SOIL GAS SURVEY

Hassayampa Landfill
Maricopa County, Arizona

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CONESTOGA-ROVERS & ASSOCIATES
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 BACKGROUND</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1 Disposal History</td>
<td>1</td>
</tr>
<tr>
<td>1.1.2 Surficial Stratigraphy</td>
<td>4</td>
</tr>
<tr>
<td>1.2 SCOPE OF SURVEY</td>
<td>4</td>
</tr>
<tr>
<td>2.0 METHODOLOGY</td>
<td>6</td>
</tr>
<tr>
<td>2.1 EQUIPMENT</td>
<td>6</td>
</tr>
<tr>
<td>2.2 SAMPLING AND ANALYTICAL PROCEDURES</td>
<td>6</td>
</tr>
<tr>
<td>2.2.1 Soil Gas Sampling Procedures</td>
<td>7</td>
</tr>
<tr>
<td>2.2.2 Analytical Procedures</td>
<td>8</td>
</tr>
<tr>
<td>2.3 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES</td>
<td>9</td>
</tr>
<tr>
<td>3.0 SURVEY RESULTS</td>
<td>12</td>
</tr>
<tr>
<td>3.1 ANALYTICAL DATA</td>
<td>12</td>
</tr>
<tr>
<td>3.2 DATA INTERPRETATION</td>
<td>12</td>
</tr>
<tr>
<td>3.2.1 Qualitative Analyses</td>
<td>12</td>
</tr>
<tr>
<td>3.2.2 Quantitative Analysis</td>
<td>14</td>
</tr>
<tr>
<td>3.3 CONCLUSIONS</td>
<td>15</td>
</tr>
<tr>
<td>4.0 SUMMARY OF RESULTS</td>
<td>16</td>
</tr>
<tr>
<td>5.0 REFERENCES</td>
<td>17</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>SITE LOCATION</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>PIT LOCATIONS</td>
<td>3</td>
</tr>
<tr>
<td>1.3</td>
<td>SITE STRATIGRAPHY SCHEMATIC</td>
<td>4</td>
</tr>
<tr>
<td>3.1</td>
<td>SOIL GAS CONCENTRATIONS - TOTAL VOLATILE HYDROCARBONS</td>
<td>12</td>
</tr>
<tr>
<td>3.2</td>
<td>SOIL GAS CONCENTRATIONS - TRICHLOROETHANE</td>
<td>12</td>
</tr>
<tr>
<td>3.3</td>
<td>SOIL GAS CONCENTRATIONS - TRICHLOROETHYLENE</td>
<td>12</td>
</tr>
<tr>
<td>3.4</td>
<td>SOIL GAS CONCENTRATIONS - TETRACHLOROETHYLENE</td>
<td>12</td>
</tr>
<tr>
<td>3.5</td>
<td>SOIL GAS CONCENTRATIONS - FREON 113</td>
<td>12</td>
</tr>
<tr>
<td>3.6</td>
<td>SOIL GAS CONCENTRATIONS - 1,1,-DICHLOROETHENE</td>
<td>12</td>
</tr>
<tr>
<td>3.7</td>
<td>TOTAL SOIL GAS CONCENTRATIONS</td>
<td>12</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>SAMPLE ANALYTES</td>
<td>8</td>
</tr>
<tr>
<td>3.1</td>
<td>SOIL AND SOIL GAS EVALUATION</td>
<td>14</td>
</tr>
<tr>
<td>3.2</td>
<td>COMPARISON OF TRC SOIL GAS RESULTS AND VADOSE ZONE BORING RESULTS</td>
<td>15</td>
</tr>
<tr>
<td>4.1</td>
<td>CONTAMINANT CONCENTRATION RANGES IN SOIL AND WASTE - SPECIAL PITS</td>
<td>17</td>
</tr>
</tbody>
</table>

LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTS</td>
</tr>
<tr>
<td>B</td>
<td>ANALYTICAL DATA SUMMARY</td>
</tr>
<tr>
<td>C</td>
<td>TRACER RESEARCH CORPORATION FIELD LOGBOOKS</td>
</tr>
<tr>
<td>D</td>
<td>CRA DATA VALIDATION</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

This report presents the results of the soil gas survey completed in the former hazardous waste area (hazardous waste area) of the Hassayampa Landfill (Landfill). The hazardous waste area is a fenced 10 acre area located within the Landfill and is approximately 40 miles west of Phoenix, Arizona, as shown on Figure 1.1.

The soil gas survey was contracted by the Hassayampa Steering Committee (HSC) to Tracer Research Corporation (TRC) in accordance with the Scope of Work (SOW) for the survey as approved by the United States Environmental Protection Agency (USEPA) Region IX in a letter to Conestoga-Rovers & Associates (CRA) dated June 24, 1991. TRC completed the survey using standard TRC Quality Assurance/Quality Control (QA/QC) procedures as amended by letters from CRA to the USEPA dated April 25, May 21, June 21, and July 3, 1991. The TRC QA/QC procedures and CRA letters are presented in Appendix A. CRA and Errol L. Montgomery and Associates (M & A) provided oversight on behalf of the HSC.

1.1 BACKGROUND

1.1.1 Disposal History

As reported in the Liquid Waste Evaluation (1990), use of the Landfill for the disposal of municipal and domestic waste began about 1961 and has continued to the present. From 1961 to 1977, the type of waste
SITE LOCATION
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona
disposed at the Landfill was not restricted, but consisted chiefly of garbage, rubbish, tree trimmings, and other plant refuse from Buckeye and surrounding areas (Schmidt and Scott, 1977).

Schmidt and Scott (1977) prepared their report for the Arizona Department of Health Services (ADHS) and concluded that the Landfill was suitable for the disposal of domestic and commercial refuse, properly prepared empty pesticide containers, and septic tank waste. This report also concluded that the Landfill was not suitable for the disposal of hazardous wastes. Based on these conclusions, Maricopa County prohibited the disposal of hazardous waste at the Landfill (ADHS, 1985).

On February 15, 1979, ADHS prohibited the disposal of industrial waste at City of Phoenix landfills. Alternate industrial waste disposal sites were not available in Arizona, and ADHS characterized the situation as "an extreme emergency" (ADHS, 1985). To provide a temporary facility for the disposal of hazardous waste, ADHS arranged for Maricopa County to accept hazardous waste on an interim basis at the Landfill. Maricopa County conditionally agreed on April 19, 1979, to accept hazardous waste at a portion of the Landfill for a 30-day period. On April 20, 1979, ADHS designated the Landfill as an interim site for disposal of the hazardous wastes (ADHS, 1985). Hazardous waste, accepted at the hazardous waste area, was generated solely in Maricopa County (Bureau of Waste Control, 1980). Subsequent to this initial 30-day period, ADHS requested and obtained several time extensions for use of the hazardous waste area for the disposal of hazardous waste. On October 28, 1980, the disposal of hazardous waste at the Landfill was again prohibited, and the hazardous waste area was closed.
During the 18-month period from April 20, 1979, to October 28, 1980, the disposal of hazardous waste at the hazardous waste area was conducted under a manifest program operated by ADHS. The manifest database was summarized in the Liquid Waste Evaluation Report (CRA and M & A, 1990) and subsequently updated in a letter to the USEPA dated August 23, 1991 from CRA.

Evaluation of this database indicated that a wide range of hazardous wastes, including approximately 3.44 million gallons of liquid wastes and approximately 3,370 tons of solid wastes, were approved by ADHS for disposal in Pits 1, 2, 3, and 4, and in the Special Pits. The locations of the pits are shown on Figure 1.2.

ADHS (1985) reported that Pit 1 was designated for the disposal of organics and oils. Organic solvents, pesticides, and oil were approved by ADHS for disposal in Pit 1. Pit 2 was designated for the disposal of acids and acid sludges. Heavy metals, acids, and organic solvents were approved by ADHS for disposal in Pit 2. Pit 3 was designated for the disposal of alkaline and metallic sludges. Heavy metal hydroxides, paint, and organic solvents were approved by ADHS for disposal in Pit 3. Pit 4 was designated for the disposal of pesticides and alkaline sludges. Pesticides, metal oxides, and metal hydroxides were approved by ADHS for disposal in Pit 4.

The Special Pits were the focus of the soil gas survey. The pits were designated for incompatible wastes. Organic solvents, pesticides, heavy metal and latex residues, oil and oil sludges, grease and associated
figure 1.2
PIT LOCATIONS
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona
emulsions were approved by ADHS for disposal in the Special Pits. These pits were reported by former Landfill employees to be small in size and spread out over several parts of the hazardous waste area. Figure 1.2 shows the location of Special Pits.

1.1.2 Surficial Stratigraphy

**Upper Alluvium Unit**

Soil gas probe sampling depths ranged from two feet to seven feet below ground surface and were completely contained within the Upper Alluvium unit. As shown on Figure 1.3, this unit occurs at the surface of the hazardous waste area and extends to an average depth of 56 feet (M & A, 1991). Within the uppermost 33 feet, the deposits consist chiefly of interbedded silty sand and gravelly sand with some cobbles and siltstone interbeds.

1.2 SCOPE OF SURVEY

The soil gas survey was conducted by the HSC at the request of the USEPA and was intended to delineate the extent of subsurface soil contamination in the vicinity of Pit 1 and the Special Pits. This delineation was focussed on the relative concentrations of target compounds in the soil gas at the hazardous waste area in order to confirm that the Special Pits were small in size and spread over the area shown on Figure 1.2.
AVERAGE DEPTH
(m) (ft.)
0 -r- 0
10 -- 33
17 -|- 56
22 -|- 73
33 - 107
82 - 268

UPPER ALLUVIAL DEPOSITS UNIT

UPPER
- SILTY SAND, GRAVELLY SAND COBBLES AND SiltSTONE INTERBEDS

LOWER
- CLAYEY Silt, SILTY CLAY
- WEATHERED NEAR TOP AND VESICULAR
- INTERBEDDED CLAYEY Silt AND SANDY Silt

UNIT A
- SILTY CLAY AND CLAYEY Silt INTERBEDDED WITH SAND AND GRAVEL

UNIT B
- SILTY CLAY

PALO VERDE CLAY

WATER LEVEL

BASALTIC LAVA-FLOW UNIT

SITE STRATIGRAPHY SCHEMATIC
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona
Samples were collected at 50 foot centers over the Special Pits area on a 400 foot by 250 foot grid. Additionally, samples were collected on three axes radially centered on Pit 1.

This report is organized into the following Sections:

- Section 2.0 - Methodology;
- Section 3.0 - Survey Results; and
- Section 4.0 - Summary of Results.
2.0 METHODOLOGY

Shallow soil gas sampling requires the extraction of a small volume of soil gas through a hollow sampling probe. A sample of this soil gas is then collected in a hypodermic needle for subsequent analysis in a temperature programmed gas chromatograph (GC). The detection of a volatile organic compound (VOC) in the soil gas indicates that the compound is present in the soil gas in the vadose zone adjacent to the probe.

2.1 EQUIPMENT

TRC utilized a one-ton Ford van equipped with hydraulically operated probe-driving equipment, a GC, and computing integrators. Built-in gasoline generators were used to operate all analytical and field equipment.

2.2 SAMPLING AND ANALYTICAL PROCEDURES

Sampling and analytical procedures described below were consistent with the USEPA-approved SOW and QA/QC procedures.
2.2.1 Soil Gas Sampling Procedures

Sampling probes consisted of 7-foot lengths of 3/4-inch diameter, hollow stainless steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced two to seven feet below grade, and then raised slightly (1-2 inches) in order to detach the solid drive tips and permit a sample to be collected. Once inserted into the ground, the tops of the sampling probes and tubing were fitted with a reducer and a length of silicon tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

For the vadose zone monitor borings, teflon lined polyethylene tubing was weighted and lowered to the bottom of the vapor borings. Separate tubing was dedicated to each boring location and was used only once.

Two to five liters of gas were evacuated with a vacuum pump to adequately purge the volume of air within the probe. Following the soil gas purging, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the stainless steel probe. Ten milliliters (mL) of gas were collected for immediate analysis by gas chromatography, in the TRC analytical field van. Soil gas was subsampled using duplicate injections in volumes ranging from 1 microliter (µL) to 2 mL, depending on the VOC concentration measured or anticipated to be present at any particular location.
The vacuum drawn on the sample probes normally ranged from 0-6 inches mercury (Hg). The maximum pump vacuum was measured at 25 inches Hg.

2.2.2 Analytical Procedures

A Varian 3300 GC was used for analyses of soil gas compounds presented in Table 2.1. It was equipped with an electron capture detector (ECD) and a flame ionization detector (FID). Compounds were separated on a 6 foot x 1/8 inch outside diameter (OD) packed column with SP-1000/OV-101 as the stationary phase in a temperature controlled oven. Nitrogen was used as the carrier gas.

Halocarbon and hydrocarbon compounds detected in the samples were identified by chromatographic retention time. The quantification of compounds was achieved by comparing of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day. System blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus, the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. Therefore, the injection sample size was maximized within the linear range.
| TABLE 2.1 |
| SAMPLE ANALYTES |
| HASSAYAMPA SOIL GAS SURVEY |
| MARICOPA COUNTY, ARIZONA |

- trichlorofluoromethane (Freon 11)
- 1,1 - dichloroethene
- trichlorotrifluoroethane (Freon 113)
- 1, 1 - dichoroethane
- 1, 1, 1 - trichloroethane
- trichloroethene
- tetrachloroethene
- benzene
- toluene
- ethylbenzene
- xylenes (total)
- total volatile hydrocarbons (consisting of approximately C4 - C9 aliphatic, alicyclic and aromatic hydrocarbons).
of response of the analytical equipment. If an injected sample exhibited a concentration beyond the quantifiable response range of the analytical equipment, a smaller sample size was reinjected for analysis and in some cases it was necessary to dilute the sample to quantify the concentration of the target analytes. Generally, this resulted in higher detection limits for all target compounds.

The detection limits for the halocarbon compounds were approximately 0.0002 micrograms per liter (μg/L). The detection limits for the other hydrocarbon compounds were approximately 0.03 μg/L. As was discussed above, these detection limits varied with the sample size.

2.3 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The amended TRC quality assurance procedures (TRC, 1991a), were closely adhered to during the survey to prevent potential cross-contamination of soil gas samples. The QA/QC procedures are described below:

1) Stainless steel probes were used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination.

2) Probe adaptors were used to connect the sample probe to the vacuum pump in order to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the
adaptor to the vacuum pump was replaced for every sample to insure cleanliness and good fit. At the end of each day, the adaptor was cleaned with soap and water and baked in the GC oven.

3) Silicone tubing (which acts as a septum for the syringe needle) was replaced after each sample was collected to ensure a proper seal around the syringe needle and to prevent cross-contamination. Soil gas samples for analysis were obtained up stream from the tubing by inserting the syringe down into the stainless steel probe.

4) Glass syringes were used for only one sample per day and were washed and baked after sampling.

5) Injector port septa through which soil gas samples were injected into the chromatograph were replaced on a daily basis to prevent possible gas leaks from the chromatographic column.

6) Analytical instruments were calibrated each day against analytical standards and calibration checks were run after approximately every five soil gas sampling locations.

7) Sampling syringes were checked for contamination prior to each sample being collected by injecting nitrogen gas syringe blank into the GC.

8) Prior to sampling each day, system blanks were run to check the sampling apparatus for contamination by drawing ambient air through
the analytical equipment and comparing the analysis to similar nitrogen system blanks.

9) All sampling and subsampling syringes were decontaminated each day prior to reuse.

10) Soil gas pumping was monitored by a vacuum gauge to insure that an adequate gas flow from the probes was maintained. A gas sample was obtained if the sample vacuum gauge reading was at least 2 inches Hg less than the maximum pump vacuum.
3.0 SURVEY RESULTS

3.1 ANALYTICAL DATA

Appendix B summarizes the analytical results of the soil gas survey as reported by TRC (Tracer Research, 1991b). These data are presented on Figures 3.1 to 3.6 in the form of concentration contours which indicate areas of relative soil gas contamination. TRC field logbooks are presented in Appendix C.

The analytical summary does not include data for benzene, toluene, ethylbenzene, and total xylenes. Of these four compounds, only xylenes were detected. This infrequency of detections, for those four compounds, makes a discussion of these results speculative and no interpretation is attempted.

CRA's validation of the analytical data is summarized in Appendix D.

3.2 DATA INTERPRETATION

3.2.1 Qualitative Analyses

Figures 3.1 to 3.6 indicate a spatial variation in the detected soil gas concentrations. Figure 3.7 illustrates this spatial variation by
LEGEND

DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 4b, and 4c were determined approximately based on existing records. Locations and boundaries for other disposal pits are based on analysis of a January 26, 1981, aerial photo and on reports. Locations and boundaries are tentative and approximate.

1. VOLATILE HYDROCARBONS CONCENTRATIONS (ug/)

FIGURE 3.1
SOIL GAS CONCENTRATIONS
TOTAL VOLATILE HYDROCARBON
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona

BASE MAP SOURCE: ERROL L. MONTGOMERY AND ASSOCIATES
BASE STATION 40 FEET SOUTH OF FENCE CORNER

BASE MAP SOURCE: ERROL L. MONTGOMERY AND ASSOCIATES

DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 4a, and 4c were determined approximately based on trenching operations. Locations and boundaries for other disposed pits are based on analysis of a January 26, 1981, aerial photo and on reports. Locations and boundaries are tentative and approximate.

LEGEND

TRICHLOROETHANE CONCENTRATIONS (ug/L)

SOIL GAS SURVEY
HASSAYAMPA LANDFILL
MARICOPA COUNTY, ARIZONA

SOIL GAS CONCENTRATIONS TRICHLOROETHANE

FIGURE 3.2

BASE STATION 40 FEET SOUTH OF FENCE CORNER

2141-17/09/91-11-0
TRICHLOROETHYLENE CONCENTRATIONS (ug/L)

LEGEND

DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 4b and 4c were determined approximately based on field observations. Locations and boundaries for other disposal pits are based on analysis of a January 26, 1981 aerial photo and on reports. Locations and boundaries are tentative and approximate.

TRICHLOROETHYLENE CONCENTRATIONS (ug/L)

figure 3.3

SOIL GAS CONCENTRATIONS
TRICHLOROETHYLENE
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona
LEGEND

DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 4a, and 4c were determined approximately based on trenching operations. Locations and boundaries for other disposal pits are based on analyses of a January 25, 1981, aerial photo and on reports. Locations and boundaries are tentative and approximate.

TETRACHLOROETHYLENE CONCENTRATIONS (μg/L)

SOIL GAS CONCENTRATIONS
TETRACHLOROETHYLENE
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona

BASE MAP SOURCE: ERROL L. MONTGOMERY AND ASSOCIATES

figure 3.4

SOIL GAS CONCENTRATIONS
TETRACHLOROETHYLENE
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona
SOIL GAS CONCENTRATIONS
FREON 113
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona

DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 4b and 4c were determined approximately based on trenching operations. Locations and boundaries for other disposed pits are based on analysis of a January 26, 1981, aerial photo and site reports. Locations and boundaries are tentative and approximate.

FREON 113 CONCENTRATIONS (ug/L)

LEGEND

BASE STATION 40 FEET SOUTH OF FENCE CORNER

figure 3.5
Figure 3.6

SOIL GAS CONCENTRATIONS
1,1 - DICHLOROETHENE
SOIL GAS SURVEY
HASSAYAMPA LANDFILL
Maricopa County, Arizona
DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 4b, and 4c were determined approximately based on trenching operations. Locations and boundaries for other disposal pits are based on analysis of a January 26, 1981, aerial photo and report. Locations and boundaries are tentative and approximate.

LEGEND

TOTAL CONCENTRATION (ug/L)

1000 - 4999
5000 - 9999
10,000 - 99,999
>100,000

TOTAL SOIL GAS CONCENTRATIONS
HASAYAMPA LANDFILL
Maricopa County, Arizona

figure 3.7
providing a composite of concentration contours for the total concentration of all target compounds detected at each sampling location.

Three distinct zones of contamination were evident. The highest detections of soil gas constituents were recorded within Pit 1. A zone of the highest detected VOC concentration encompasses Pit 1 and an elevated VOC concentration contour is centered in Pit 1. It is likely that the data point reflects a spatial trend associated with the waste layer which remains in Pit 1. A zone of elevated VOC concentrations was detected surrounding Pit 1.

The central and north central parts of the Special Pits contain a large area of elevated concentrations of VOCs in the soil gas, though the concentrations are much less significant than in the area surrounding Pit 1.

A third area, located in the southwest corner of the hazardous waste area, is identified as a probable area of elevated soil gas contamination characterized substantially by Total Volatile Hydrocarbons (TVHC), 1,1,1-trichloroethane, and 1,1-dichloroethene.

In addition to the above, a single elevated detection appears to the north of the hazardous waste area. An elevated VOC concentration was detected in the soil gas adjacent to or along the alignment of Old Wickenburg Road. It is improbable that diffusive transport or liquid transport of the contaminants detected in the disposal pits are responsible for this single, discontinuous elevated detection.
3.2.2 Quantitative Analysis

Soil properties in the surficial Upper Alluvium unit are considered to be relatively homogeneous. It is assumed that residual waste properties (in the Special Pits area) are similar to those in Pit 1. Therefore, the water:vapor partition coefficient for contaminants is expected to similarly remain spatially homogeneous. This partition coefficient is a measure of a tendency of a soluble volatile compound to migrate from the water in the soil to the vapor phase. Thus, soil gas concentrations may be correlated to observed concentrations of targeted compounds in soil and waste samples from Pit 1 in order to provide an order of magnitude estimate of the concentrations of these targeted compounds in the soil and residual wastes (if wastes exist) in the Special Pits area.

The concentrations of the target compounds in soil and waste samples collected in Pit 1 were therefore compared to soil gas concentrations to develop this linear correlation, as shown in Table 3.1. Using the calculated ratios, it was possible for both waste and soil samples from Pit 1, to estimate soil concentrations for soil gas sampling locations in the Special Pits area. Estimated waste and soil concentrations based on the maximum and median detections of VOCs in the soil gas in the Special Pits area are also presented in Table 3.1.

A further comparison was conducted of the TRC soil gas results, southeast of Pit 1, with vadose zone boring results (M & A, August 1991) which were collected at approximately the same
### Table 3.1
SOIL AND SOIL GAS EVALUATION
HASSAYAMPA SOIL GAS SURVEY
MARICOPA COUNTY, ARIZONA

#### Table: PIT 1 DATA

<table>
<thead>
<tr>
<th>Compound</th>
<th>Representative Soil Concentration (1)</th>
<th>Detected Soil Gas Concentrations (µg/L)(2)</th>
<th>Ratio: Representative Soil Concentration to Soil Gas Concentration (mg/kg:µg/L)</th>
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<tr>
<td></td>
<td>Pit 1 Waste (mg/kg)</td>
<td>Pit 1 Soil (mg/kg)</td>
<td>Waste (mg/kg:µg/L)</td>
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<tr>
<td>1,1-dichloroethene</td>
<td>28</td>
<td>175</td>
<td>710</td>
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<tr>
<td>tetrachloroethene</td>
<td>496</td>
<td>184</td>
<td>3600</td>
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**Soil Gas Concentrations (µg/L)**

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<th>Special Pits</th>
<th>Typical</th>
<th>Maximum</th>
<th>Median</th>
<th>Typical Maximum</th>
<th>Waste</th>
<th>Soil</th>
<th>Median</th>
<th>Waste</th>
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<td>50</td>
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<td>14</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,1,1-trichloroethane</td>
<td>10000</td>
<td>1000</td>
<td>200</td>
<td>700</td>
<td>20</td>
<td>20</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trichloroethene</td>
<td>5700</td>
<td>1000</td>
<td>114</td>
<td>114</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freon 113</td>
<td>10000</td>
<td>1000</td>
<td>3</td>
<td>300</td>
<td>0.3</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**


2) Typical data from contour immediately surrounding Pit 1.
locations as the TRC soil gas samples but at increased depths below ground surface. Table 3.2 presents TRC soil gas results and vadose zone boring results and the comparison indicates that vadose zone soil gas results are three orders of magnitude higher than TRC soil gas results for the same sample location. This variation of soil gas results is possibly due to the difference in sample depths. TRC soil gas samples were collected at depths up to six feet below ground surface while vadose zone boring soil gas samples were collected at depths up to 51 feet below ground surface. Due to the shallow sampling depths of TRC soil gas samples, the results may have potentially been diluted by ambient air. However, both sampling events (TRC and M&A) show that VOC concentrations in the soil gas decreases with increased distance from Pit 1.

3.3 CONCLUSIONS

Three distinct and significant areas of soil gas contamination exist in the hazardous waste area. The area in and surrounding Pit 1 contains the most significant level of VOCs in the soil gas. Similarly, the concentrations of contaminants detected in soil gas samples from Pit 1 were the most substantial detections in the RI.

The second distinct area is located around the center of the Special Pits area. The concentrations of contaminants detected in soil gas samples were utilized to estimate concentrations of contaminants in the soil and waste in the Special Pits area. These estimated concentrations indicate
TABLE 3.2
COMPARISON OF TRC SOIL GAS RESULTS
AND VADOSE ZONE BORING RESULTS
HASSAYAMPA SOIL GAS SURVEY
MARICOPA COUNTY, ARIZONA

<table>
<thead>
<tr>
<th>Compound</th>
<th>SG-SE1-4</th>
<th>VB-1</th>
<th>SG-SE2-4</th>
<th>VB-2f</th>
<th>VB-2c</th>
<th>SG-SE3-4</th>
<th>VB-3</th>
<th>SG-SE4-6</th>
<th>VB-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>trichlorofluoromethane</td>
<td>26</td>
<td>51,000</td>
<td>30</td>
<td>111,000</td>
<td>45,000</td>
<td>33</td>
<td>33,000</td>
<td>17</td>
<td>16,000</td>
</tr>
<tr>
<td>1,1-dichloroethene</td>
<td>420</td>
<td>2,400,000</td>
<td>350</td>
<td>4,900,000</td>
<td>2,100,000</td>
<td>320</td>
<td>1,200,000</td>
<td>85</td>
<td>640,000</td>
</tr>
<tr>
<td>1,1-dichloroethane</td>
<td>41</td>
<td>140,000</td>
<td>ND (7)</td>
<td>220,000</td>
<td>78,000</td>
<td>ND (7)</td>
<td>54,000</td>
<td>ND (6)</td>
<td>21,000</td>
</tr>
<tr>
<td>trichlorotrifluoroethane</td>
<td>3,600</td>
<td>6,100,000</td>
<td>3,400</td>
<td>13,000,000</td>
<td>5,200,000</td>
<td>3,300</td>
<td>3,300,000</td>
<td>1,600</td>
<td>1,800,000</td>
</tr>
<tr>
<td>1,1,1-trichloroethane</td>
<td>2,600</td>
<td>3,800,000</td>
<td>770</td>
<td>2,500,000</td>
<td>1,000,000</td>
<td>250</td>
<td>360,000</td>
<td>53</td>
<td>98,000</td>
</tr>
<tr>
<td>trichloroethene</td>
<td>80</td>
<td>230,000</td>
<td>6</td>
<td>290,000</td>
<td>120,000</td>
<td>25</td>
<td>68,000</td>
<td>7</td>
<td>30,000</td>
</tr>
<tr>
<td>tetrachloroethene</td>
<td>77</td>
<td>97,000</td>
<td>20</td>
<td>120,000</td>
<td>53,000</td>
<td>14</td>
<td>31,000</td>
<td>1</td>
<td>14,000</td>
</tr>
</tbody>
</table>

Notes:
(1) SG-SE1-4 where, SG = soil gas
    SE1 = sample location ID
    4 = depth of sample below ground surface (ft)
(2) VB-2c where, VB = vadose zone boring
    2c = sample location ID
(3) ND - Not detected, with detection limit shown in brackets.
that the concentrations of target compounds are at least one order of magnitude less than those detected in waste samples from Pit 1.

The third area of elevated VOC concentrations in soil gas is located in the southwest corner of the hazardous waste area, near the Special Pits area. The concentration of VOCs in this area is approximately one-third the value of the highest soil gas concentration in the center of the Special Pits area and corresponding median concentrations of VOCs in the soils in this area would be expected to be at least two orders of magnitude less than those detected in waste samples from Pit 1.
4.0 SUMMARY OF RESULTS

Analytical data for the soil gas survey are summarized in Appendix B and graphically presented on Figures 3.1 to 3.6.

Three qualitative levels of VOC contamination in soil gas were evident in three locations within the hazardous waste area. Pit 1 was observed to contain the most significant VOC concentrations of soil gas contaminants. An extensive area of less significant soil gas concentration was detected in the center of the Special Pits area. A smaller area of less significant VOC concentration in the soil gas was found in the southwest corner of the hazardous waste area. In addition, a single elevated detection of VOCs in the soil gas appears to the north of the hazardous waste area adjacent to or along the alignment of Old Wickenburg Road.

The concentrations of targeted compounds in Pit 1 soil and waste were compared to the detected soil gas concentrations in sampling points surrounding Pit 1. This comparison was used to develop an estimate of the concentrations of targeted compounds in soils and wastes in the Special Pits area. The estimate of the concentrations of contaminants in soils and residual wastes in the Special Pit area are summarized in Table 4.1.
<table>
<thead>
<tr>
<th>Compound</th>
<th>Typical Maximum Range (1) (mg/kg)</th>
<th>Median Range (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1-dichloroethene</td>
<td>20-178</td>
<td>20-125</td>
</tr>
<tr>
<td>tetrachloroethene</td>
<td>50-140</td>
<td>5-14</td>
</tr>
<tr>
<td>1,1,1-trichloroethane</td>
<td>200-700</td>
<td>20-70</td>
</tr>
<tr>
<td>trichloroethene</td>
<td>114</td>
<td>20</td>
</tr>
<tr>
<td>Freon 113</td>
<td>3-300</td>
<td>0.3-30</td>
</tr>
</tbody>
</table>

Note:
(1) Typical maximum and median ranges are as shown in Table 3.1.
5.0 REFERENCES


TRACER RESEARCH CORPORATION'S
SAMPLING PROCEDURES
AND
QA/QC PROCEDURES

PREPARED BY:

[Signature]

TRACER RESEARCH CORPORATION
SOIL GAS SAMPLING PROCEDURE

I. Probe Placement
A) A clean probe (pipe) is removed from the "clean" storage tube on top of the van.
B) The soil gas probe is placed in the jaws of hydraulic pusher/puller mechanism.
C) A sampling point is put on the bottom of the probe.
D) The hydraulic pushing mechanism is used to push the probe into the ground.
E) If the pusher mechanism will not push the probe into the ground a sufficient depth for sampling, the hydraulic hammer is used to pound the probe into the ground.

II. Sample Extraction
A) An adaptor (Figure 1) is put onto the top of the soil gas probe.
B) The vacuum pump is hooked onto the adaptor.
C) The vacuum pump is turned on and used to evacuate soil gas.
D) Evacuation will be at least 30 seconds but never more than 5 minutes for samples having evacuation pressures less than 15 inches of mercury. Evacuation times will be at least 1 minute, but no more than 5 minutes for probes reading greater than 15 inches of mercury.
E) Gauges on the vacuum pump are checked for inches of mercury.
   1. Gauge must read at least 2 inches of mercury less than maximum vacuum to be extracting sufficient soil gas to collect a valid sample.

III. Sample Collection
A) With vacuum pump running, a hypodermic syringe needle is inserted through the silicone rubber and down into the metal tubing of adaptor
(Figure 1).

B) Gas samples should only contact metal surfaces and never contact potentially sorbing materials (i.e., tubing, hose, pump diaphragm).

C) The syringe is purged with soil gas then, without removing syringe needle from adaptor, a 2-10 mL soil gas sample is collected.

D) The syringe and needle are removed from the adaptor and the end of the needle is capped.

E) If necessary, a second 10 mL sample is collected using the same procedure.

IV. Deactivation of Sampling Apparatus

A) The vacuum pump is turned off and unhooked from the adaptor.

B) The adaptor is removed and stored with equipment to be cleaned.

C) Using the hydraulic puller mechanism, the probe is removed from the ground.

D) The probe is stored in the "dirty" probe tube on top of the van.

E) The probe hole is backfilled, if required.

V. Log Book and U.S. EPA Field Sheet Notations For Sampling (Figures 2A-2D)

A) Time (military notation)

B) Sample number (use client's numbering system)

C) Location (approximate description - i.e., street names)

D) Sampling depth

E) Evacuation time before sampling

F) Inches of mercury on vacuum pump gauge

G) Probe and adaptor numbers

H) Number of sampling points used
I) Observations (i.e., ground conditions, concrete, asphalt, soil appearance, surface water, odors, vegetation, etc.)
J) Backfill procedure and materials, if used.

VI. Other Recordkeeping
A) Client-provided data sheets are filled out, if required
B) Sample location is marked on the site map

VII. Determination of Sampling Locations
A) Initial sample locations will be determined by client (perhaps after consultation with TRC personnel) prior to start of job.
B) Remaining sample locations may be determined by:
   1) Client
      a) Entire job sampling locations set up on grid system.
      b) Client decides location of remaining sample locations based on results of initial study, or
   2) Client and TRC Personnel
      a) Client and TRC personnel decide location of remaining sample locations based on results of initial sample locations.
ANALYTICAL PROCEDURES

I. Varian 3300 Gas Chromatograph
   A) Equipped with Electron Capture Detectors (ECD), Flame Ionization Detectors (FID), Photo Ionization Detectors (PID) and/or Thermal Conductivity (TC) Detectors.
   B) The chromatographic column used by TRC for the analysis of halocarbons is a 1/8" diameter packed column containing Alltech OV-101. This nicely separates most of the tri-chloro and tetra-chloro compounds that are encountered in soil gas investigations. The di-chloro compounds tend to elute ahead of the tri-chloro and tetra-chloro compounds, thus creating no interference. In the event that assurance of the identity of a compound in any particular sample is needed, it will be analyzed on a SP-1000 column after the OV-101 analysis.

II. Two Spectra Physics SP4270 Computing Integrators.
    The integrators are used to plot the chromatogram and measure the size of the chromatographic peaks. The integrators compute and record the area of each peak. The peak areas are used directly in calculation of contaminant concentration.

III. Chemical Standards From ChemServices, Inc. of Westchester, Pennsylvania.
    A) TRC uses analytical standards that are preanalyzed, of certified purities and lot numbered for quality control assurance. Each vial is marked with an expiration date. All analytical standards are the highest grade available. Certified purities are typically 99%.
    B) The Quality Assurance procedures used by ChemService were described by the Laboratory Supervisor, Dr. Lyle Phipher:
1) The primary measurement equipment at ChemServices, the analytical balance, is serviced by the Mettler Balance Company on an annual basis and recalibrated with NBS traceable weights.
2) All chemicals purchased for use in making the standards are checked for purity by means of gas chromatography using a thermal conductivity detector. Their chemicals are purified as needed.
3) The information on the purification and analysis of the standards is made available upon request for any item they ship when the item is identified by lot number. All standards and chemicals are shipped with their lot numbers printed on them. The standards used by TRC are made up in a two step dilution of the pure chemical furnished by ChemServices.

IV. Analytical Supplies
1. Sufficient 2 and 10 cc glass and Hamilton syringes so that none have to be reused without first being cleaned.
2. Disposable lab supplies, where appropriate.
3. Glassware to prepare aqueous standards.
4. Miscellaneous laboratory supplies.
QA/QC PROCEDURES

I. Standards

A) A fresh standard is prepared each day. The standards are made by serial dilution.

1) First, a stock solution containing the standard in methanol is prepared at TRC offices in Tucson. The stock solution is prepared by pipetting the pure chemical into 250 mL of methanol in a volumetric flask at room temperature. The absolute mass is determined from the product of volume and density calculated at room temperature. Hamilton microliter syringes, with a manufacturer’s stated accuracy of + or - 1%, are used for pipetting. Information on density is obtained from the CRC Handbook of Physics and Chemistry. Once the stock solution is prepared, typically in concentration range of 50-1000 mg/L, a working standard is prepared in water each day. The solute in the stock solution has a strong affinity to remain in methanol so there is no need to refrigerate the stock solution. Additionally, the solute tends not to biodegrade or volatilize out of the stock solution.

2) The working standards are prepared in 40 mL VOA septum vials by diluting the appropriate ug/L quantity of the standard solution into 40 mL of water.

B) The standard water is analyzed for contamination before making the aqueous standard each day.

C) The aqueous standard is prepared in a clean vial using the same syringe each day. The syringe should only be used for that standard.
D) Final dilution of the calibration standards are made in water in a VOA vial having a Teflon coated septum cap instead of in a volumetric flask in order to have the standard in a container with no air exposure. The VOA bottle permits mixing of the standard solution and subsequent syringe sampling all day long without opening the bottle or exposing it to air. The measurement uncertainty inherent in the use of a VOA bottle instead of a volumetric flask is approximately + or - 1%.

E) The aqueous standard will contain the compounds of interest in the range of 5 to 100 ug/L depending on the detectability of the individual components. The standard will be analyzed at least three times at the beginning of each day to determine the mean response factor (RF) for each component (Figure 3). The standard will be injected again after every fifth sample to check detector response and chromatographic performance of the instrument throughout the day.

F) The RF allows conversion of peak areas into concentrations for the contaminants of interest. The RF used is changed if the standard response varies 25%. If the standard injections vary by more than 25% the standard injections are repeated. If the mean of the two standard injections represents greater than 25% difference then a third standard is injected and a new RF is calculated from the three standard injections. A new data sheet is started with the new RF's and calibration data.

\[
\% \text{ difference} = \frac{A \text{ area} - B \text{ area}}{A \text{ area}}
\]

Where: 
A = mean peak area of standard injection from first calibration
B = peak area of subsequent standard injection

G) The low ug/L aqueous standards that are made fresh daily need not be refrigerated during the day because they do not change significantly in a 24
hour period. On numerous occasions the unrefrigerated 24 hour old standards have been compared with fresh standards and no difference has been measurable. If the standards were made at high ppm levels in water, the problem of volatilization would probably be more pronounced in the absence of refrigeration.

H) Primary standards are kept in the hotel room when on a project.
I) A client may provide analytical standards for additional calibration and verification.

II. Syringe Blanks
A) Each uL syringe is blanked before use.
B) 2 cc (glass) syringes will each be blanked if ambient air concentrations are elevated (greater than or equal to 0.01 ug/L) for components of interest.
C) If ambient air concentrations are <0.01 ug/L for components of interest, a representative sample of at least two syringes are blanked at the beginning of each day. If representative syringes have no detectable contamination remaining syringes need not be blanked. If any of representative syringes show contamination, all 2 cc syringes must be blanked prior to use.
D) Syringe blanks are run with air or nitrogen.
E) If it is necessary for any syringe to be used again before cleaning, it is blanked prior to its second use.

III. System Blanks
A) System blanks are ambient air drawn through the probe and complete sampling apparatus (probe adaptor and 10 cc syringe) and analyzed by the same procedure as a soil gas sample. The probe is above the ground.
B) One system blank is run at the beginning of each day and compared to a concurrently sampled air analyses.
C) A system blank is run before reusing any sampling system component.

IV. Ambient Air Samples
A) Ambient air samples are collected and analyzed a minimum of two times daily to monitor safety of the work environment and to establish site background concentrations, if any, for contaminants of interest.
B) All ambient air samples shall be documented (Figure 3).

V. Samples
A) All unknown samples will be analyzed at least twice.
B) More unknown samples will be run until reproducibility is within 25%, computed as follows:

\[
\text{Difference} = \frac{A - B}{(A + B)/2}
\]

Where; 
A is first measurement result
B is second measurement result

If the difference is greater than .25, a subsequent sample will be run until two measurements are made that have a difference of .25 or less. Those two measurements will be used in the final calculation for that sample.
C) The injection volume should be adjusted so that mass of analyte is as near as possible to that which is contained in the standard, at least within a factor of ten.
D) Whenever possible the attenuation for unknown samples is kept constant through the day (so as to provide a visual check of integrations).
E) A water plug is used as a gas seal in uL syringes
F) A seal is established between syringes when subsampling
G) At very high concentrations air dilutions are acceptable once concentration of contaminants in air have been established.
H) All sample analysis are documented (Figure 3).
I) Separate data sheets are used if chromatographic conditions change.
J) Everything is labeled in ug/L, mg/L, etc. PPM and PPB notations are to be avoided.

VI. Daily System Preparation (Figure 4).
A) Integrators parameters are initialized
   1. Pt. evaluation
   2. Attenuation
   3. Peak markers
   4. Auto zero
   5. Baseline offset (min. 10% of full scale)
B) The baseline is checked for drift, noise, etc.
C) System parameters are set.
   1. Gas flows (Note: \(N_2\), air, \(H_2\) tank pressure on Page 1 of chromatograms).
   2. Temperatures
      a) Injector
      b) Column
      c) Detector
D) After last analysis of the day conditioned septa are rotated into injection ports used during the day and replaced with fresh septa.
E) Column and injector temperatures are run up to bake out residual contamination.
F) Syringes are cleaned each day
   1. 2 and 10 cc syringes are cleaned with Alconox or equivalent detergent and brush
2. uL syringes are cleaned daily with IPA or MeOH and purged with $N_2$. Syringe Kleen is used to remove metal deposits in the barrel.

3. Syringes are baked out overnight in the oven of the gas chromatograph at a minimum temperature of 60°C.

VII. Sample Splits

If desired, TRC's clients or any party, with the approval of TRC's client, may use sample splits to verify TRC's soil gas or groundwater sampling results.

A) Sample splits may be collected in two valve, flow through-type all-glass or internally electroplated stainless steel containers for analysis within 10 days of collection.

1. Flow through sample collection bottles should be cleaned by purging with nitrogen at 100°C for at least 30 minutes. Once clean, the bottles should be stored filled with nitrogen at ambient pressure.

2. Sample bottles are filled by placing them in the sample stream between the probe and the vacuum pump. Five sample bottle volumes should be drawn through the container before the final sample is collected. The sample should be at ambient pressure.

B) Sample splits can be provided in 10 cc glass syringes for immediate analysis in the field by the party requesting the sample splits.

C) Splits of the aqueous standards or the methanol standards used by TRC for instrument calibration may be analyzed by the party requesting sample splits.
Figures 1 through 4
FIGURE 1. SAMPLING APPARATUS

IA. CLOSE-UP OF SYRINGE SOIL GAS SAMPLING THROUGH EVACUATION LINE

IB. DIAGRAM OF SOIL GAS SAMPLING PROBE WITH ADAPTOR FOR SAMPLING AND EVACUATION OF THE PROBE AFTER IT IS DRIVEN INTO THE GROUND
SOIL GAS INVESTIGATION BACKGROUND INFORMATION

SITE NAME: DAVIDSON CHEMICAL
LOCATION: 14000 WEST AVENUE N. LAUTON, SOUTH DAKOTA
DATES OF INVESTIGATION: 2/18-2/19/99
CLIENT NAME & ADDRESS: BLANDENBURRE ENVIRONMENTAL
602 HARRON RD
CHELSEA, SD 57327
FIELD REPRESENTATIVE(S) FOR CLIENT: JOE ANDREWS

PERSON TO WHOM REPORT AND QUESTIONS SHOULD BE DIRECTED: SARAH WENDEL
PHONE: 673-787-1003
CREW: CHEMIST S. CAULBOOTT GEOLOGIST M. KASEM

REPORT TO INCLUDE (CIRCLE):
A. QA/QC-PROCEDURES-DATA ONLY OR
B. FULL REPORT WITH CONTOUR MAPS AND INTERPRETATION

PURPOSE OF INVESTIGATION
DETERMINE EXTENT OF CONTAMINATION FROM STORAGE TANKS

TARGET VOCs
TCA
TE
AVG

GROUNDWATER INFORMATION:
DEPTH TO WATER: 12-16' DIRECTION: NE

SOURCES OF CONTAMINATION
COUNTY USED CHEMICAL IN METAL WORK SHOP IN MANAGEMENT OF
PREDNISONE CIRCIT 1982. STORAGE TANK LEAKED AND LEAKED FROM
AMM 1972-1983 WHEN CHEMICAL SHUT DOWN SOURCE WAS REMOVED
IN 1973

GEOLOGIC SETTING: (e.g. soil type, subsurface geology, etc.)
WENT A CURVILE TEC (200') FEATURED FILTRATION FROM 1'

FIGURE 2A
FIELD LOGEOOK - BACKGROUND INFORMATION
SITE MAP

SITE MAPS TO INCLUDE: SITE NAME, SCALE, NORTH ARROW, SOIL GAS
LOCATIONS & NUMBERS, CULTURAL AND NATURAL FEATURES TO IDENTIFY

FIGURE 2B
FIELD LOGBOOK - SITE MAP
DATE: 2-16-87
LOCATION: DAVIDSON CHEMICAL, HAMTHORN, SD
CLIENT: BRANDENBURG ENV.

GC Operator: S. CHARLES
Field Assistant: M. EVERTON
Weather: 12°F SNOW FLAKES, COLD & BREEZY

FIELD HOURS

<table>
<thead>
<tr>
<th>Am. on site</th>
<th>0730</th>
<th>B. off site</th>
<th>1930</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lunch hours</td>
<td></td>
<td>Downtime hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standby hours</td>
<td></td>
</tr>
<tr>
<td>Hours on site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(B - A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours: 1/4
Total hours: 1/2

Verified by GC operator
Verified by field assistant

DAILY SUMMARY

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Sampling</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time start</td>
<td>0730</td>
<td>Max vacuum: 83 in Hg</td>
</tr>
<tr>
<td>Time end</td>
<td>0830</td>
<td>Points used: 20</td>
</tr>
<tr>
<td>Total hours</td>
<td></td>
<td>Soil gas samples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>collected: 18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water samples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>collected: 0</td>
</tr>
</tbody>
</table>

Field data and gas standards checked by
Data checking hours: 1/2

1 - Downtime includes time spent repairing sampling & analytic equipment;
   note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client;
   note times and explanation on following field data pages

FIGURE 2C
FIELD LOGBOOK - DAILY SUMMARY
### Sampling Data

<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE #</th>
<th>ABDOT #</th>
<th>PROBE/PUSH</th>
<th>VAC (IN HG)</th>
<th>TIME</th>
<th>VOLUME</th>
<th>NOTES/ADD'L DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0845</td>
<td>S4-01</td>
<td>6' 27''</td>
<td>54-01</td>
<td>2.05</td>
<td>3.30</td>
<td>93</td>
<td>8:06</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>0900</td>
<td>S4-01</td>
<td>6' 27''</td>
<td>54-01</td>
<td>2.05</td>
<td>3.30</td>
<td>93</td>
<td>8:06</td>
<td>8</td>
<td>THE FIELD EMERGENCY MEASURE OF SAMPLING POINT, EVIDENCE OF LEAKS (LEAKS IS DEAD, FROM PUMP THROUGH DEE AND DEEP ON LOADING 20'-25' E</td>
</tr>
<tr>
<td>0915</td>
<td>S4-02</td>
<td>6' 38''</td>
<td>54-02</td>
<td>2.06</td>
<td>3.30</td>
<td>79</td>
<td>8:15</td>
<td>8</td>
<td>WHEN ASSESS MEASUREMENT TO THE CONDITIONS, EASY AND NOT LIKE IN APPEARANCE &amp; FEEL, WE NEED TO DEAL, SEE FIELD CONSTRUCTION ISSUE, NEEDS WITH ZONE</td>
</tr>
<tr>
<td>0941</td>
<td>S4-04</td>
<td>5' 70''</td>
<td>54-02</td>
<td>2.06</td>
<td>3.30</td>
<td>8</td>
<td>8:51</td>
<td>8</td>
<td>MAKE THE FIELD ASSESS, FIELD WAS INDICATED THAT PATCH WONT BE NEEDED</td>
</tr>
</tbody>
</table>

**Figure 2D**
FIELD LOGBOOK - SAMPLING DATA
### TABLE 3.
**EXPLANATION OF FIELD DATA SHEET**

1. Site and staff information.
2. Name of compound.
4. Flow errors obtained from standard injections during calibration.
5. Response factor (RF) for compound obtained from three calibrator runs.
   The RFs are used for calculation of actual concentrations and are
   included in each data sheet.
6. Water blank verifies purity of standard water and cleanliness of
   injection system.
7. Nitrogen blank verifies decontamination of syringe and analytical equip.
8. Air sample gives ambient concentrations for comparison with system blank.
9. System blank verifies decontamination of sampling equipment.
10. Sample 18 january 1A-14 (well gas sample 1 taken 1' below grade).
    1A-15 (water sample).
11. Time of analysis identifies the chromatogram from which the data was
    taken.
12. Amount of sample injected - used for concentration calculation.
13. Data - raw data produced by the computing integrator that is
    proportional to the area of analyte in the sample.
14. Actual concentration present in the sample rounded to 3 significant
    figures.
15. Mean concentration of duplicate injections.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Component</th>
<th>Time (hr/day)</th>
<th>Concentration (ug/L)</th>
<th>Mean</th>
<th>Error</th>
</tr>
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<tbody>
<tr>
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<tr>
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<tr>
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<td>1000 -0.00001 &lt;0.00001</td>
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<tr>
<td>1.124</td>
<td>5</td>
<td>3.12</td>
<td>1000 -0.0004 &lt;0.0004</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3.**
READY
DATE * 01-27-89
TIME = 15:36
FI= 1. FE= 1. MN= 0.
PRES 'ENTER' TO SKIP ENTRY
FILE NAME=" STD
TIME FUNCTION VALUE
TT= .01 TF=" R2 TV= 1
TT= .01 TF=" FR TV= 1
TT= 

METHOD NUMBER:MN=

END OF DIALOG
AT= 32
OF=20
PT=1000

CHANNEL A
INJECT: 01-27-89 15:43:04

FILE 1. METHOD 0. RUN 1 INDEX 1
PEAK# AREA% RT AREA BC
1 0.377 0.34 13779 02
2 1.754 0.48 64194 03
3 0.164 0.85 6011 01
4 0.152 0.99 5547 01
5 25.021 1.23 91778 01
6 26.951 2.75 986147 01
7 45.521 6.36 1665628 01

TOTAL 100. 3659014

FIGURE 4
CHROMATOGRAM DOCUMENTATION
April 25, 1991

Mr. Tom Dunkelman (H-7-2)
Remedial Project Manager
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California
94105

Dear Mr. Dunkelman:

Re: Quality Assurance/Quality Control (QA/QC) Procedures
Soil Gas Survey
Hassayampa Landfill Site

Enclosed please find three (3) copies of the above referenced QA/QC procedures received from Tracer Research Corporation. We are submitting the procedures for your review and comment, but are aware that Tracer has previously completed soil gas surveys at a number of Region IX sites using these protocols.

If you have comments or questions, please direct them to the undersigned prior to May 6, 1991, the scheduled start date for the survey.

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

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Steve M. Quigley, P. Eng.
SMQ/pse/8

C.C. Hassayampa Technical Committee (w/o attach.)
J. Sherard - Tracer (w/o attach.)
B. Victor - Errol L. Montgomery & Associates (w/o attach.)
Mr. Tom Dunkelman (H-7-2)
Remedial Project Manager
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California
U.S.A.  94105

Dear Mr. Dunkelman:

Re: Quality Assurance/Quality Control (QA/QC) Procedures
Soil Gas Survey
Hassayampa Landfill Site

This letter has been written to respond to USEPA's May 17, 1991 comments in the comments on the above-captioned procedures and to document a sampling plan as requested in the comments. On April 25, 1991 CRA submitted the QA/QC procedures to the USEPA for review and comment.


The responses to the USEPA comments listed below and the attached sampling plan are proposed to be incorporated into the scope of work as documented in the January 11 and 25 letters to the USEPA.

A. Responses to Comments

1. The soil gas survey is intended to be utilized as a screening tool to identify the site-specific intensity of selected organic species in the soil gas. While the proposed procedures will provide numerical assessments of the relative concentrations of the targeted compounds, they will not provide an absolute quantitation of the compounds of concern.
The resultant data will be utilized to develop a vapor concentration contour map to identify the relative distribution of organic compounds over the Site. The data and the map will be used in the Feasibility Study in the development of the design and cost estimate for soil and waste treatment alternatives.

2. The analytical methods utilized by Tracer Research Corporation are applied consistently at all its project sites, including other Superfund sites, such as Indian Bend Wash. There are no USEPA-approved soil gas analytical techniques, but USEPA has selected Tracer Research Corporation and utilized their methodology at other sites across the United States.

3. Detection limits for the targeted compounds are as follows:

   halocarbons - 0.0005 µg compound per liter of air
   volatile petroleum hydrocarbons - 0.05 µg compound per liter of air

   These detection limits are derived from field calibration using laboratory standards.

4. The sampling grid dimensions relate to the reported distribution of the special pits. A 50-foot grid is proposed in order to intercept the believed locations of the special pits and provide an assessment of their areal extent.

   The sampling depths of three to eight feet were selected to account for:

   (a) the homogeneity of soil gas distribution in the subsurface soils;

   (b) the minimum soil cover depth of two feet; and

   (c) the limitations of the sampling equipment.

   Further, the use of the resultant analytical data as a screening tool indicates that the results will be meaningful as long as the same sampling procedure is used at each sampling point.

5. The soil gases must be withdrawn from the subsurface soils, so some negative relative pressure must exist in the sampling apparatus.
6. Maximum vacuum refers to the maximum differential pressure as indicated in calibration charts for the sampling equipment. This range is between 1 and 21 inches of mercury.

7. The silicon tubing that is in the trains of sampling equipment acts as a septum and is appropriately used to collect the sample of vapor.

8. As stated above, the protocols and analyses are used as a screening tool. Since the galvanized probes will be used at all sites and the probes are blanked prior to use (checked to ensure that soil gases are not detected in the clean probes) then their use is appropriate.

9. Table 1 (attached hereto) provides the additional QA/QC information requested.

10. The use of a liquid analytical standard which is traceable to the National Institute of Standards Technology is appropriate given the qualitative nature of the technique.

11. Both ambient air and nitrogen are used as blanks and both will be reported. Ambient air is used because many halocarbons (Freon 113, for example) are frequently detected at approximately 0.1 to 5 μg/L in "background air".

12. Duplicate samples are collected and analyzed at a frequency of 1 in 20 sampling locations or once per day, whichever is more frequent. The results of the analyses of the duplicates will be reported with the rest of the analytical and QA/QC data.

**B. Sampling Plan**

1. **Purpose**

   The purpose of the proposed soil gas survey is to provide a delineation of the relative concentration of volatile organic compounds in the soil gas in the area of the special pits at the former hazardous waste area at the Hassayampa Landfill. The analytical results will be utilized in the
Table 1
Additional QA/QC Procedures
Soil Gas Survey
Hassayampa Landfill Site

(i) Length of Column:

Analytical Columns will be 5 feet in length and packed with either SP-1000 matrix (halocarbons) or OV-101 (volatile petroleum hydrocarbons), dependent on the analyses.

(ii) Detectors:

Compound detection and quantitation is performed on laboratory-grade gas chromatographs equipped with laboratory-grade detectors—an electron capture detector (ECD) for halogenated compounds and a flame ionization detector (FID) for petroleum hydrocarbons.

(iii) Gas Chromatograph Operating Parameters:

Gas chromatograph operation is dependent upon analyte class.

Petroleum Hydrocarbons: Isothermal @ 90 degrees C
OV-101 Column
30 cc/min nitrogen through column
FID detector @ 300 cc/min air flow, 30 cc/min hydrogen

Halocarbons: Ramp Temperature from 90 degrees C (hold for 3 min.) to 170 degrees C at a rate of 18 degrees per min.
SP-1000 Column
40 cc/min. nitrogen through column
ECD Detector (doesn't require additional gases)

Note: Injectors are maintained at a temperature at least 50 degrees C over column temperature.

(iv) Calibration Procedures:

Each instrument is calibrated at the beginning of the work day over the working range for the compounds of interest. Calibration standards are prepared fresh each day from laboratory standards. Calibrations are performed by repeatedly injecting known quantities of standards into the gas chromatograph until a response curve can be generated. Replicate injections must have a relative percent difference between injections of not greater than 20%. At a frequency of 10%, or greater, continuing calibration checks are performed by injecting a standard into the gas chromatograph and ensuring that the response factor falls within ± 20%. If not, the system is recalibrated and the condition requiring the recalibration is assessed.
assessment, design and costing of soil treatment technologies and alternatives in the Feasibility Study.

2. Scope

The special pits were reported by the former operators of the former hazardous waste area to be a large number of small pits, spread out over the west part of the former hazardous waste area shown on the attached Figure. Use of a 50-foot grid would provide sufficient data to confirm these reports and delineate the presence of elevated levels of contaminant concentrations.

Compounds in the soil gas to be analyzed by gas chromatography include: benzene; toluene; ethylbenzene; total petroleum hydrocarbons; trichloroethene; tetrachloroethene; trichloroethane; Freon 113; Freon 11; 1,1-dichloroethane; and 1,1-dichloroethene.

The result of the field activities and the analytical data will be reported to the USEPA according to the schedule of submittals provided in the Administrative Order on Consent.

3. Protocols

Protocols for sampling and analyses to be utilized are described in "Tracer Research Corporation's, Sampling Procedures and QA/QC Procedures", submitted to the USEPA on April 25, 1991 and as amended by this letter.
EXPLANATION

○ MW-1UA UNIT A MONITOR WELL AND IDENTIFIER

○ MW-1UB UNIT B MONITOR WELL AND IDENTIFIER

Φ HS-1 ABANDONED MONITOR WELL AND IDENTIFIER. CONSTRUCTED BY ARIZONA DEPARTMENT OF HEALTH SERVICES; ABANDONED JUNE 1988

口 EX-1 EXPLORATION BORING AND IDENTIFIER

△ SB-1 VERTICAL SOIL BORING AND IDENTIFIER

△ AB-1 ANGLED SOIL BORING AND IDENTIFIER; dot in center of triangle indicates location at land surface; a indicates estimated location of bottom of bore

PROPOSED AREA OF GRID FOR SOIL GAS SURVEY

□ LOCATION FOR PROPOSED UNIT B GROUNDWATER MONITOR WELL

SECTION 3, TOWNSHIP 1 SOUTH, RANGE 3 WEST

DISPOSAL PIT: Locations and boundaries for Pits 1, 2, 3a, 3b, 5a, 6b, and 6e were determined approximately based on trenching operations. Locations and boundaries for other disposal pits are based on analysis of a January 25, 1981, aerial photo and on reports. Locations and boundaries are tentative and approximate.

LOCATION FOR WASTE SAMPLES OBTAINED FROM TRENCHES

FIGURE 1. LOCATION MAP FOR HAZARDOUS WASTE AREA, HASSAYAMPA LANDFILL
May 21, 1991

It is our intention to proceed with this investigation as soon as possible, preferably on May 28, 1991 as previously agreed. We would therefore appreciate your assistance in expediting your review of these responses.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Steve M. Quigley, P. Eng.

SMQ/jh/9
Encl.
May 21, 1991

Reference No. 2141

-6-

c.c. Jackie Maye (telefax)
    Grant Gibson (telefax)
    James Derouin (telefax)
    David Machlowitz
    David Kimball
    Kim Williamson
    Charles Bischoff
    Errol Montgomery
    William R. Victor (telefax)
    Terry Thompson
    Lt. Col. Ray Swensen
    William Cheeseman
    Roger Ferland
    Robert Hacker
    Alan Abbott
    G. Van Velsor Wolf
    Richard Keiffer
    Robert Brauer
    Elizabeth M. Powell
    Carl Meier
    Charles Geadelmann
    G.S. Hagy
    Cindy Lewis
    G. Eugene Neil
    Rob Whitten
    Louis Thanukos
June 21, 1991

Mr. Tom Dunkelman (H-7-2)
Remedial Project Manager
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California
U.S.A. 94105

Dear Mr. Dunkelman:

Re: Quality Assurance/Quality Control (QA/QC) Procedures Soil Gas Survey
    Hassayampa Landfill Site

This letter has been written to respond to the U.S.EPA’s comments on the Hassayampa Steering Committee’s responses to the U.S.EPA’s, May 17, 1991 comments on the above captioned QA/QC procedures. The U.S.EPA comments were transmitted to CRA in a letter dated June 10, 1991. The responses to the U.S.EPA’s comments listed below are based on telephone conversations held between CRA and the U.S. EPA on June 13 and 17, 1991 and are proposed to be incorporated into the scope of work as documented in the January 11, January 25 and May 21, 1991 letters from the Hassayampa Steering Committee to the U.S.EPA.

Responses to Comments

1. No response required.

2. To reiterate, there are no U.S.EPA approved soil gas analytical techniques. However, soil gas survey techniques have been shown to provide effective delineation of sources of contamination in both soil and groundwater at many U.S. EPA Superfund Sites.

3. It is understood following the telephone conversation on June 17, 1991 that the reviewer’s concern is that all non-detects be confirmed, or the minimum sample volume be identified to demonstrate that an adequate mass of contaminants potentially exist in the sample to provide acceptable quantitation.

Therefore, the soil gas survey QA/QC procedures will be modified such that any sample of less than 6.0 ml which does not exhibit detectable
concentrations will be re-injected and re-analyzed with a sample volume of 1.0 ml. (Note 2-10mL samples are collected but up to 1.0 mL is injected into the chromatograph for analysis).

4. Response to this comment is unnecessary given the level of detail of discussion of these issues in the final remedial investigation report. Reviewers of this protocol should refer to that document.

However, a 3 to 8 foot sampling depth is considered appropriate given the soil cover depth of 2 feet, the expected maximum depth of burial of the waste of 15 feet below ground surface, the depth to groundwater of approximately 70 to 80 feet below ground surface and the expected and observed limited lateral migration of the waste materials.

The shallow sampling depth is therefore consistent with the intent of the soil gas survey to identify the locations of the Special Pits which are believed to have bottoms not more than 15 feet below ground surface.

5. See response to comment No. 3 (above). The soil gas survey will provide meaningful results based on the modifications proposed herein.

6. No response required.

7. A silicon tube septum will be installed in the sampling train. Samples will be collected only through this septum. A new septum will be used at each sampling point.

8. Pursuant to the telephone discussion held on June 17, the QA/QC and sampling procedures will be modified to include the use of a stainless steel tube which will be installed inside the galvanized probe after it has been installed in the ground. A figure indicating the method by which Tracer Research Corporation will collect the sample through this tube is be provided to the USEPA prior to commencing field activities.

9. Actual chromatograms of some of the compounds of interest in the vapor phase are provided in Figure 4 of the QA/QC procedures submitted on April 25, 1991.

10. No follow-up commentary provided.

11. Ambient air samples are collected through the sampling train by pumping ambient air through the galvanized tube and complete sampling apparatus
and samples are collected using syringes in the same manner that soil gas samples are collected. For sampling locations with high ambient concentrations (100 x detection limit), nitrogen is purged into the sampling device using a compatible fitting and the sampling pump is activated providing a flow of nitrogen through the sampling train for the purposes of providing a system blank. Samples for blank analysis will be collected in the same manner as soil gas samples.

12. No response necessary.

13. Responses to comments on the voluntary scope of work for the four vadose zone monitoring wells.

i) The wells were placed between the known extremities of Pit 1 and the former ADHS monitoring well HS1 in order to provide some indication of the migration pathway of soil gas to this area. The direction toward HS1 was selected because this is the area where groundwater is believed to have been impacted most significantly by the disposals in Pit 1. The screen size for the monitoring well is not a significant issue since the well is used to collect soil gas samples only.

A single well was placed in the fine grained unit to provide some assessment of the presence of soil gases in the fine grained soil. It may be possible to demonstrate soil gases are or are not migrating into the groundwater through the fine grained unit and the basalt by measuring the presence of soil gases there and comparing those concentrations with those measured in the course grained unit and in the fine grained unit.

ii) As indicated above, the monitoring wells were placed beyond the extremities of Pit 1 and beyond the limit of expected lateral migration of wastes in order to indicate the lateral migration of soil gas. The wells which were installed in the course grained unit are screened at an interval which is below the bottom of Pit 1 as measured during the recent soil boring through the pit and extend to a depth approximately equal to the bottom of the fine grained unit.

iii) Decontamination procedures are consistent with those provided in the approved Quality Assurance Project Plan.

iv) Soil gas samples will be collected by Tracer Research Corporation in a manner consistent with the procedures discussed and modified above.
Additional gas samples will be collected through the use of a peristaltic pump and teflon lined polyethylene tubing connected to a Tedlar bag. The pump will be connected to the tubing (note that the pump is not an integral part of the sampling equipment), the tubing will be pumped to ensure that any residual air is evacuated from the tubing, then the tubing will be connected to the sampling bag and the bag filled with air. [Analytical methods employed will be EPA method 8020 for VOCs.]

v) The overburden soils are 60 to 70 feet deep and separated from groundwater by a layer of basalt. It is not anticipated that groundwater will have any impact on any of the wells or the material in the soil gas that collects in the wells. Surface infiltration is directed away from the wells through simple grading of soils, the provision of a concrete collar, and a protective well casing. Condensate has not been anticipated to be present in the well and should be no-existent once the well temperature equilibrates with the surrounding soils.

The comment seems to indicate that the monitoring wells would be installed into or near the groundwater. No additional wells have been installed for the purpose of the soil gas investigation which in any way intercept the groundwater. Therefore, the wells need not be purged prior to sample collection nor do we anticipate that there will be any bias of results based on volatilization which occurs from the groundwater. The samples that will be collected will be direct samples of soil gas from the surrounding soils. The wells were not constructed with an impermeable base. Further, if any condensation were to occur from soil moisture (expected to be low), this condensation would probably travel on the surface of the well screen and be eventually transported into the soils below the well screen.

These responses have been provided in order for the Hassayampa Steering Committee and U.S. EPA to resolve these final concerns related to the soil gas sampling program. Your prompt response is requested in order for us to reschedule and start this survey.
June 21, 1991

If you have any questions, please call our office.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Stephen M. Quigley, P.Eng.

SMQ/bjr

cc. See list attached.
Reference No. 2141

-6-

c.c. Jackie Maye (telefax)
    Grant Gibson (telefax)
    James Derouin (telefax)
    David Machlowitz
    David Kimball
    Kim Williamson
    Charles Bischoff
    Errol Montgomery
    William R. Victor (telefax)
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    Robert Hacker
    Alan Abbott
    G. Van Velsor Wolf
    Richard Keiffer
    Robert Brauer
    Elizabeth M. Powell
    Carl Meier
    Charles Geadelmann
    G.S. Hagy
    Cindy Lewis
    G. Eugene Neil
    Rob Whitten
    Louis Thanukos
July 3, 1991

Mr. Tom Dunkelman (H-7-2)
Remedial Project Manager
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California
U.S.A. 94105

Dear Mr. Dunkelman:

Re: Quality Assurance/Quality Control (QA/QC) Procedures
Soil Gas Survey
Hassayampa Landfill Site

This letter has been written to confirm the final details of the above captioned QA/QC procedures for the soil gas survey to be conducted beginning July 8 by Tracer Research Corporation (TRC).

The following modifications have been made to the QA/QC procedures:

1) TRC will replace their galvanized steel probes with probes constructed of stainless steel;

2) TRC will reanalyze all non-detect using a sample volume of 1.0 mL (Note: 2-10mL samples will be collected but up to 1.0 mL is injected into the chromatograph for analysis); and

3) At sampling locations with a high ambient concentration (100 x detection limit), the sampling train will be purged with nitrogen and a system blank sample taken.

Actual chromatograms of some of the compounds of interest in the vapor phase and of standard samples are provided in Attachment A.
July 3, 1991

If you have any questions please contact our office.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Stephen M. Quigley, P. Eng.

SMQ/pw/10
Attach.
July 3, 1991

Reference No. 2141

- 3 -

c.c. Jackie Maye (telefax)
     Grant Gibson (telefax)
     James Derouin (telefax)
     David Machlowitz
     David Kimball
     Kim Williamson
     Charles Bischoff
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     William R. Victor (telefax)
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     G. Eugene Neil
     Rob Whitten
     Louis Thanukos
APPENDIX B

ANALYTICAL DATA SUMMARY
## TABLE B.1

**ANALYTICAL DATA SUMMARY**  
**HASSAYAMPA SOIL GAS SURVEY**  
**MARICOPA COUNTY, ARIZONA**

**SOIL GAS CONCENTRATION (μg/L)**

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<tr>
<th>Sample</th>
<th>TVHC</th>
<th>E-11</th>
<th>L1-DCE</th>
<th>L1-PCB</th>
<th>E-11X</th>
<th>TCA</th>
<th>TCE</th>
<th>PCE</th>
<th>Total</th>
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</thead>
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<td>9</td>
<td>0.2</td>
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<td>0.4</td>
<td>24</td>
<td>10</td>
<td>14</td>
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<td>73</td>
</tr>
<tr>
<td>SG-A2-6</td>
<td>130</td>
<td>1</td>
<td>44</td>
<td>&lt;6</td>
<td>89</td>
<td>58</td>
<td>17</td>
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<td>347</td>
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<tr>
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<td>150</td>
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<td>63</td>
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<td>1300</td>
<td>&lt;5</td>
<td>2</td>
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<td>47</td>
<td>86</td>
<td>&lt;6</td>
<td>&lt;.5</td>
<td>150</td>
<td>&lt;5</td>
<td>15</td>
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<td>310</td>
<td>5</td>
<td>170</td>
<td>&lt;7</td>
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<tr>
<td>SG-B2-3</td>
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<td>42</td>
<td>&lt;7</td>
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<td>140</td>
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<td>429</td>
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<tr>
<td>SG-B3-3</td>
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<td>110</td>
<td>&lt;7</td>
<td>200</td>
<td>600</td>
<td>140</td>
<td>35</td>
<td>1423</td>
</tr>
<tr>
<td>SG-B4-4</td>
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<td>470</td>
<td>1500</td>
<td>320</td>
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<td>530</td>
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</tr>
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<td>65</td>
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### TABLE B.1

ANALYTICAL DATA SUMMARY
HASSAYAMPA SOIL GAS SURVEY
MARICOPA COUNTY, ARIZONA

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<th>Sample</th>
<th>TVHC</th>
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<th>1,1-DCA</th>
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<th>TCE</th>
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**Notes:**
- TVHC Total Volatile Hydrocarbons
- F-11 Trichlorofluoromethane
- 1,1-DCE 1,1-Dichloroethene
- 1,1-DCA 1,1-Dichloroethane
- F-113 Trichlorotrifluoroethane
- TCA 1,1,1-Trichloroethane
- TCE Trichloroethene
- PCE Tetrachloroethylene
- µg/L micrograms per liter
- Total is the sum of detections plus the sum of half the value of the detection limit for compounds that were not detected
- <2 Not detected at the detection limit of 2 µg/L
- NA Not Available
- SG-E1-2 where,
- SG soil gas
- E1 sample location as shown on Figures 3.1 to 3.7
- 2 depth of sample, in feet, below ground surface
APPENDIX C

TRACER RESEARCH CORPORATION
FIELD LOGBOOKS
Tracer Research Corporation

FIELD LOGBOOK

CLIENT Montgomery
SITE Review and Fill
LOCATION Harjo, AZ.
SOIL GAS INVESTIGATION BACKGROUND INFORMATION

SITE NAME: Hanes Mill

LOCATION: Hesperian, CA

DATES OF INVESTIGATION: Aug 1994

CLIENT NAME & ADDRESS: E.L. Montgomery & Assoc.
1075 E. Ft. Lowell Rd. Suite R
Tucson AZ 85719

FIELD REPRESENTATIVE(S) FOR CLIENT: Tex Meyer

PERSON TO WHOM REPORT AND QUESTIONS SHOULD BE DIRECTED: William Victor

PHONE: (602) 891-4912

CREW: CHEMIST Heath GEOLOGIST Walter Kuponga

REPORT TO INCLUDE (CIRCLE):
A. QA/QC-PROCEDURES-DATA ONLY or
B. FULL REPORT WITH CONTOUR MAPS AND INTERPRETATION

PURPOSE OF INVESTIGATION
To investigate for contamination

TARGET VOCs

<table>
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<td>EHT</td>
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<td>ETOL</td>
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GROUNDWATER INFORMATION:

DEPTH TO WATER: 50 feet DIRECTION:

SOURCES OF CONTAMINATION

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<tbody>
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GEOLOGIC SETTING: (e.g. soil type, subsurface geology, etc.)

Sand + gravel
Fence
C - Fence post

SITE MAP

IF MAPS ARE SUPPLIED BY CLIENT, NOTE SUCH AND CHECK FOR ACCURACY AND CLARITY.
MAP CHECKED FOR COMPLETENESS AND ACCURACY BY [Signature] Field Assistant
SOIL GAS INVESTIGATION BACKGROUND INFORMATION

SITE NAME: Landfill

LOCATION: 47

DATES OF INVESTIGATION: 8 July 1991

CLIENT NAME & ADDRESS: E. Y. M. & Associates

Tucson, AZ 85719

FIELD REPRESENTATIVE(S) FOR CLIENT: Jeff Meyer

PERSON TO WHOM REPORT AND QUESTIONS SHOULD BE DIRECTED: William Vater

PHONE: (602) 881-4918

CREW: CHEMIST Heath GEOLOGIST Wil

REPORT TO INCLUDE (CIRCLE):

A. QA/QC-PROCEDURES-DATA ONLY or
B. FULL REPORT WITH CONTOUR MAPS AND INTERPRETATION

PURPOSE OF INVESTIGATION

To investigate for contamination

TARGET VOCs

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<th>TCE</th>
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GROUNDWATER INFORMATION:

DEPTH TO WATER: 6 ft 3 sec DIRECTION:

SOURCES OF CONTAMINATION

Landfill waste

GEOLOGIC SETTING: (e.g. soil type, subsurface geology, etc.)

Sand & gravel
DATE: 9 July 1991
LOCATION: Montgomery, AL
CLIENT: Montgomery

GC Operator: Heath
Weather: Clear Skies

Field Assistant: Waltz, Kaupanger

FIELD HOURS

A. Time on site: 07:30
B. Time off site: 16:30

Hours on site (B - A): 9 hrs

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours:

Verified by GC operator

Verified by field assistant

DAILY SUMMARY

Calibration
Sampling
Analysis

Time start: 0
Time end: 0

Total hours: 0

Max vacuum: 25 in Hg
Probes used: 0
Points used: 0
Soil gas samples collected: 0
Water samples collected: 0

Total system blanks: 0
Total air samples: 0

Field data and gas standards checked by

Data checking hours:

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
DATE: 9 July 1991
LOCATION: Houston

CLIENT: Montgomery

NOTES

Down time: did not have #11 shaded
or #12 for system BIK
DATE: 9 July 1991
LOCATION: Hassayampa, AZ.
CLIENT: Montgomery
GC Operator: Heath
Weather: Clear sky
Temp: 100°

FIELD HOURS

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<tbody>
<tr>
<td>Time off site</td>
<td>20:00</td>
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</tbody>
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Lunch hours: 0
Downtime hours\(^1\): 0
Standby hours\(^2\): 0

Hours on site (S-A): 13 hrs

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours: ________________
Verified by GC operator

Verified by field assistant

DAILY SUMMARY

Calibration
Sampling
Analysis

<table>
<thead>
<tr>
<th>Time start</th>
<th>Time end</th>
<th>Total hours</th>
</tr>
</thead>
</table>

Max vacuum: 25 in Hg
Total system blanks:

Probes used: 9
Points used: 10
Total air samples:

Soil gas samples collected: 9
Water samples collected: 0

Field data and gas standards checked by ______________________
Data checking hours:

\(^1\) - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages

\(^2\) - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
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<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE/ POUND</th>
<th>VAC/VOL (%)</th>
<th>TIME(S)</th>
<th>NOTES/ADD'L DATA</th>
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<td>3' 1/1</td>
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<td>Push easily 2' pound.</td>
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<td>56-A2</td>
<td>6' 2/2</td>
<td>Push</td>
<td></td>
<td>1:30</td>
<td>Hard to pound 1' @ 3' depth.</td>
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<td>56-A3</td>
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<td>Hand pressed</td>
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<td>5:35</td>
<td>Pushed easily from 4'–6'.</td>
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<td>12:53</td>
<td>SL-A4</td>
<td>5' 4/1</td>
<td>Hand pressed</td>
<td></td>
<td>5:35</td>
<td>Hand pound 5' fairly easy.</td>
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<tr>
<td>13:25</td>
<td>SL-A5</td>
<td>5' 5/1</td>
<td>Hand pressed</td>
<td></td>
<td>5:35</td>
<td>On side of bank.</td>
</tr>
<tr>
<td>17:24</td>
<td>SL-A7</td>
<td>7' 7/1</td>
<td>Push</td>
<td></td>
<td>4:25</td>
<td>At fence line, North of well.</td>
</tr>
<tr>
<td>17:50</td>
<td>56-A8</td>
<td>7' 8/1</td>
<td>Push</td>
<td></td>
<td>0:30</td>
<td>Outside (west) of fence.</td>
</tr>
<tr>
<td>18:47</td>
<td>SL-A9</td>
<td>3' 9/1</td>
<td>Pound</td>
<td></td>
<td>0:30</td>
<td>Hard @ 2' moved 3' s.w.</td>
</tr>
</tbody>
</table>

**DATE:** 9 July 1991

**LOCATION:** Hassayampa Landfill

**CLIENT:** Montgomery

**SAMPLING DATA**

**TIME ON SITE:**

**BEGIN CALIBRATION:**

**NOTES/ADD'L DATA REQUESTED BY CLIENT**
DATE: 07-10-91
LOCATION: Hassayampa Landfill, Hassayampa, AZ.
CLIENT: Montgomery & Assoc.

GC Operator: ___________________________ Field Assistant: ___________________________
Weather: ______________________________

FIELD HOURS

A. Time on site: 07:00
B. Time off site: 19:30

Hours on site (B - A): 12:30

Lunch hours: 0
Downtime hours: 0
Standby hours: 0

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours: ___________________________

Verified by GC operator

Verified by field assistant

DAILY SUMMARY

Calibration

Time start: ___________________________
Time end: ___________________________
Total hours: _________________________

Sampling

Max vacuum: 25 in Hg
Probes used: 3
Points used: 3
Soil gas samples collected: 18
Water samples collected: 0

Analysis

Total system blanks: 
Total air samples: 

Verified by Client

Verified by GC operator

Field data and gas standards checked by

Data checking hours:

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE#</th>
<th>ADAPT</th>
<th>PROBE</th>
<th>PUSH/POUND</th>
<th>VAC(IQ)</th>
<th>EVAC TIME(A)</th>
<th>SAMPLE VOLUME</th>
<th>NOTES/ADD'L DATA REQUESTED BY CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME ON SITE: BEGIN CALIBRATION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:48</td>
<td>S6-</td>
<td>7,10</td>
<td>Push</td>
<td>0</td>
<td>0:30</td>
<td>1</td>
<td>Pushed easy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:06</td>
<td>S6-</td>
<td>4,11</td>
<td>Push</td>
<td>0</td>
<td>0:30</td>
<td>1</td>
<td>Probe refusal @ 4' due to rock.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:30</td>
<td>VB-1</td>
<td>45</td>
<td>-</td>
<td>0:60</td>
<td>0:30</td>
<td>8</td>
<td>Station is a Vapor Boring. Sampling tube saved by Montgomery.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:45</td>
<td>VB-2</td>
<td>45</td>
<td>-</td>
<td>0:60</td>
<td>0:30</td>
<td>8</td>
<td>See comment for S6-VB-1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:33</td>
<td>VB-20</td>
<td>45</td>
<td>-</td>
<td>4:60</td>
<td></td>
<td>7</td>
<td>Drop tubing into boring 45' using pounded by client.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15:30</td>
<td>VB-3</td>
<td>45</td>
<td>-</td>
<td>4:60</td>
<td></td>
<td>8</td>
<td>Drapped tubing into boring 45' using provided by client.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td>VB-4</td>
<td>45</td>
<td>-</td>
<td>4:60</td>
<td></td>
<td>6</td>
<td>See comment for S6-VB-1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:00</td>
<td>S6-</td>
<td>6,3</td>
<td>0</td>
<td></td>
<td>4:30</td>
<td>10</td>
<td>Pounded Easily.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DATE: July 11
LOCATION: Hazen
CLIENT: Montgomery

GC Operator: Heath
Weather: Clear sky
Temp 109°

FIELD HOURS

Time on site: 7:00
Time off site: 5:00

Lunch hours:
Downtime hours:
Standby hours:

Hours on site:
13.25

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours verified by GC operator:

Total hours verified by field assistant:

DAILY SUMMARY

Calibration

Sampling

Analysis

Time start:
Time end:
Total hours:
Max vacuum: 25 in Hg
Probes used:
Points used:
Soil gas samples collected:
Water samples collected:

Verified by Client

Field data and gas standards checked by

Data checking hours:

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
DATE: 5/19/91
LOCATION: Landfill
CLIENT: Montgomery
GC Operator: Heufe
Weather: Clear sky
Temp 110°

FIELD HOURS

A. Time on site: 9:00
B. Time off site: 17:30
Lunch hours: 6
Downtime hours: 0
Standby hours: 0

Hours on site: (B - A): 8.5 hrs

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours: __________
Verified by GC operator
Verified by field assistant

DAILY SUMMARY

Calibration

Time start: 7:30
Time end: 9:30
Total hours: 2 hrs

Sampling

Max vacuum: 25 in Hg
Probes used: 9
Points used: 10
Soil gas samples collected: 9
Water samples collected: 0

Analysis

Total system blanks: 1
Total air samples: 2

Field data and gas standards checked by ________________________

Verified by Client
Data checking hours:

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE #</th>
<th>ADAPT #</th>
<th>PROBE PUSH</th>
<th>POUND</th>
<th>VAC (in Hg)</th>
<th>EVAC TIME (s)</th>
<th>TIME VOL (cc)</th>
<th>NOTES/ADD'L DATA REQUESTED BY CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:58</td>
<td>SC-2</td>
<td>3.15</td>
<td>3</td>
<td>3</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Push 3 ft and could not go any further</td>
</tr>
<tr>
<td>11:31</td>
<td>SC-1</td>
<td>6.14</td>
<td>6</td>
<td>6</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Pushed fairly easy</td>
</tr>
<tr>
<td>12:05</td>
<td>SC-0-1</td>
<td>3.11</td>
<td>3</td>
<td>3</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Hard to push</td>
</tr>
<tr>
<td>12:50</td>
<td>SC-2</td>
<td>3.14</td>
<td>3</td>
<td>3</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>7</td>
<td>1</td>
<td>Drilled compacted sand and then pushed</td>
</tr>
<tr>
<td>13:48</td>
<td>SC-3</td>
<td>3.8</td>
<td>3</td>
<td>3</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Drilled compacted sand and then pushed</td>
</tr>
<tr>
<td>14:24</td>
<td>SC-4</td>
<td>6.6</td>
<td>6</td>
<td>6</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Pushed fairly easy</td>
</tr>
<tr>
<td>15:00</td>
<td>SC-5</td>
<td>4.12</td>
<td>4</td>
<td>4</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Near pit</td>
</tr>
<tr>
<td>15:41</td>
<td>SC-6</td>
<td>4.10</td>
<td>4</td>
<td>4</td>
<td>Push</td>
<td>2</td>
<td>30</td>
<td>9</td>
<td>1</td>
<td>Could not push after 4</td>
</tr>
<tr>
<td>16:15</td>
<td>SC-7</td>
<td>4.3</td>
<td>4</td>
<td>4</td>
<td>Push</td>
<td>4</td>
<td>35</td>
<td>8</td>
<td>2</td>
<td>Seemed like it hit a big rock</td>
</tr>
</tbody>
</table>
Soil Survey Grid and distance from corners of grid to the existing fence line and/or other
APPENDIX D

CRA DATA VALIDATION
MEMORANDUM

TO:        Steve Quigley
FROM:      David Dempsey
RE:        Tracer Air Data

REFERENCE NO. 2141
DATE: October 28, 1991

As requested, I reviewed the Tracer air data for the soil borings. Based upon standard quality assurance/quality control protocols, the data can be used for estimating analyte concentrations. As the analytical procedure is used as a screening procedure, the data cannot be used to quantitatively assess analyte concentrations.
**DATE:** 07-11-91  
**LOCATION:** Hassayampa Landfill  
**CLIENT:** Montgomery & Assoc.

### Sampling Data

<table>
<thead>
<tr>
<th>Time</th>
<th>Sample Number</th>
<th>Depth</th>
<th>Probe#</th>
<th>Adapt#</th>
<th>Probe Push/ Pound</th>
<th>Vacuum (Hg)</th>
<th>Sample Volume (L)</th>
<th>Notes/Add'l Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:05</td>
<td>SE-3</td>
<td>4</td>
<td>1</td>
<td>0-4'</td>
<td>6:45</td>
<td>8</td>
<td>1</td>
<td>Hard pounding</td>
</tr>
<tr>
<td>12:00</td>
<td>SE-2</td>
<td>4</td>
<td>2</td>
<td>Push</td>
<td>2:30</td>
<td>8</td>
<td>1</td>
<td>Push 4' then hit hard surface and could not get through.</td>
</tr>
<tr>
<td>12:40</td>
<td>SE-1</td>
<td>4</td>
<td>3</td>
<td>Push</td>
<td>2:30</td>
<td>6</td>
<td>1</td>
<td>Push 4' then hit hard surface.</td>
</tr>
<tr>
<td>13:21</td>
<td>SE-7</td>
<td>7</td>
<td>5</td>
<td>Push</td>
<td>2:30</td>
<td>6</td>
<td>1</td>
<td>Pushed 7' fairly easy after the 2' mark.</td>
</tr>
<tr>
<td>14:13</td>
<td>SE-N1</td>
<td>4</td>
<td>4</td>
<td>Hand</td>
<td>3:30</td>
<td>8</td>
<td>2</td>
<td>Hand # just outside fence.</td>
</tr>
<tr>
<td>15:33</td>
<td>N-2</td>
<td>14</td>
<td>6</td>
<td>0-4'</td>
<td>5:30</td>
<td>8</td>
<td>1</td>
<td>Hard pounding. About 45' outside fence.</td>
</tr>
<tr>
<td>16:34</td>
<td>N-3</td>
<td>5</td>
<td>7</td>
<td>Hand</td>
<td>6:35</td>
<td>7</td>
<td>1</td>
<td>Hard pounded about 95' outside fence.</td>
</tr>
<tr>
<td>18:37</td>
<td>SE-B1</td>
<td>4</td>
<td>10</td>
<td>Push</td>
<td>2:30</td>
<td>7</td>
<td>1</td>
<td>Pushed fairly easy until 45'</td>
</tr>
<tr>
<td>18:00</td>
<td>SE-N4</td>
<td>5</td>
<td>8</td>
<td>Hand</td>
<td>2:30</td>
<td>8</td>
<td>1</td>
<td>About 145' away from fence.</td>
</tr>
</tbody>
</table>
### Field Hours

| Time on site    | 07:00 |
| Time off site  | 16:30 |
| Hours on site  | 9.5 hrs |

#### Downtime Hours

- Lunch hours: 0
- Downtime hours\(^1\): 1.5
- Standby hours\(^2\): 0

### Decontamination

- **Probe Decontamination**
  - Total hours: [Signature]
  - Verified by GC operator

- **Syringe Decontamination**
  - Total hours: [Signature]
  - Verified by Field Assistant

### Daily Summary

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Sampling</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time start</td>
<td>Max vacuum: 25 in Hg</td>
<td>Total system blanks:</td>
</tr>
<tr>
<td>Time end</td>
<td>Probes used: 7</td>
<td>Total air samples:</td>
</tr>
<tr>
<td>Total hours:</td>
<td>Points used: 9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil gas samples collected: 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water samples collected: 0</td>
<td></td>
</tr>
</tbody>
</table>

Field data and gas standards checked by [Signature]

Verified by Client

Data checking hours:

1. Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages.
2. Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages.
**DATE:** 12 July 1991  
**LOCATION:** Hassanampa Landfill  
**CLIENT:** Montgomery

### Sampling Data

<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE</th>
<th>NUMBER</th>
<th>DEPTH</th>
<th>PROBE #</th>
<th>ADAPT #</th>
<th>PROBE POUND</th>
<th>VAC/VOL (ml)</th>
<th>TIME (s)</th>
<th>NOTES/ADD'L DATA REQUESTED BY CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:54</td>
<td>S6-B2</td>
<td>3</td>
<td>4</td>
<td>Push</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3:10</td>
<td>Push easy first 2 feet then</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>very hard to push &amp; pound.</td>
</tr>
<tr>
<td>9:30</td>
<td>S6-B3</td>
<td>3</td>
<td>6</td>
<td>Push</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3:10</td>
<td>Ground felt real hard after 3'</td>
</tr>
<tr>
<td>10:09</td>
<td>B-4</td>
<td>4</td>
<td>5</td>
<td>Pound</td>
<td></td>
<td></td>
<td></td>
<td>0:30</td>
<td>Pound easy.</td>
</tr>
<tr>
<td>11:27</td>
<td>B-5</td>
<td>6</td>
<td>7</td>
<td>Pound</td>
<td></td>
<td></td>
<td></td>
<td>0:30</td>
<td>Pounded easily.</td>
</tr>
<tr>
<td>12:03</td>
<td>B-6</td>
<td>4</td>
<td>1</td>
<td>Push</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3:30</td>
<td>Push easy first 3' &amp; very hard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to push</td>
</tr>
<tr>
<td>13:07</td>
<td>B-7</td>
<td>3</td>
<td>8</td>
<td>Pound</td>
<td></td>
<td></td>
<td></td>
<td>2:30</td>
<td>Very, very hard to pound.</td>
</tr>
<tr>
<td>14:51</td>
<td>B-8</td>
<td>3</td>
<td>9</td>
<td>Pound</td>
<td></td>
<td></td>
<td></td>
<td>0:30</td>
<td>Very hard pounding.</td>
</tr>
</tbody>
</table>
DATE: 12 July 1991
LOCATION: Hessvamp Landfill
CLIENT: Montgomery

NOTES

downtime -

A large amount of DCE contaminants, had to change parts.
DATE: 15 July 1991
LOCATION: Montgomery
CLIENT: GC Operator: Heath
Weather: Clear Sky
Temp: 105°

FIELD HOURS

<table>
<thead>
<tr>
<th>A</th>
<th>Time on site</th>
<th>B</th>
<th>Time off site</th>
<th>Lunch hours</th>
<th>Downtime hours</th>
<th>Standby hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>07:00</td>
<td></td>
<td>15:00</td>
<td></td>
<td>1.5</td>
<td>0</td>
</tr>
</tbody>
</table>

Hours on site (B - A): 8.0

DECONTAMINATION

<table>
<thead>
<tr>
<th>Probe Decontamination</th>
<th>Syringe Decontamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hours:</td>
<td>Total hours:</td>
</tr>
</tbody>
</table>

Verified by GC operator
Verified by field assistant

DAILY SUMMARY

Calibration

<table>
<thead>
<tr>
<th>Time start</th>
<th>Time end</th>
<th>Total hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sampling

<table>
<thead>
<tr>
<th>Max vacuum</th>
<th>Probes used</th>
<th>Points used</th>
<th>Soil gas samples collected</th>
<th>Water samples collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 in Hg</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Analysis

<table>
<thead>
<tr>
<th>Total system blanks</th>
<th>Total air samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Field data and gas standards checked by

Data checking hours:

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE #</th>
<th>PROBE/ POUND</th>
<th>EVAC TIME(s)</th>
<th>NOTES/ADD'L DATA REQUESTED BY CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:05</td>
<td>SG B-8</td>
<td>3</td>
<td>2</td>
<td>Push</td>
<td>3</td>
<td>2:30</td>
</tr>
<tr>
<td>11:05</td>
<td>SG B-8</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>3:10</td>
</tr>
<tr>
<td>11:05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd time doing this point, cost.</td>
</tr>
<tr>
<td>11:05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>the last sample in C.C., let write down.</td>
</tr>
<tr>
<td>11:05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>very hard to pound.</td>
</tr>
<tr>
<td>11:05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:16</td>
<td>C-9</td>
<td>2</td>
<td>1</td>
<td>Push</td>
<td>2</td>
<td>2:30</td>
</tr>
<tr>
<td>12:16</td>
<td>C-9</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>8.2</td>
</tr>
<tr>
<td>14:06</td>
<td>E-9</td>
<td>2</td>
<td>8</td>
<td></td>
<td>2</td>
<td>3:30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>2:2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>get thru.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DATE: July 1981
LOCATION: Hassayampa Landfill
CLIENT: Montgomery

NOTES

Downtime: 1.5 hours. Printing cartridge ran out of ink.
DATE: 16 July 1991
LOCATION: Huffman Landfill
CLIENT: Montgomery
GC Operator: Heath
Weather: Clear sky

FIELD HOURS

A. Time on site: 7:20
B. Time off site: 24:00

Lunch hours: 12:00
Downtime hours: 4:00
Standby hours: 0

Hours on site: 16:00

DECONTAMINATION

Probe Decontamination
Syringe Decontamination

Total hours: ________________________________

Verified by GC operator: [Signature]
Verified by field assistant: [Signature]

DAILY SUMMARY

Calibration
Time start: ____________________________
Time end: ____________________________
Total hours: ____________________________

Sampling
Max vacuum: 25 in Hg
Probes used: 8
Points used: 9
Soil gas samples collected: 8
Water samples collected: 0

Analysis
Total system blanks: 1
Total air samples: 2

Verified by Client: ____________________________
Verified by GC operator: ____________________________
Verified by field assistant: ____________________________

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages
<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE#</th>
<th>ADAPT#</th>
<th>PROBE/PUSH/POUND</th>
<th>VAC (in Hg)</th>
<th>EVAC TIME (s)</th>
<th>SAMPLE VOLUME</th>
<th>NOTES/ADD'L DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>17:26</td>
<td>SC - E-8</td>
<td>3</td>
<td>5</td>
<td>Push</td>
<td>1</td>
<td>-</td>
<td>2:30</td>
<td>8</td>
<td>Started to push easy but then had to hand pound 2'.</td>
</tr>
<tr>
<td>18:05</td>
<td>SC - E-7</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td></td>
<td>-</td>
<td>2:30</td>
<td>9</td>
<td>Hand pounding was not as hard as the 2 previous probes.</td>
</tr>
<tr>
<td>19:02</td>
<td>SC - E-6</td>
<td>3</td>
<td>7</td>
<td>Push</td>
<td>3</td>
<td>-</td>
<td>2:30</td>
<td>8</td>
<td>Pushed 2', then pounded 1'.</td>
</tr>
<tr>
<td>19:28</td>
<td>SC - E-5</td>
<td>3:04</td>
<td>Push</td>
<td>2.5</td>
<td>Hand pounded 1'.</td>
<td>-</td>
<td>2:30</td>
<td>8</td>
<td>Started to push easy, then had to hand pound.</td>
</tr>
<tr>
<td>19:45</td>
<td>SC - E-4</td>
<td>3:10</td>
<td>Push</td>
<td>2</td>
<td></td>
<td>-</td>
<td>2:30</td>
<td>8</td>
<td>Pushed all the way to 7'.</td>
</tr>
<tr>
<td>20:40</td>
<td>SC - E-3</td>
<td>7</td>
<td>2</td>
<td>Push</td>
<td>7</td>
<td>-</td>
<td>2:30</td>
<td>8</td>
<td>Pushed fairly hard and then had to hand pound.</td>
</tr>
<tr>
<td>22:25</td>
<td>SC - E-2</td>
<td>3</td>
<td>9</td>
<td>Push</td>
<td>7</td>
<td></td>
<td>2:30</td>
<td>7</td>
<td>Pushed 2', hand pounding didn't help the probe go down further.</td>
</tr>
<tr>
<td>23:06</td>
<td>SC - E-1</td>
<td>2</td>
<td>1</td>
<td>Push</td>
<td>2</td>
<td></td>
<td>2:30</td>
<td>8</td>
<td>Pushed 2'. Hand pounding didn't help the probe go down further.</td>
</tr>
</tbody>
</table>

**NOTES/ADD'L DATA**
- REQUESTED BY CLIENT: None.
DATE: 16 July 1991
LOCATION: Hussayen Landfill
CLIENT: Montgomery

NOTES

Downtime - waited for a new integrator from Tucson.
DATE: 17 July 1991
LOCATION: Nassau Bay Landfill
CLIENT: Montgomery
GC Operator: Heath
Weather: Clear Sky

FIELD HOURS

A. Time on site: 8:30
B. Time off site: 20:00

---

Lunch hours: O
Downtime hours: O
Standby hours: O

Hours on site (B - A): 11:30

DECONTAMINATION

Probe Decontamination

Total hours: __________

Syringe Decontamination

Total hours: __________

Verified by GC operator
Verified by field assistant

DAILY SUMMARY

Calibration

Time start: 
Time end: 

---

Total hours:

Sampling

Max vacuum: 25 in Hg
Probes used: 15
Points used: 15
Soil gas samples collected: 15
Water samples collected: 0

Analysis

Total system blanks: 
Total air samples: 2

Field data and gas standards checked by ____________________________

Verified by Client

Data checking hours:

1 - Downtime includes time spent repairing sampling & analytic equipment; note times and explanation on following field data pages.
2 - Standby includes time available for sampling but waiting for client; note times and explanation on following field data pages.
<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE#</th>
<th>ADAPT#</th>
<th>PROBE/ POUND</th>
<th>EVAC TIME (SEC)</th>
<th>SAMPLE VOL (SEC)</th>
<th>NOTES/ ADD'L DATA REQUESTED BY CLIENT</th>
</tr>
</thead>
</table>
| 9:23 | SG F-1        | 4.10  | Push 4 | 30     | 8            |                 |                 | Push 4', ground still a little rough to push |+
<p>| 10:31| SG F-2        | 3.7   | Push 2 | 30     | 7            |                 |                 | Push 2', hand found 1'                 |
| 10:48| SG F-3        | 6.5   | Push 6 | 2:30   | 9            |                 |                 | Pushed 6', did not have to use hand pushing |
| 11:42| SG F-4        | 4.3   | Push 4 | 2:30   | 8            |                 |                 | Pushed 4 ft, still pushed rough after 2' |
| 12:17| SG F-5        | 5.9   | Push 5 | 2:30   | 8            |                 |                 | Pushed fairly easy at 3.5' then had to work it in by pushing very hard |
| 13:04| SG F-6        | 5.12  | Push 5 | 2:30   | 8            |                 |                 | Started pushing hard after 15'         |
| 1:00 | SG F-7        | 3.6   | Push 3 | 2:30   | 8            |                 |                 | It was difficult to push the probe, tried to pound but was not going in very far |
| 14:16| SG F-8        | 3.1   | Push 3 | 2:30   | 9            |                 |                 | Very hard to push                      |
| 14:36| SG F-9        | 3.2   | Push 3 | 2:30   | 8            |                 |                 | Very hard to push                      |
| 14:50| SG D-8        | 4.4   | Push 4 | 6:35   | S            |                 |                 | Pushed easy first 3 ft, then...         |
| 15:13| SG D-7        | 5.6   | Push 5 | 2:30   | 8            |                 |                 | Pushed 5', 5.6&quot; and could not go deeper |
| 16:19| SG D-6        | 4.11  | Push 4 | 2:30   | 8            |                 |                 | Pushed easily 5' then could not push any farther |
| 16:58| SG D-5        | 7.13  | Push 7 | 2:30   | 8            |                 |                 | Pushed all the way                      |
| 17:49| SG D-4        | 3.5   | Push 3 | 2:30   | 8            |                 |                 | Could not push any further              |</p>
<table>
<thead>
<tr>
<th>TIME</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>PROBE #</th>
<th>ADAPT #</th>
<th>PROBE PUSH/ POUND</th>
<th>VAC (in Hg)</th>
<th>EVAC TIME(s)</th>
<th>SAMPLE VOLS</th>
<th>POINTS</th>
<th>NOTES/ADD'L DATA REQUESTED BY CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>18:31</td>
<td>56</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>-</td>
<td>2</td>
<td>30</td>
<td>8</td>
<td>1</td>
<td>Pushed all the way.</td>
</tr>
<tr>
<td>0-3</td>
<td>7:14</td>
<td>-</td>
<td>7</td>
<td>0</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>30</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>