interference-free, homogeneous matrix from which to gather data to establish control limits. These limits are used to determine whether data generated by the laboratory on any given day is in control.

Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/- 3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate DCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are fairly narrow based on the consistency of the matrix being monitored and are updated on a quarterly basis.

For each batch of samples analyzed, an additional control measure is taken in the form of a Single Control Sample (SCS). The SCS consists of a control matrix that is spiked with either representative target compounds or surrogate compounds appropriate to the method being used. An SCS is prepared for each sample lot for which the DCS pair are not analyzed.

Accuracy for DCS and SCS is measured by Percent Recovery.

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Precision for DCS is measured by Relative Percent Difference (RPD).

$$\text{RPD} = \frac{|\text{Measured Concentration DCS1} - \text{Measured Concentration DCS2}|}{(\text{Measured Concentration DCS1} + \text{Measured Concentration DCS2})/2} \times 100$$

All samples analyzed concurrently by the same test are assigned the same QC lot number. Projects which contain numerous samples, analyzed over several days, may have multiple QC lot numbers associated with each test. The QC information which follows includes a listing of the QC lot numbers associated with each of the samples reported, DCS and SCS (where applicable) recoveries from the QC lots associated with the samples, and control limits for these lots. The QC data is reported by test code, in the order that the tests are reported in the analytical results section of this report.

QC LOT ASSIGNMENT REPORT
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
011960-0001-SA	SOIL	8240-S	20 OCT 90-L	29 OCT 90-L
011960-0002-SA	SOIL	8240-S	20 OCT 90-L	29 OCT 90-L
011960-0003-SA	SOIL	8240-S	20 OCT 90-L	29 OCT 90-L
011960-0004-SA	SOIL	8240-S	20 OCT 90-L	29 OCT 90-L
011960-0005-SA	SOIL	8240-S	01 NOV 90-H	01 NOV 90-H2
011960-0006-SA	AQUEOUS	624-A	24 OCT 90-D	28 OCT 90-D
011960-0007-SA	AQUEOUS	624-A	31 OCT 90-F	04 NOV 90-F
011960-0008-SA	AQUEOUS	624-A	24 OCT 90-D	28 OCT 90-D

DUPLICATE CONTROL SAMPLE REPORT
Volatile Organics by GC/MS

Analyte	Concentration		Measured DCS2	AVG	Accuracy Average(%)		Precision (RPD)		
	Spiked	DCS1			DCS	Limits	DCS Limit		
Category: 8240-S									
Matrix: SOIL									
QC Lot: 20 OCT 90-L									
Concentration Units: ug/kg									
1,1-Dichloroethene	5000	6260	5980	6120	122	59-172	4.6	22	
Trichloroethene	5000	5210	5060	5140	103	62-137	2.9	24	
Benzene	5000	4730	4650	4690	94	66-142	1.7	21	
Toluene	5000	4900	4770	4840	97	59-139	2.7	21	
Chlorobenzene	5000	5060	5050	5060	101	60-133	0.2	21	

Category: 8240-S
Matrix: SOIL
QC Lot: 01 NOV 90-H
Concentration Units: ug/kg

1,1-Dichloroethene	5000	4600	4400	4500	90	59-172	4.4	22
Trichloroethene	5000	4870	4870	4870	97	62-137	0.0	24
Benzene	5000	5330	5290	5310	106	66-142	0.8	21
Toluene	5000	5120	5110	5120	102	59-139	0.2	21
Chlorobenzene	5000	5050	4980	5020	100	60-133	1.4	21

Category: 624-A
Matrix: AQUEOUS
QC Lot: 24 OCT 90-D
Concentration Units: ug/L

1,1-Dichloroethene	50	54.2	53.6	53.9	108	61-145	1.1	14
Trichloroethene	50	52.0	51.9	52.0	104	71-120	0.2	14
Benzene	50	51.1	52.0	51.6	103	76-127	1.7	11
Toluene	50	53.2	54.3	53.8	108	76-125	2.0	13
Chlorobenzene	50	55.0	52.7	53.8	108	75-130	4.3	13

Category: 624-A
Matrix: AQUEOUS
QC Lot: 31 OCT 90-F
Concentration Units: ug/L

1,1-Dichloroethene	50	50.7	48.8	49.8	100	61-145	3.8	14
Trichloroethene	50	57.1	56.3	56.7	113	71-120	1.4	14
Benzene	50	55.5	55.2	55.4	111	76-127	0.5	11
Toluene	50	51.0	52.1	51.6	103	76-125	2.1	13

Calculations are performed before rounding to avoid round-off errors in calculated results.

DUPLICATE CONTROL SAMPLE REPORT
Volatile Organics by GC/MS (cont.)

Analyte	Spiked	Concentration		Measured DCS2	AVG	Accuracy Average(%)		Precision (RPD)	
		DCS1				DCS	Limits	DCS	Limit
Category: 624-A									
Matrix: AQUEOUS									
QC Lot: 31 OCT 90-F									
Concentration Units: ug/L									
Chlorobenzene	50	53.1	52.8	53.0	106	75-130	0.6	13	

Calculations are performed before rounding to avoid round-off errors in calculated results.

SINGLE CONTROL SAMPLE REPORT
Volatile Organics by GC/MS

Analyte	Concentration		Accuracy (%)	
	Spiked	Measured	SCS	Limits
Category: 8240-S				
Matrix: SOIL				
QC Lot: 20 OCT 90-L QC Run: 29 OCT 90-L				
Concentration Units: ug/kg				
1,2-Dichloroethane-d4	5000	5250	105	70-121
4-Bromofluorobenzene	5000	4720	94	74-121
Toluene-d8	5000	4990	100	81-117

Category: 8240-S
Matrix: SOIL
QC Lot: 01 NOV 90-H QC Run: 01 NOV 90-H2
Concentration Units: ug/kg

1,2-Dichloroethane-d4	5000	4900	98	70-121
4-Bromofluorobenzene	5000	5300	106	74-121
Toluene-d8	5000	5210	104	81-117

Category: 624-A
Matrix: AQUEOUS
QC Lot: 24 OCT 90-D QC Run: 28 OCT 90-D
Concentration Units: ug/L

1,2-Dichloroethane-d4	50.0	50.1	100	76-114
4-Bromofluorobenzene	50.0	49.1	98	86-115
Toluene-d8	50.0	47.1	94	88-110

Category: 624-A
Matrix: AQUEOUS
QC Lot: 31 OCT 90-F QC Run: 04 NOV 90-F
Concentration Units: ug/L

1,2-Dichloroethane-d4	50.0	48.4	97	76-114
4-Bromofluorobenzene	50.0	49.7	99	86-115
Toluene-d8	50.0	51.7	103	88-110

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT
Volatile Organics by GC/MS

Analyte	Result	Units	Reporting Limit
Test: 8240-TCL-L-S			
Matrix: SOIL			
QC Lot: 20 OCT 90-L QC Run: 29 OCT 90-L			
1,1,1-Trichloroethane	ND	ug/kg	5.0
Trichloroethene	ND	ug/kg	5.0
Hexane	ND	ug/kg	10
n-Propyl acetate	ND	ug/kg	--

Test: 8240-TCL-L-S
Matrix: SOIL
QC Lot: 01 NOV 90-H QC Run: 01 NOV 90-H2

1,1,1-Trichloroethane	ND	ug/kg	5.0
Trichloroethene	ND	ug/kg	5.0
Hexane	ND	ug/kg	10
n-Propyl acetate	ND	ug/kg	--

Test: 8240CP-TCL-AP
Matrix: AQUEOUS
QC Lot: 24 OCT 90-D QC Run: 28 OCT 90-D

Hexane	ND	ug/L	10
n-Propyl acetate	ND	ug/L	--
1,1,1-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0

Test: 8240CP-TCL-AP
Matrix: AQUEOUS
QC Lot: 31 OCT 90-F QC Run: 04 NOV 90-F

Hexane	ND	ug/L	10
n-Propyl acetate	ND	ug/L	--
1,1,1-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0

QC LOT ASSIGNMENT REPORT
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
010318-0001-SA	SOIL	DAI-S	02 NOV 90-B	02 NOV 90-B
010318-0002-SA	SOIL	DAI-S	02 NOV 90-B	02 NOV 90-B
010318-0003-SA	SOIL	DAI-S	02 NOV 90-B	02 NOV 90-B
010318-0004-SA	SOIL	DAI-S	02 NOV 90-B	02 NOV 90-B
010318-0005-SA	SOIL	DAI-S	02 NOV 90-B	02 NOV 90-B

DUPLICATE CONTROL SAMPLE REPORT
Semivolatile Organics by GC

Analyte	Concentration Spiked	Concentration Measured		AVG	Accuracy Average(%)		Precision (RPD)	
		DCS1	DCS2		DCS	Limits	DCS	Limits
Category: DAI-S								
Matrix: SOIL								
QC Lot: 02 NOV 90-B								
Concentration Units: mg/kg								
Methanol	25	27.0	27.0	27.0	108	50-150	0.0	20
1-Propanol	25	24.0	23.0	23.5	94	50-150	4.3	20
1-Butanol	25	23.0	27.0	25.0	100	50-150	16	20

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT
Semivolatile Organics by GC

Analyte	Result	Units	Reporting Limit
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Test: DAI-FID-S

Matrix: SOIL

QC Lot: 02 NOV 90-B QC Run: 02 NOV 90-B

Methanol	ND	mg/kg	1.0
1-Propanol	ND	mg/kg	1.0

QC LOT ASSIGNMENT REPORT
Wet Chemistry Analysis and Preparation

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
011960-0001-SA	AQUEOUS	PH-A	07 NOV 90-D	-
011960-0002-SA	AQUEOUS	PH-A	07 NOV 90-D	-
011960-0003-SA	AQUEOUS	PH-A	07 NOV 90-D	-
011960-0004-SA	AQUEOUS	PH-A	07 NOV 90-D	-
011960-0005-SA	AQUEOUS	PH-A	07 NOV 90-D	-

DUPLICATE CONTROL SAMPLE REPORT
Wet Chemistry Analysis and Preparation

Analyte	Concentration		Measured DCS2	AVG	Accuracy Average(%)		Precision
	Spiked	DCS1			DCS	Limits	(RPD) DCS Limit
Category: PH-A Matrix: AQUEOUS QC Lot: 07 NOV 90-D Concentration Units: units							
pH	9.2	9.22	9.21	9.22	100	98-102	0.1 5

Calculations are performed before rounding to avoid round-off errors in calculated results.