A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

# Endicott School Soil Gas Survey
# Endicott, Washington
# August 1993

## Introduction

This technical report documents the results of the soil gas survey and ground water sampling conducted August 1993 at the Endicott School, located in southeast Washington in Whitman County (Figure 1). These results have already been transmitted informally to Ecology's Eastern Regional Office (ERO). Since the completion of the field work, the project status has changed. The site is now considered an independent cleanup and Ecology is no longer an active participant.

Soil and ground water contamination were discovered on the school property when an underground leaded gasoline tank was removed in 1989. From 1989 to 1991 eleven monitoring wells were installed and tested. Free product was encountered in the area of the tank excavation. High concentrations of benzene, toluene, ethylbenzene and xylene (BTEX) were detected in the ground water over a large portion of the site. To remediate the soil and ground water contamination a vapor extraction system (VES) and a free product recovery system were installed between August 1991 and September 1992. To date, no free product has been recovered.

The primary objective of the soil gas survey was to determine the configuration of the contaminant plume. Secondary objectives were to evaluate why free product was not being recovered and to assess the cause of the mounded water table in the central portion of the site. A total of 25 soil gas samples and six ground water samples from on-site monitoring wells were collected and tested. Soil gas samples were analyzed in the field using a portable gas chromatograph.

## Results

Table 1 presents a summary of the soil gas survey results. Concentrations of compounds that were not identified by the gas chromatograph library are summed in the "Unknown" column of Table 1. Table 2 presents a summary of the ground water results from the

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34-1010
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samples collected from the on-site monitoring wells. Sample locations are shown in Figure 2 and sample methods are discussed in Appendix A. Soil gas sample chromatograms are included in Appendix B. The Quality assurance review and laboratory reporting sheets for the ground water results are presented in Appendix C. The distribution of the identified compounds is discussed below.

## Soil Gas

Due to site characteristics very little contamination was detected in the soil gas samples. The site is located in the Palouse region which is characterized by Pleistocene loess, alluvial and lacustrine deposits. Borings at the site penetrated up to 24 feet of the Palouse Formation silts and clays along with associated soils. Based on observations during the soil gas sampling, a hard clay layer was encountered at a depth of six feet beneath portions of the site. The hard clay layer was underlain by wet soils. A large capillary fringe is typical of fine grained soils (Testa and Paczkowski, 1989). Also, saturated soil was encountered at shallow depths on the south half of the study area, probably due to a leaking swimming pool and lawn watering. Due to the high moisture content we were not able to collect soil gas samples below five feet. Clay layers and wet soil in the vadose zone retard the upward migration of volatile contaminants. Some primary gasoline compounds (benzene, toluene, and xylenes) were identified in a few of the soil gas samples, but at very low concentrations (less than 1 ppm).

Depth profile soil gas samples were collected at the first station, END1, at three, six, and nine feet below ground surface (bgs). Although this station was near a well with floating product, only very low concentrations of contaminants were detected in the soil gas samples. A second profile sample was collected at station END2 at six and at eight and one-half feet bgs. Although little was detected at six feet bgs, high concentrations of several contaminants were detected at eight and one-half feet (See chromatograph #13). Because of the clay layers and wet soil, most samples were collected from three to six feet bgs.

## Ground Water

*Field Observations*

Depth-to-water measurements, water level elevations, purge volume, stabilized pH, specific conductance, and temperature results are listed in Table 2. Depth to water was measured in all of the monitoring wells and ranged from 8.95 to 13.45 feet. Water table elevations ranged from 1695.26 to 1696.01 mean sea level (MSL). Based on these water levels, ground water flow direction was toward the northwest. During sampling, well MW5 was purged dry. This well recharged at a rate that allowed sampling to continue within ten minutes. Stabilized field measurements for pH, specific conductance, and

temperature ranged as follows: pH from 8.2 to 9.7 standard units, specific conductance from 680 to 1000 umhos/cm, and temperature from 13.4 to 14.3 °C. During this survey product was measured in wells: 1MW(0.08'), 2MW (0.3'), 4MW (0.33'), MW1 (0.25') and MW2 (0.45').

*Analytical Results*

Six of the eleven monitoring wells (MW5, MW7, MW4, MW3, MW6, and 3MW) were sampled and analyzed for benzene, toluene, ethylbenzene and xylene (BTEX), total petroleum hydrocarbons as gasoline (TPH-G), and general chemistry parameters. The other five monitoring wells contained product and were not sampled. High concentrations of benzene were detected in three monitoring wells: MW3 (585 µg/L), 3MW (500 µg/L), and MW6 (370 µg/L). These wells are to the west of the former tank area. High concentrations of benzene in these wells coincide with analytical results from 1991 (SAIC, 1991a). Toluene, ethylbenzene, and xylene were also detected in these wells, but at low concentrations. TPH-G was detected in MW3 and 3MW, also at low concentrations.

General chemistry samples were collected and analyzed to assess the cause of the mounded water table in the central portion of the site. It was suspected that the mounding may be caused by a leaking storm or sewer line beneath the bus barn, since the mounding appeared to decrease in the summer when school was not in session (Gregory, 1991). Samples were analyzed for chloride, sulfate, total organic carbon (TOC), total dissolved solids (TDS), nitrate + nitrite as nitrogen (NO3/NO2-N), ammonia-N (NH3-N), and total phosphorous. In previous ground water sampling it was reported that "gray" water was encountered in wells MW5, 3MW, and 4MW (Leinart, 1994). Relative to concentrations in MW7 (considered background) elevated concentrations of chloride, sulfate, TDS, and nitrate/nitrite were detected in wells 3MW, MW3, and MW4. Concentrations for these parameters ranged as follows: chloride from 21.6 to 39.5 mg/L; sulfate from 67.8 to 160 mg/L; TDS from 679 to 900 mg/L; and nitrate/nitrite from 5.57 to 6.94 mg/L. These wells showed low concentrations of ammonia and total phosphorous which is inconsistent with wastewater discharge. Ammonia and total phosphorous concentrations are expected to be higher near wastewater discharge areas. However, this sampling was conducted in August, which is a low use time of the school facilities. No "gray" water was observed in any of the wells we sampled.

## Discussion

### Soil Gas

Because of the clayey and wet soils, the soil gas results were not useful for delineating the floating product plume. The high clay and moisture content of the site soils retarded the vertical diffusion of volatile contaminants (ASTM, 1994; NGWA, 1987).

## Ground Water

A secondary objective of this study was to determine why floating product had not been recovered. Primary factors which affect product recovery are the actual product thickness, the products properties, and the hydraulic characteristics of the formation (Testa and Paczkowski, 1989). After reviewing the wells and hydrogeologic data, the poor product recovery is, in my opinion, probably due to one or a combination of three factors. First, the apparent product thickness in monitoring wells is probably much greater than the actual product thickness on the aquifer. Second, ground water flow direction is highly variable, and during part of the year the recovery trench may not be located downgradient of the plume. And third, the effective radius of influence of the recovery trench is limited due to the clayey soils. All three of these factors are either the result of, or are exacerbated by, the fine-grained soil (silty clay) in the vadose zone and the aquifer. These factors are discussed briefly below.

*Floating Product Thickness*

Floating product has been observed in five of the monitoring wells. Water level measurements and product thickness have been recorded in wells 2MW and 4MW since 1991. Product appeared in wells MW1 and MW2 after the installation of the product recovery trench. Overall, product thickness has reflected the seasonal changes in the water table. The measured product thickness increased as the water level in the monitoring wells declined, and it decreased as the water level rose. This pattern is consistent with floating product behavior in fine grained materials (Testa and Paczkowski, 1989). Since 1991 product thickness in the wells has ranged from 0.08 to 1.5 feet. During this survey, product measurements ranged from 0.08 feet in 1MW to 0.45 feet in MW2.

It is commonly accepted that the measured product thickness in monitoring wells will be greater than the actual product thickness in the formation (Testa and Paczkowski, 1989; Lenhard and Parker, 1990). The movement of free product into a monitoring well can be a complex process affected by numerous variables. Hall, *et al* (1984) showed that the difference between the measured and actual product thickness increased with decreasing grain size. This is largely a function of the height of the capillary fringe. The larger the capillary fringe, the more pronounced the error between the measured and actual product thickness (Testa and Paczkowski, 1989). Based on observations during the soil gas sampling, the height of the capillary fringe was about five feet. In this case it appears that the floating product has spread to form a thin, widely dispersed layer, which makes product recovery more difficult.

*Ground Water Flow Direction*

In a water table aquifer with a low hydraulic conductivity due to the fine-grained soil, ground water flow direction will be especially sensitive to spatial and temporal variations in recharge. Lawn watering, leakage from the swimming pool, uneven infiltration from precipitation due to variations in surface cover, and leakage from a storm drain or sewer could have a pronounced effect on the ground water flow direction. Based on water levels obtained since 1991, the ground water flow direction has ranged from southwestward to southeastward. During the August 1993 survey, ground water flow was toward the northwest, away from the trench. These changes in the ground water flow direction seem to have compounded the dispersion of the floating product and complicated the proper placement of the recovery trench. Variations in the ground water flow direction indicate that the recovery trench may not be downgradient of the plume during portions of the year.

*Effective Radius of Influence of the Recovery Trench*

The radius of influence from a trench can be estimated using a steady-state, analytical method described by McWhorter and Sunada (1977). With this method the radius of influence is a function of hydraulic conductivity, recharge rate, and height of the water table above the trench. In a soil with low hydraulic conductivity a trench has a limited radius of influence. The method is described in more detail in Appendix D. Using extreme site conditions I estimate the trench's radius of influence to be between 10 and 100 feet. For more average site conditions the radius of influence would probably be less than 50 feet. Based on this estimate only portions of the plume would be influenced by the trench and could help to explain the poor product recovery.

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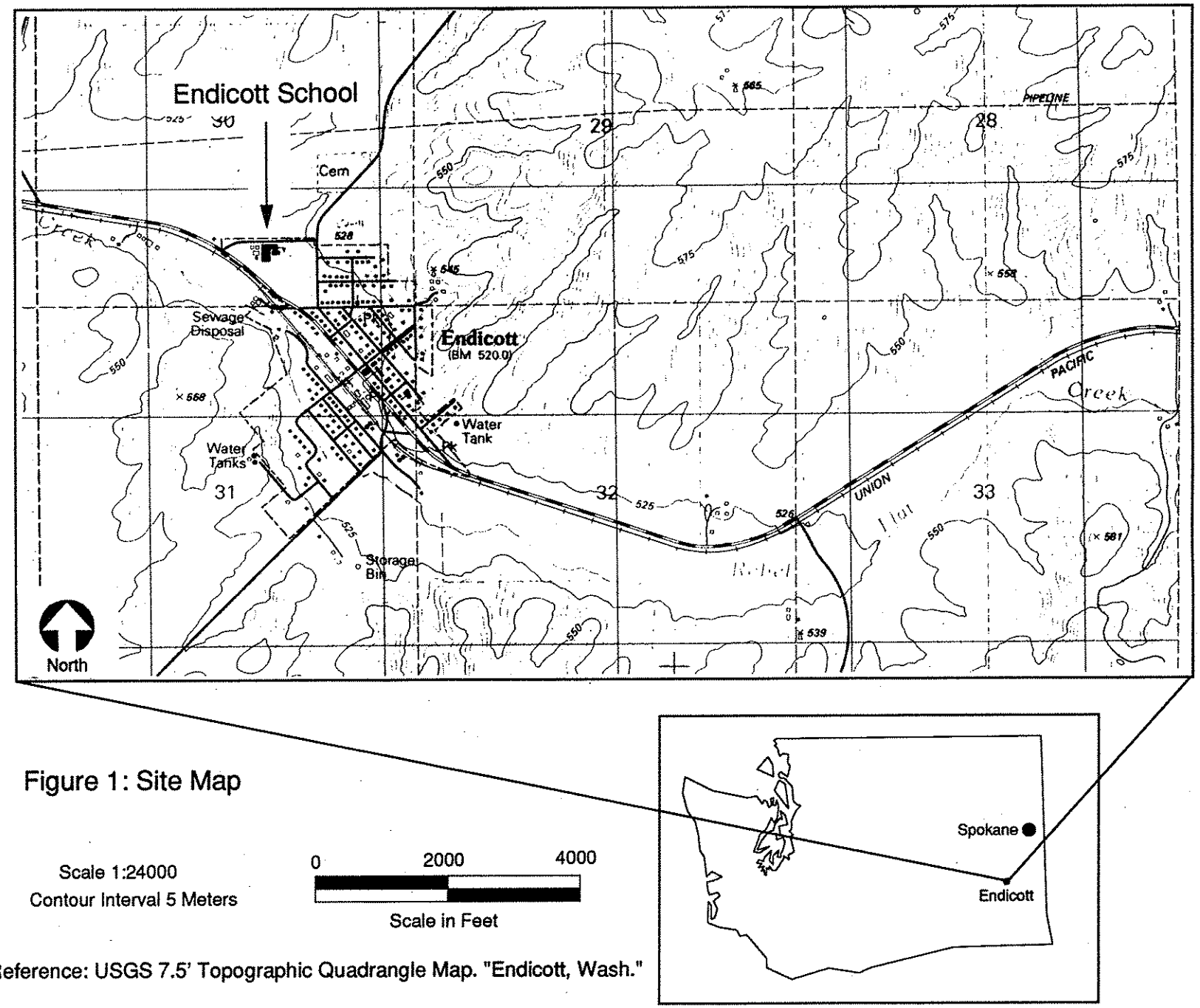



Figure 1: Site Map

Reference: USGS 7.5' Topographic Quadrangle Map. "Endicott, Wash."

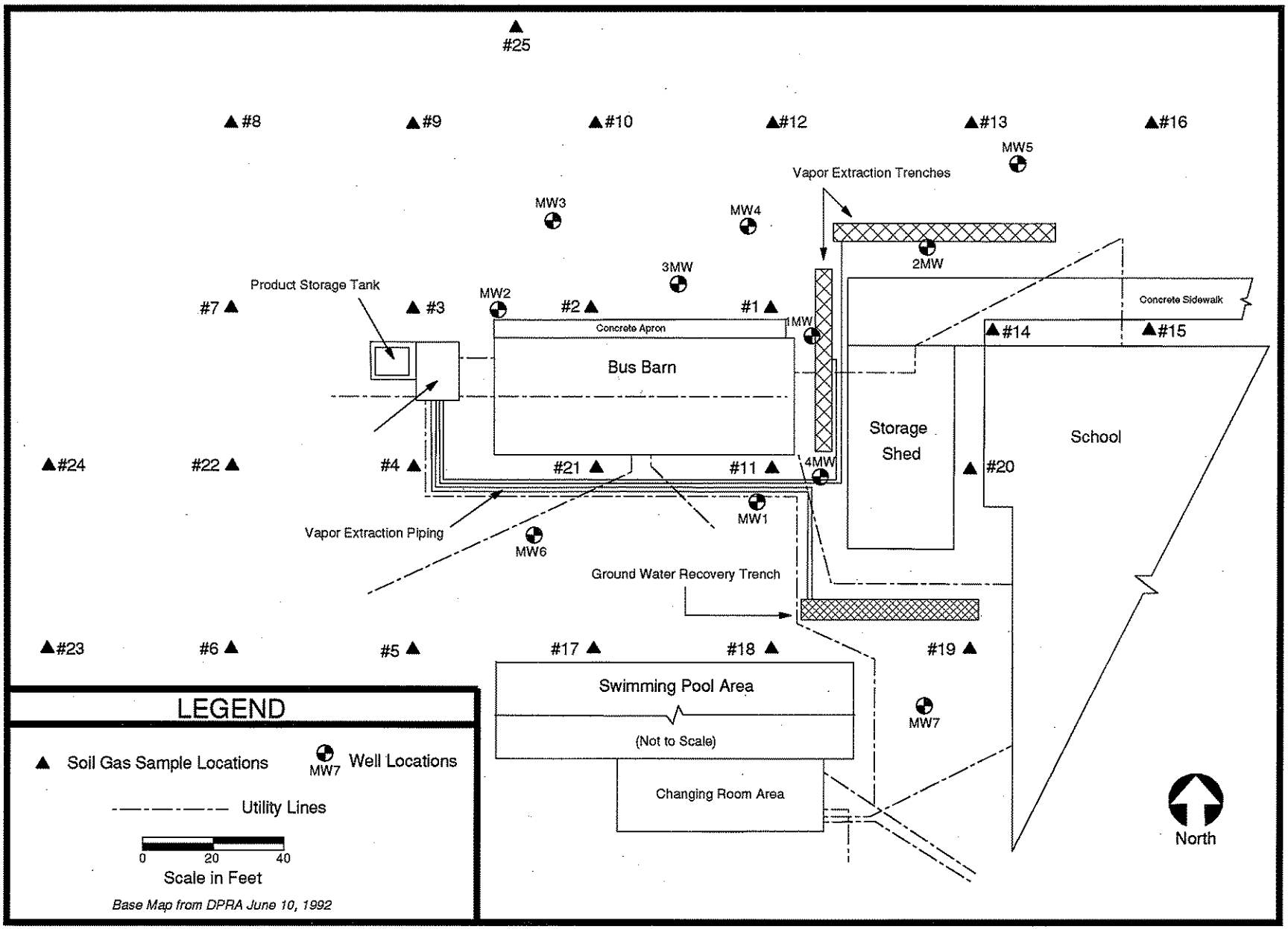



Figure 2: Endicott School Ground Water and Soil Gas Sample Locations

Table 1: Summary of Soil-Gas Results collected August, 1993 from the Endicott School, WA

NOTE: Results were determined using a Sentex portable gas chromatograph.
Analytes are considered tentatively identified and concentrations are estimates.

| Trace # | Sample I.D. (END-) | Depth (feet) | Benzene | | Toluene | | Xylenes | | Unknowns | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Retention Time (seconds) | Conc. (ppm) (estimate) | Retention Time (seconds) | Conc. (ppm) (estimate) | Retention Time (seconds) | Conc. (ppm) (estimate) | Retention Time (Range) (seconds) | Total Conc. (ppm) (estimate) |
| 2 | 1a | 3 | – | – | – | – | 580-702 | 0.05 | 92-742 | 0.31 |
| 6 | 1b | 6 | – | – | – | – | – | – | – | – |
| 7 | 1c | 9 | – | – | – | – | – | – | – | – |
| 10 | 2b | 6 | – | – | 357 | 0.03 | 559-589 | 0.02 | 116-801 | 0.03 |
| 13 | 2c | 8.5 | – | – | 360 | 0.03 | 566 | 1.3 | 97-1124 | 118.4 |
| 18 | 3 | 6 | – | – | 364 | 0.01 | – | – | 118-701 | 0.02 |
| 25 | 4 | 5 | – | – | – | – | – | – | 211-1020 | 0.01 |
| 28 | 5 | 3 | – | – | – | – | – | – | – | – |
| 32 | 7 | 6 | – | – | – | – | 744 | 0.003 | 341-1216 | 0.03 |
| 33 | 8 | 6 | – | – | – | – | – | – | – | – |
| 34 | 6 | 5 | 308 | 0.001 | – | – | 715 | 0.003 | 104-519 | 0.02 |
| 37 | 9 | 4 | – | – | – | – | – | – | 125-557 | 0.05 |
| 39 | 10 | 6 | – | – | 460 | 0.001 | – | – | 125-1204 | 0.02 |
| 47 | 11 | 6 | – | – | – | – | – | – | 55-1053 | 0.07 |
| 50 | 12 | 4.3 | – | – | – | – | – | – | – | – |
| 51 | 13 | 5 | – | – | 439 | 0.005 | 710 | 0.006 | 122-989 | 0.1 |
| 55 | 14 | 4.8 | – | – | – | – | 637 | 0.001 | 90-1069 | 0.03 |
| 56 | 15 | 6 | – | – | – | – | – | – | 126-1045 | 0.03 |
| 57 | 16 | 6 | – | – | – | – | – | – | 187-1113 | 0.03 |
| 62 | 17 | 4.5 | – | – | – | – | – | – | 68-1084 | 0.03 |
| 63 | 18 | 4.3 | – | – | – | – | – | – | 485 | 0.003 |
| 64 | 19 | 6.3 | – | – | – | – | – | – | – | – |
| 66 | 20 | 6 | – | – | 426 | 0.002 | 850-861 | 0.004 | 162-1118 | 0.03 |
| 67 | 21 | 4.5 | – | – | 431 | 0.008 | 678 | 0.001 | 71-901 | 0.03 |
| 73 | 22 | 6 | – | – | – | – | – | – | – | – |
| 74 | 23 | 3 | – | – | – | – | – | – | – | – |
| 84 | 25 | 4.6 | – | – | – | – | 680-902 | 0.01 | 112-819 | 0.03 |
| 85 | 24 | 6 | 300 | 0.002 | 446 | 0.24 | – | – | 182-1117 | 0.01 |

Table 2: Summary of Ground Water Results from Samples collected August 11–12, 1993 at the Endicott School

| Well Identification | | MW5 | MW7* | MW4 | MW3 | MW6 | MW6a | 3MW | Transfer | Transport |
|---|---|---|---|---|---|---|---|---|---|---|
| Laboratory Number | | 338030 | 338031 | 338032 | 338033 | 338034 | 338035 | 338036 | 338037 | 338038 |
| | | | | | | | (Duplicate) | | | |
| Depth to Water | (feet) | 13.45 | 10.86 | 11.58 | 11.16 | 8.95 | --- | 11.72 | --- | --- |
| Water Level Elevation | (msl) | 1695.60 | 1696.01 | 1695.38 | 1695.26 | 1695.57 | --- | 1695.38 | --- | --- |
| pH | (st. units) | 8.25 | 9.39 | 9.72 | NM | NM | --- | NM | --- | --- |
| Temperature | (C) | 14.3 | 13.9 | 20.9 | 23.2 | 23.8 | --- | 13.4 | --- | --- |
| Specific Conductance | (umhos/cm) | 680 | 740 | 1000 | 970 | 730 | --- | 860 | --- | --- |
| Purge Volume | (gallons) | 20 | 6 | 25 | 28 | 33 | --- | 4.5 | --- | --- |
| WTPH-G | (ug/L) | ND | ND | ND | 57 | ND | ND | 480 | ND | ND |
| Benzene | (ug/L) | ND | ND | 17 | 585 | 370 | 333 | 500 | ND | ND |
| Toluene | (ug/L) | ND | ND | 1.1B | 2.8 | 0.26B | 0.28B | 2.4 | 0.32 | 0.28 |
| Ethylbenzene | (ug/L) | ND | ND | ND | 1.3 | 0.24 | 0.22 | 1.3 | ND | ND |
| Total Xylenes | (ug/L) | ND | ND | ND | 3.2 | 0.88 | 0.84 | 12.5 | ND | ND |
| Chloride | (mg/L) | 11.3 | 7.6 | 21.6 | 39.5 | 19.7 | 19.5 | 28.5 | NT | NT |
| Sulfate | (mg/L) | 20.7 | 30.8 | 67.8 | 160 | 32.2 | 32.3 | 97.3 | NT | NT |
| TOC | (mg/L) | 1.8 | 4.4 | 2.5 | 2.9 | 3.4 | 3.4 | 2.8 | NT | NT |
| TDS | (mg/L) | 443 | 511 | 679 | 900 | 638 | 618 | 763 | NT | NT |
| NH3-N | (mg/L) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | NT | NT |
| NO3/NO2-N | (mg/L) | 3.78 | 3.50 | 6.68 | 6.94 | 2.26 | 2.48 | 5.57 | NT | NT |
| TP | (mg/L) | 0.31 | 1.1 | 0.26 | 0.15 | 0.16 | 0.16 | 0.25 | NT | NT |

msl = Mean Sea Level
NM = Not Measured due to probe failure
ND = Not Detected
NT = Not Tested
B = Analyte was detected in the field blanks indicating the sample may have been contaminated.

* = Considered background for purposes of this study.

# APPENDIX A

Endicott School Soil Gas Survey
Sampling Procedures
August 1993

## APPENDIX A

METHODS

### Sample Collection

Twenty-five soil gas and six ground water (monitoring well) samples were collected and tested. Sample locations are shown in Figure 2. Soil gas samples were collected every 50 feet from a grid along four east-west transects and six north-south transects. Six of the eleven monitoring wells (MW5, MW7, MW4, MW3, MW6, and 3MW) were sampled and analyzed for benzene, toluene, ethylbenzene and xylene (BTEX), total petroleum hydrocarbons as gasoline (TPH-G), and general chemistry parameters. The other five monitoring wells contained free product and were not sampled.

Pam Marti, Denis Erickson, Marc Heffner and Phil Leinart collected soil gas samples on August 8-12, 1993. Ground water samples were collected on August 11 and 12, 1993. Weather conditions for all sampling was warm and sunny.

Soil Gas Sampling

Soil gas samples were obtained using portable sampling equipment. Sample stations in paved areas were drilled with an electric percussion drill equipped with a 1½-inch asphalt bit. A pilot hole was advanced to the required depth by driving a 1/2-inch diameter, solid steel rod. After removing the pilot hole rod, a stainless steel retractable soil gas sampling tip (Retract-a-Tip) was driven into the pilot hole. The retractable tip was then pulled back about 2 inches to expose the sampling screen. A bentonite plug was installed at the surface to prevent air flow from the atmosphere to the sample area. The sample line was purged using a hand pump prior to sampling. Soil gas samples were withdrawn using a suction pump through 3/16-inch ID teflon tubing and collected under vacuum pressure in 1-liter Tedlar bags. Test holes were plugged using hydrated bentonite. Overlying fill and asphalt cover (cold mix) were placed as necessary.

Depth profile sampling was conducted at sample stations END1 and END2, to determine an appropriate sample depth. Soil gas samples were collected at three-foot intervals to a depth of nine feet at station END1, and at three and eight and one-half feet at station END2. Due to wet soils and the presence of a clayey layers, sample depth was selected from three to six feet. Sample depth was adjusted to accommodate obstructions in the subsurface and wet soil conditions.

Soil gas samples were analyzed in the field using a portable gas chromatograph (Sentex Scentograph Plus), equipped with an Argon Ionization Detector (AID) and a 12-foot, 10% SP-1000 (80/100 mesh) packed column. Prior to sample analysis, the gas chromatograph was calibrated using a mixture of 1.0 ppm benzene, 1.3 ppm toluene and 1.5 ppm m-xylene. An industrial solvents chemical compound library (Sentex) was used to identify other gasoline constituents. Operating parameters such as sample time, temperature, and chart duration were adjusted to maximize results. Copies of soil gas analyses, as well as operating parameter information are included in Appendix B.

All non-disposable down-hole equipment was decontaminated between test holes using sequential washes of tap water with Liquinox® detergent, deionized water, and laboratory grade methanol. Retractable tips were completely disassembled for cleaning. Teflon® tubing was discarded between test holes.

Ground Water Sampling

Ground water samples were collected from six of the on-site monitoring wells for benzene, toluene, ethylbenzene and xylene (BTEX), total petroleum hydrocarbons as gasoline (TPH-G) and general chemistry parameters of total organic carbon (TOC), total phosphorus, nitrate + nitrite as nitrogen, ammonia-N, chloride, sulfate, and total dissolved solids (TDS). Prior to sample collection, static water level and product thickness measurements were obtained from all 11 on-site wells using an interface probe. The probe was washed with Liquinox® and tap water, rinsed with deionized water and wiped clean between measurements. Monitoring wells without free product were sampled which included: 3MW, MW3, MW4, MW5, MW6, and MW7. Monitoring wells that were sampled were purged with a centrifugal pump until pH, temperature, and specific conductance readings stabilized, and a minimum of three well volumes had been removed. Monitoring well samples were collected using decontaminated, bottom-emptying teflon bailers.

After sample collection and proper labeling, ground water samples were stored on ice in an ice chest and transported to the laboratory within the required holding time. Chain-of-custody was maintained on all samples using Manchester Laboratory protocols (Ecology, 1994).

# APPENDIX B

Endicott School Soil Gas Survey
Select Soil Gas Chromatograms
August 1993

TRACE PRINTOUT

TRACE #2 DATE: Mon Aug 09 15:36:28 1993

NAME: ENDla CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 30 SAMPLE TIME: 2

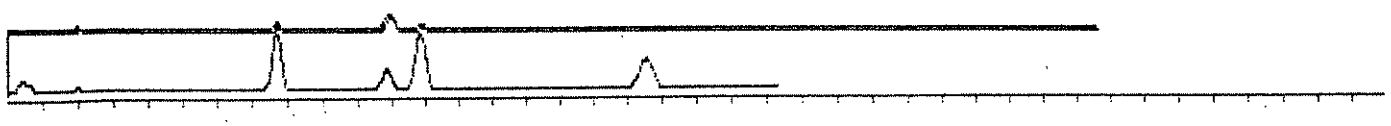
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|---|
| 1 | [illegible] | | [illegible] | [illegible] | [illegible] PPM | PBM |
| 2 | UNKNOWN | | 92 | 9364 | 0.083 PPM | |
| 3 | [illegible] | UNK | 102 | 5948 | 0.053 PPM | PBM |
| 4 | [illegible] | UNK | 119 | 2429 | 0.022 PPM | PBM |
| 5 | [illegible] | UNK | 127 | 584 | 0.005 PPM | PBM |
| 6 | UNKNOWN | | 137 | 3595 | 0.032 PPM | |
| 7 | UNKNOWN | | 153 | 1224 | 0.011 PPM | |
| 8 | [illegible] | | [illegible] | [illegible] | [illegible] PPM | PBM |
| 9 | [illegible] | | [illegible] | [illegible] | [illegible] PPM | PBM |
| 10 | [illegible] | | [illegible] | [illegible] | [illegible] PPM | PBM |
| 11 | XYLENE | | 580 | 4127 | 0.020 PPM | |
| 12 | UNKNOWN | | 657 | 8866 | 0.079 PPM | |
| 13 | #O-XYLENE | | 702 | 3865 | 0.034 PPM | |
| 14 | UNKNOWN | | 742 | 3147 | 0.028 PPM | |

[illegible]

NAME: ENDla
UPPER TRACE #2 13.14% Aug 09,93 15:36
LOWER TRACE #1 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 30
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 2
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #6 DATE: Mon Aug 09 16:30:01 1993

NAME: END1b-2 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 30 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | ~~UNKNOWN~~ | ~~94~~ | ~~2500~~ | ~~0.010 PPB~~ | PBM |
| 2 | UNKNOWN | 136 | 2589 | 0.011 PPB | |
| 3 | ~~UNKNOWN~~ | ~~230~~ | ~~19660~~ | ~~0.076 PPB~~ | PBM |
| 4 | ~~UNKNOWN~~ | ~~252~~ | ~~60402~~ | ~~0.247 PPB~~ | PBM |
| 5 | ~~UNKNOWN~~ | ~~402~~ | ~~40260~~ | ~~0.177 PPB~~ | PBM |
| | ~~TOTAL AREA:~~ | | ~~127523~~ | | |

NAME: END1b-2

UPPER TRACE #6 1.85% Aug 09,93 16:30

LOWER TRACE #5 100.00%

COLUMN: 10%SP1000

COLUMN PRESSURE: 30

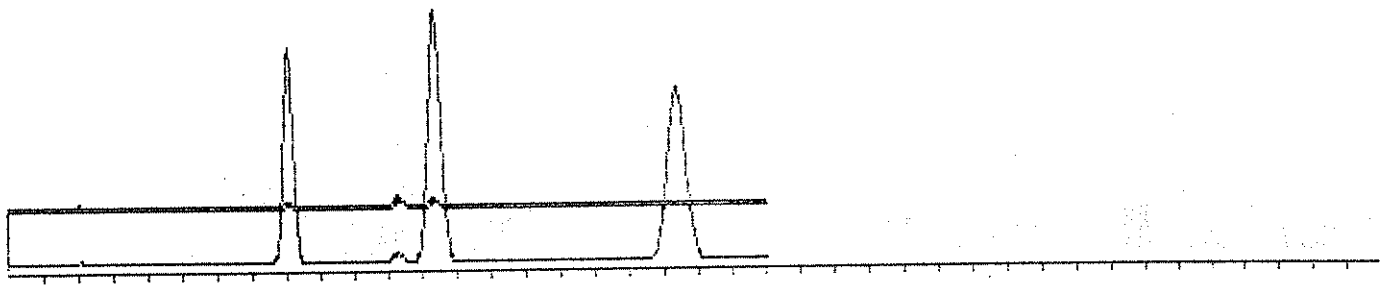
DETECTOR: AID

TEMPERATURE: 100-100, 0 Secs

SAMPLE TIME: 5

COIN: 1.000

DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #7 DATE: Mon Aug 09 16:42:01 1993

NAME: END1c CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

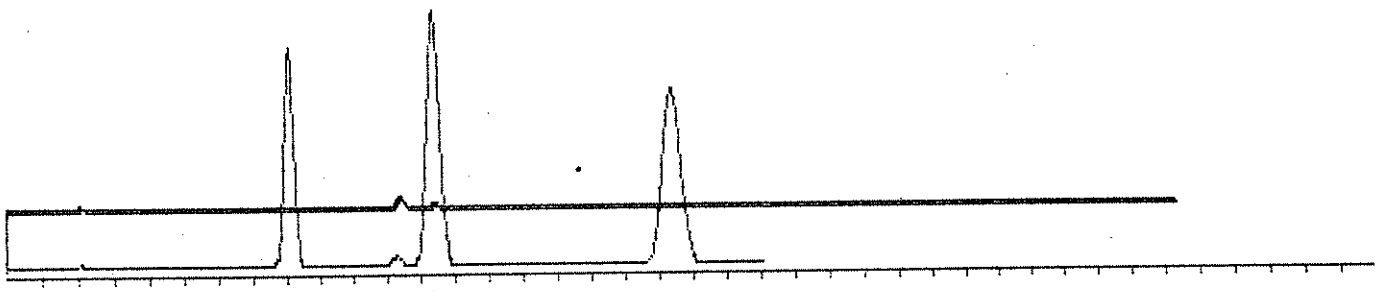
COLUMN PRESSURE: 30 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | ~~UNKNOWN~~ | ~~94~~ | ~~205~~ | ~~0.001 PPB~~ PBM |
| 2 | ~~UNKNOWN~~ | ~~275~~ | ~~51529~~ | ~~0.210 PPB~~ PBM |
| 3 | ~~UNKNOWN~~ | ~~406~~ | ~~18030~~ | ~~0.074 PPB~~ PBM |
| | ~~TOTAL AREA~~ | | ~~69764~~ | |

NAME: END1c
UPPER TRACE #2 1.07% Aug 09,93 16:42
LOWER TRACE #5 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 30
DETECTOR: AID
TEMPERATURE:100-100, 0 Secs
SAMPLE TIME:5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #10 DATE: Mon Aug 09 17:22:36 1993

NAME: END2 -6' CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 30 SAMPLE TIME: 5

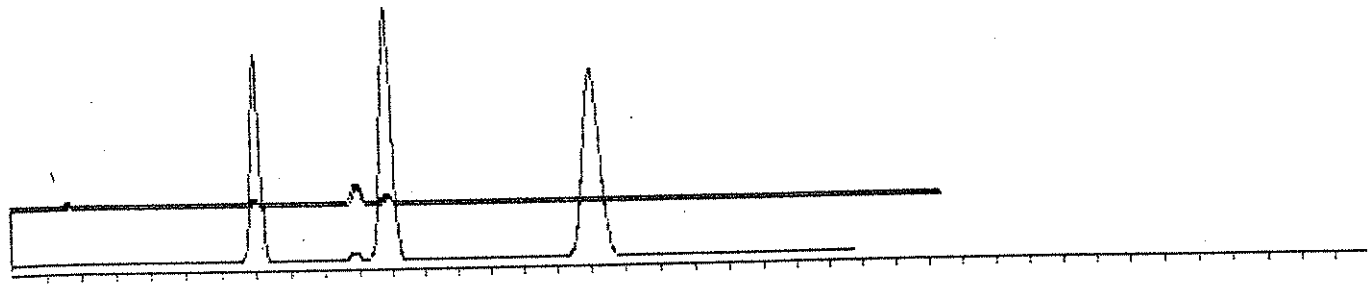
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 2 | [illegible] UNK | 116 | 5243 | 0.004 PPM | PBM |
| 3 | UNKNOWN | 133 | 3452 | 0.003 PPM | |
| 4 | [illegible] UNK | 146 | 7006 | 0.005 PPM | PBM |
| 5 | UNKNOWN | 202 | 7280 | 0.006 PPM | |
| 6 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 7 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 8 | TOLUENE | 357 | 47193 | 0.031 PPM | |
| 9 | #P-XYLENE | 559 | 16073 | 0.012 PPM | |
| 10 | #M-XYLENE | 589 | 6732 | 0.005 PPM | |
| 11 | UNKNOWN | 645 | 8352 | 0.006 PPM | |
| 12 | UNKNOWN | 759 | 7487 | 0.006 PPM | |
| 13 | UNKNOWN | 788 | 1837 | 0.001 PPM | |
| 14 | UNKNOWN | 801 | 4123 | 0.003 PPM | |

[illegible]

NAME: END2
UPPER TRACE #10 4.09% Aug 09,93 17:22
LOWER TRACE #9 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 30
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes

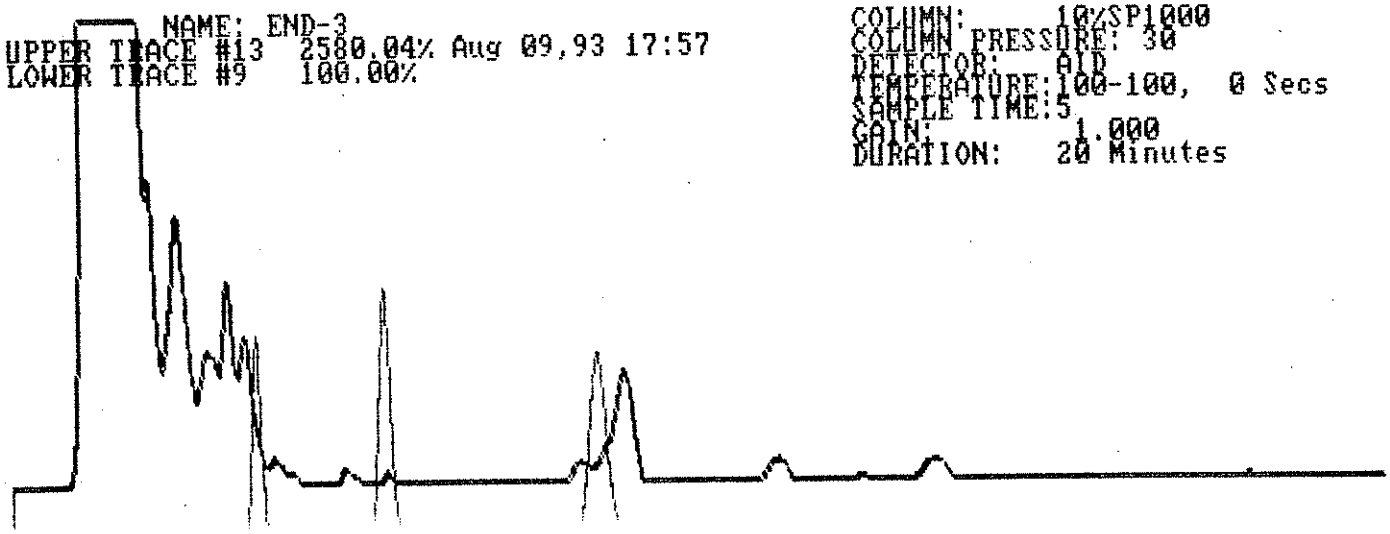


#13

NAME: END~~2-3~~ 8.5 CHART DURATION: 20
COLUMN: 10%SP1000 DETECTOR: AID
COLUMN PRESSURE: 30 SAMPLE TIME: 5
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | UNKNOWN | 97 | 95280436 | 72.761 PPM | |
| 2 | ~~#1,1-DCE~~ UNK | 118 | 42384528 | 32.367 PPM | PBM |
| 3 | UNKNOWN | 138 | 5257999 | 4.015 PPM | |
| 4 | ~~#ACETONE~~ UNK | 149 | 2151278 | 1.643 PPM | PBM |
| 5 | UNKNOWN | 173 | 3743875 | 2.859 PPM | |
| 6 | UNKNOWN | 201 | 1742626 | 1.331 PPM | |
| 7 | UNKNOWN | 217 | 1720078 | 1.314 PPM | |
| 8 | UNKNOWN | 232 | 1560915 | 1.192 PPM | |
| 9 | UNKNOWN | 259 | 256170 | 0.196 PPM | |
| 10 | ~~#PCE~~ UNK | 275 | 52388 | 0.040 PPM | PBM |
| 11 | ~~#CHLOROFORM~~ UNK | 290 | 7522 | 0.006 PPM | PBM |
| 12 | ~~#1,1,2-TCE~~ | ~~922~~ | ~~111252~~ | ~~0.085 PPM~~ | PBM |
| 13 | TOLUENE | 360 | 47807 | 0.031 PPM | |
| 14 | #ETHBENZ | 529 | 209503 | 0.160 PPM | |
| 15 | #P-XYLENE | 566 | 1682331 | 1.285 PPM | |
| 16 | UNKNOWN | 699 | 267961 | 0.205 PPM | |
| 17 | UNKNOWN | 772 | 20479 | 0.016 PPM | |
| 18 | UNKNOWN | 837 | 293242 | 0.224 PPM | |
| 19 | UNKNOWN | 922 | 16242 | 0.012 PPM | |
| 20 | UNKNOWN | 1115 | 28687 | 0.022 PPM | |
| 21 | UNKNOWN | 1124 | 2260 | 0.002 PPM | |

~~TOTAL AREA: 156007579~~



TRACE PRINTOUT

TRACE #18 DATE: Mon Aug 09 18:56:51 1993

NAME: END3 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 30 SAMPLE TIME: 5

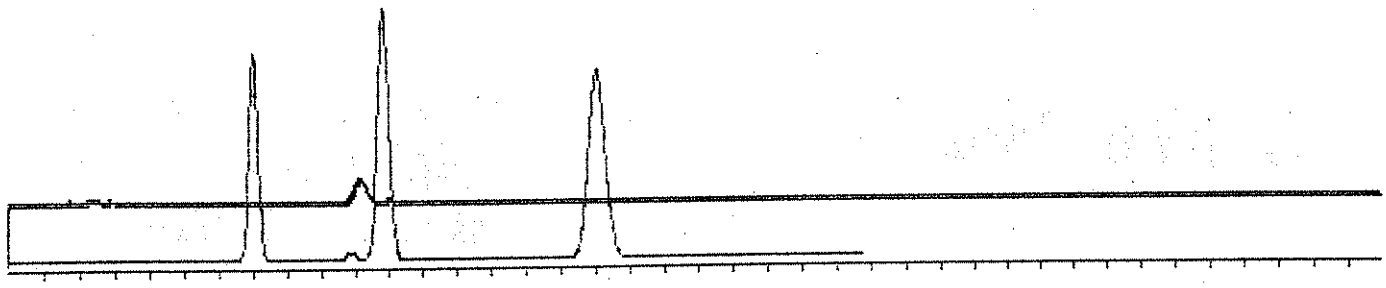
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|---|
| 1 | [illegible] | | [illegible] | | [illegible] | PBM |
| 2 | [illegible] | | [illegible] | | [illegible] | PBM |
| 3 | [illegible] | UNK | 118 | 7961 | 0.006 PPM | PBM |
| 4 | [illegible] | UNK | 276 | 9714 | 0.007 PPM | PBM |
| 5 | UNKNOWN | | 312 | 155 | 0.000 PPM | |
| 6 | [illegible] | | [illegible] | | [illegible] | PBM |
| 7 | #TOLUENE | | 364 | 17283 | 0.013 PPM | |
| 8 | UNKNOWN | | 701 | 4358 | 0.003 PPM | |

[illegible]

NAME: END3
UPPER TRACE #18 4.94% Aug 09,93 18:56
LOWER TRACE #9 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 30
DETECTOR: AID
TEMPERATURE:100-100, 0 Secs
SAMPLE TIME:5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #25 DATE: Tue Aug 10 11:09:10 1993

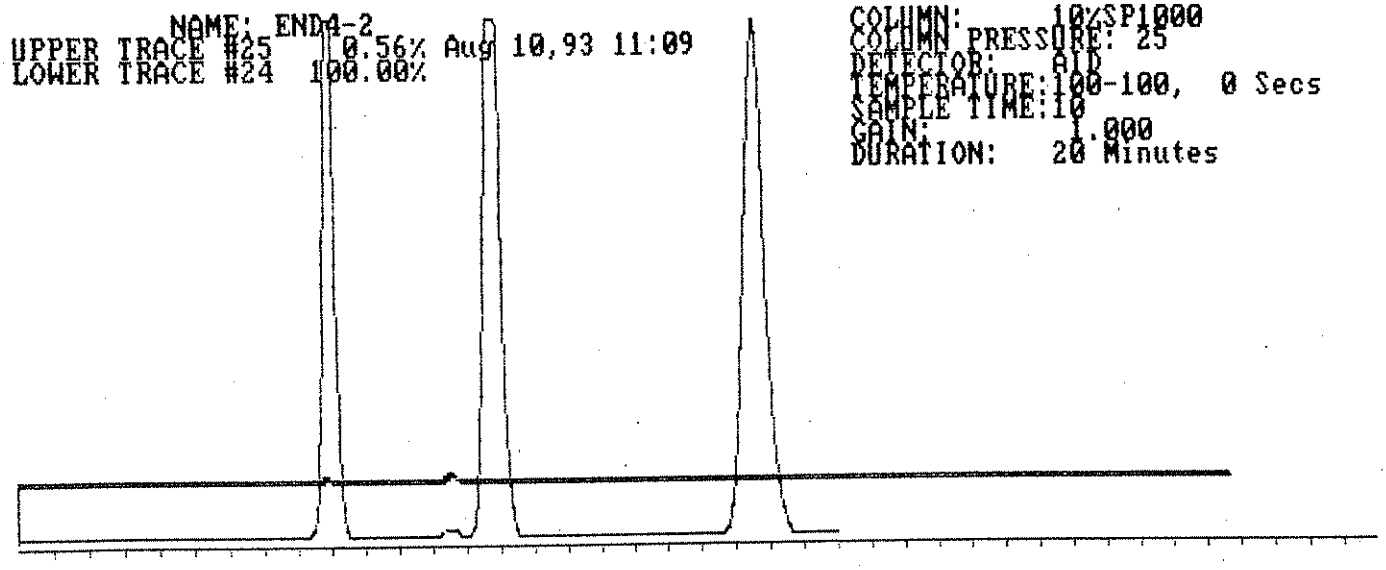
NAME: END4-2 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 10

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | UNKNOWN | 211 | 9623 | 0.002 PPM | |
| 2 | [redacted] | [redacted] | [redacted] | [redacted] | PBM |
| 3 | [redacted] | [redacted] | [redacted] | [redacted] | PBM |
| 4 | [redacted] | [redacted] | [redacted] | [redacted] | PBM |
| 5 | UNKNOWN | 518 | 8240 | 0.002 PPM | |
| 6 | UNKNOWN | 553 | 2232 | 0.000 PPM | |
| 7 | UNKNOWN | 749 | 3996 | 0.001 PPM | |
| 8 | UNKNOWN | 923 | 14370 | 0.003 PPM | |
| 9 | UNKNOWN | 1020 | 4056 | 0.001 PPM | |
| | [redacted] | | | | |



TRACE PRINTOUT

TRACE #28 DATE: Tue Aug 10 11:54:53 1993

NAME: END5-2 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 2 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 3 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 4 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |

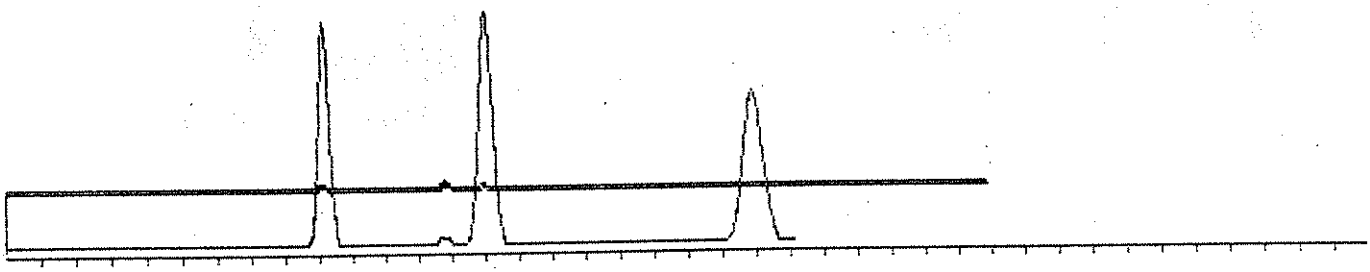
[illegible]

NAME: END5-2

UPPER TRACE #28 0.99% Aug 10,93 11:54

LOWER TRACE #27 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 25
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #32 DATE: Tue Aug 10 12:42:06 1993

NAME: END7 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 5

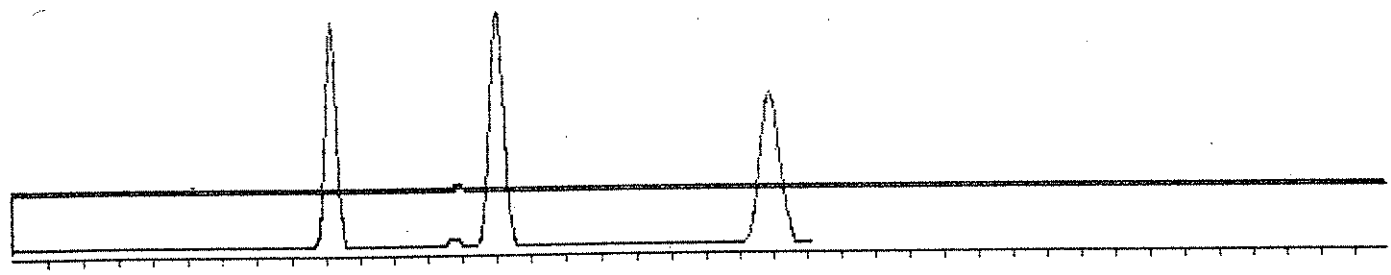
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | UNKNOWN | 341 | 9570 | 0.005 PPM |
| 2 | [illegible] | [illegible] | [illegible] | [illegible] PPM |
| 3 | UNKNOWN | 555 | 10341 | 0.006 PPM |
| 4 | #M-XYLENE | 744 | 4627 | 0.003 PPM |
| 5 | UNKNOWN | 753 | 1187 | 0.001 PPM |
| 6 | UNKNOWN | 818 | 5632 | 0.003 PPM |
| 7 | UNKNOWN | 861 | 3175 | 0.002 PPM |
| 8 | UNKNOWN | 1027 | 6229 | 0.004 PPM |
| 9 | UNKNOWN | 1216 | 9573 | 0.005 PPM |

[illegible]

NAME: END7
UPPER TRACE #32 1.14% Aug 10,93 12:42
LOWER TRACE #27 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 25
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #33 DATE: Tue Aug 10 13:03:11 1993

NAME: END8 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM |

NAME: END8

UPPER TRACE #33 1.37% Aug 10,93 13:03

LOWER TRACE #27 100.00%

COLUMN: 10%SP1000

COLUMN PRESSURE: 25

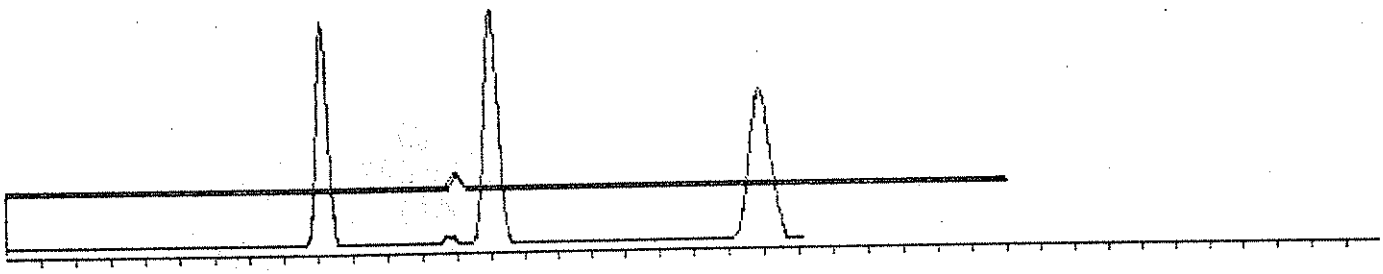
DETECTOR: AID

TEMPERATURE: 100-100, 0 Secs

SAMPLE TIME: 5

GAIN: 1.000

DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #34 DATE: Tue Aug 10 13:18:42 1993

NAME: END6-2 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 5

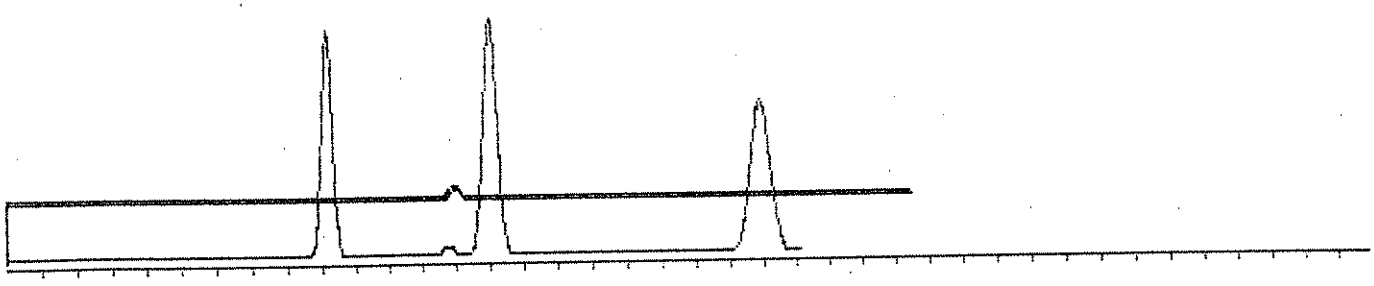
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 2 | UNKNOWN | 104 | 3701 | 0.002 PPM | |
| 3 | [illegible] UNK | 157 | 7281 | 0.004 PPM | PBM |
| 4 | UNKNOWN | 183 | 6143 | 0.003 PPM | |
| 5 | [illegible] UNK | 192 | 2626 | 0.001 PPM | PBM |
| 6 | UNKNOWN | 241 | 6156 | 0.003 PPM | |
| 7 | BENZENE | 308 | 2462 | 0.001 PPM | |
| 8 | [illegible] UNK | 405 | 11443 | 0.006 PPM | PBM |
| 9 | [illegible] | [illegible] | [illegible] | [illegible] | PBM |
| 10 | UNKNOWN | 519 | 7290 | 0.004 PPM | |
| 11 | #P-XYLENE | 715 | 5205 | 0.003 PPM | |

[illegible]

NAME: END6-2
UPPER TRACE #34 2.05% Aug 10,93 13:18
LOWER TRACE #27 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 25
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #37 DATE: Tue Aug 10 13:58:21 1993

NAME: END9 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | UNKNOWN | 125 | 25905 | 0.015 PPM | |
| 2 | [illegible] | 134 | 41161 | 0.024 PPM | PPM |
| 3 | UNKNOWN | 149 | 11317 | 0.007 PPM | |
| 4 | [illegible] | [illegible] | [illegible] | [illegible] | PPM |
| 5 | [illegible] | [illegible] | [illegible] | [illegible] | PPM |
| 6 | [illegible] | [illegible] | [illegible] | [illegible] | PPM |
| 7 | UNKNOWN | 557 | 3535 | 0.002 PPM | |

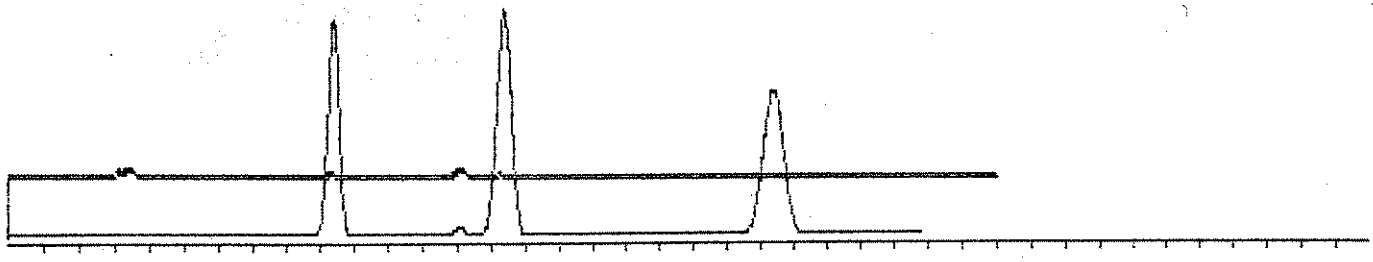
[illegible]

NAME: END9

UPPER TRACE #37 2.78% Aug 10,93 13:58

LOWER TRACE #36 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 25
DETECTOR: AID
TEMPERATURE:100-100, 0 Secs
SAMPLE TIME:5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #39 DATE: Tue Aug 10 14:29:12 1993

NAME: END10 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 25 SAMPLE TIME: 5

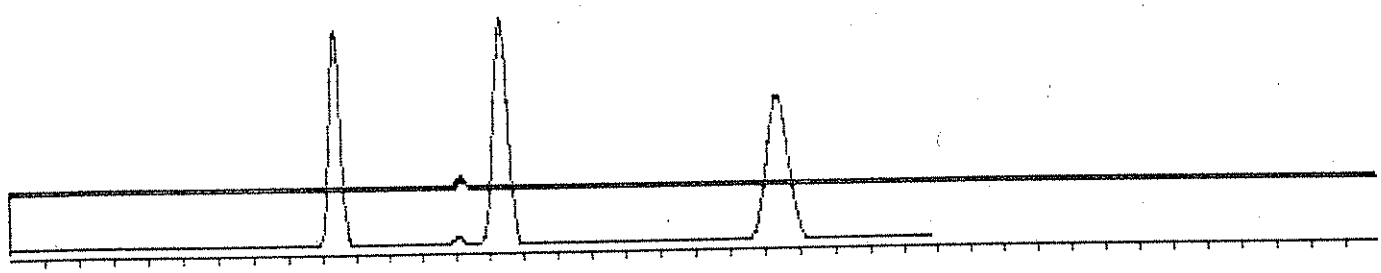
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | UNKNOWN | 125 | 6565 | 0.004 PPM |
| 2 | ~~#TCE~~ UNK | 364 | 6983 | 0.004 PPM PBM |
| 3 | ~~#1112TCA~~ | ~~427~~ | ~~50775~~ | ~~0.034 PPM~~ PBM |
| 4 | TOLUENE | 460 | 2197 | 0.001 PPM |
| 5 | UNKNOWN | 646 | 2254 | 0.001 PPM |
| 6 | UNKNOWN | 773 | 3727 | 0.002 PPM |
| 7 | UNKNOWN | 841 | 6054 | 0.003 PPM |
| 8 | UNKNOWN | 952 | 4424 | 0.003 PPM |
| 9 | UNKNOWN | 966 | 3024 | 0.002 PPM |
| 10 | UNKNOWN | 1051 | 3404 | 0.002 PPM |
| 11 | UNKNOWN | 1204 | 3775 | 0.002 PPM |

~~TOTAL AREA: 100100~~

NAME: END10
UPPER TRACE #39 1.55% Aug 10,93 14:29
LOWER TRACE #36 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 25
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #47 DATE: Tue Aug 10 16:10:01 1993

NAME: END11 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

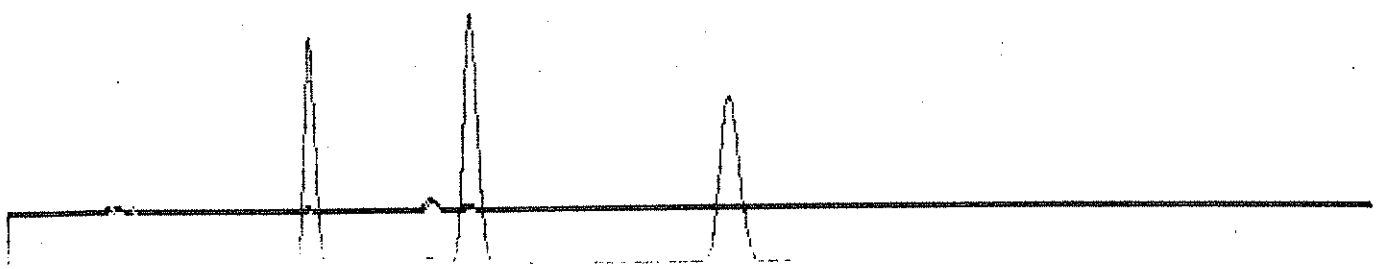
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|
| 1 | UNKNOWN | 55 | 6229 | 0.004 PPM | |
| 2 | UNKNOWN | 119 | 16048 | 0.009 PPM | |
| 3 | ~~[illegible]~~ UNK | 130 | 25222 | 0.015 PPM | PBM |
| 4 | UNKNOWN | 141 | 9148 | 0.005 PPM | |
| 5 | UNKNOWN | 189 | 10945 | 0.006 PPM | |
| 6 | UNKNOWN | 214 | 4766 | 0.003 PPM | |
| 7 | ~~[illegible]~~ | ~~[illegible]~~ | ~~[illegible]~~ | ~~[illegible]~~ | PBM |
| 8 | UNKNOWN | 305 | 8600 | 0.005 PPM | |
| 9 | UNKNOWN | 351 | 5163 | 0.003 PPM | |
| 10 | ~~[illegible]~~ | ~~[illegible]~~ | ~~[illegible]~~ | ~~[illegible]~~ | PBM |
| 11 | UNKNOWN | 420 | 2263 | 0.001 PPM | |
| 12 | ~~[illegible]~~ | ~~[illegible]~~ | ~~[illegible]~~ | ~~[illegible]~~ | PBM |
| 13 | UNKNOWN | 794 | 12990 | 0.008 PPM | |
| 14 | UNKNOWN | 941 | 13210 | 0.008 PPM | |
| 15 | UNKNOWN | 1053 | 7840 | 0.005 PPM | |

~~[illegible]~~

NAME: END11
UPPER TRACE #47 3.83% Aug 10,93 16:10
LOWER TRACE #46 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #50 DATE: Tue Aug 10 17:15:23 1993

NAME: END12 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM |

[illegible] AREA: [illegible]

NAME: END12

UPPER TRACE #50 1.25% Aug 10,93 17:15

LOWER TRACE #46 100.00%

COLUMN: 10%SP1000

COLUMN PRESSURE: 23

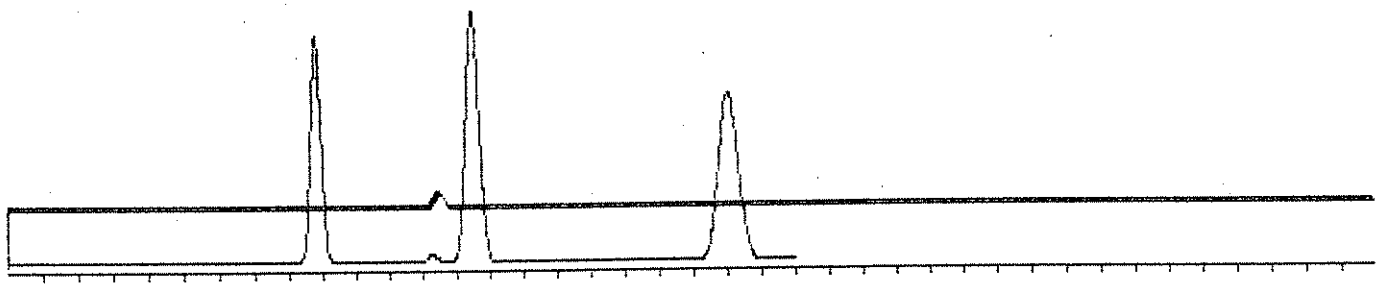
DETECTOR: AID

TEMPERATURE: 100-100, 0 Secs

SAMPLE TIME: 5

GAIN: 1.000

DURATION: 20 Minutes



#51

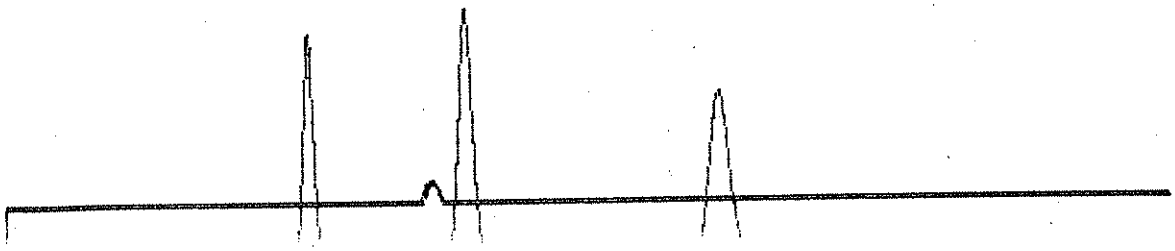
NAME: END13 CHART DURATION: 20
COLUMN: 10%SP1000 DETECTOR: AID
COLUMN PRESSURE: 23 SAMPLE TIME: 5
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | ~~UNKNOWN~~ | ~~102~~ | ~~945~~ | ~~0.000 PPM~~ PBM |
| 2 | UNKNOWN | 122 | 9325 | 0.005 PPM |
| 3 | ~~#CARB DG~~ UNK | 156 | 5222 | 0.003 PPM PBM |
| 4 | ~~#ACETONE~~ UNK | 179 | 10780 | 0.006 PPM PBM |
| 5 | UNKNOWN | 209 | 25477 | 0.015 PPM |
| 6 | UNKNOWN | 308 | 3930 | 0.002 PPM |
| 7 | UNKNOWN | 317 | 2429 | 0.001 PPM |
| 8 | UNKNOWN | 329 | 13246 | 0.008 PPM |
| 9 | ~~UNKNOWN~~ | ~~407~~ | ~~173272~~ | ~~0.102 PPM~~ PBM |
| 10 | UNKNOWN | 423 | 11373 | 0.007 PPM |
| 11 | TOLUENE | 439 | 8273 | 0.005 PPM |
| 12 | UNKNOWN | 460 | 6956 | 0.004 PPM |
| 13 | UNKNOWN | 485 | 4554 | 0.003 PPM |
| 14 | UNKNOWN | 499 | 6607 | 0.004 PPM |
| 15 | UNKNOWN | 548 | 2543 | 0.001 PPM |
| 16 | UNKNOWN | 558 | 25944 | 0.015 PPM |
| 17 | #M-XYLENE | 710 | 9934 | 0.006 PPM |
| 18 | UNKNOWN | 765 | 15165 | 0.009 PPM |
| 19 | UNKNOWN | 853 | 18328 | 0.011 PPM |
| 20 | UNKNOWN | 979 | 1685 | 0.001 PPM |
| 21 | UNKNOWN | 989 | 11218 | 0.007 PPM |

~~TOTAL AREA: 866506~~

NAME: END13
UPPER TRACE #51 5.25% Aug 10,93 17:42
LOWER TRACE #46 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #55 DATE: Tue Aug 10 18:29:48 1993

NAME: END14 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

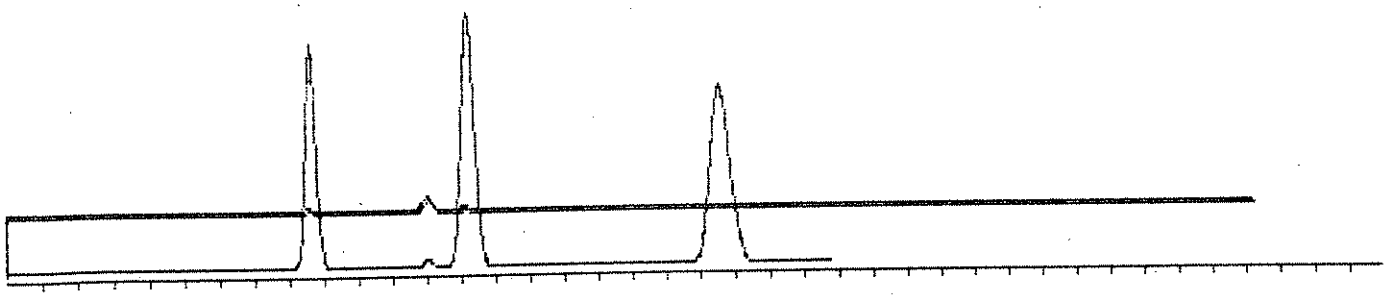
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | ~~UNKNOWN~~ | ~~76~~ | ~~888~~ | ~~2672.001 PPM~~ PBm |
| 2 | UNKNOWN | 90 | 3357 | 0.002 PPM |
| 3 | UNKNOWN | 118 | 6449 | 0.004 PPM |
| 4 | UNKNOWN | 204 | 5845 | 0.004 PPM |
| 5 | ~~BENZENE~~ | ~~289~~ | ~~16461~~ | ~~0.010 PPM~~ PBm |
| 6 | ~~#1120FOR~~ | ~~894~~ | ~~85602~~ | ~~0.053 PPM~~ PBm |
| 7 | ~~TOLUENE~~ | ~~426~~ | ~~20360~~ | ~~0.012 PPM~~ PBm |
| 8 | UNKNOWN | 579 | 2016 | 0.001 PPM |
| 9 | XYLENE | 637 | 2394 | 0.001 PPM |
| 10 | UNKNOWN | 812 | 7512 | 0.005 PPM |
| 11 | UNKNOWN | 900 | 5806 | 0.004 PPM |
| 12 | UNKNOWN | 1029 | 1621 | 0.001 PPM |
| 13 | UNKNOWN | 1069 | 7142 | 0.004 PPM |

~~TOTAL AREA: 164841~~

NAME: END14
UPPER TRACE #55 2.40% Aug 10,93 18:29
LOWER TRACE #54 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE:100-100, 0 Secs
SAMPLE TIME:5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #56 DATE: Tue Aug 10 18:48:56 1993

NAME: END15 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

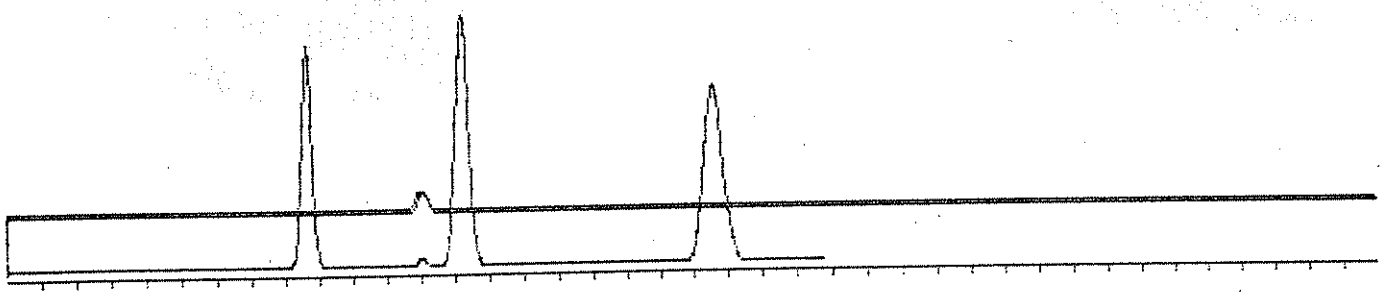
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | | RT | AREA | CONCENTRATION | |
|---|---|---|---|---|---|---|
| 1 | [illegible] | | [illegible] | [illegible] | [illegible] | PBM |
| 2 | [illegible] | UNK | 126 | 8624 | 0.005 PPM | PBM |
| 3 | [illegible] | UNK | 222 | 6450 | 0.004 PPM | PBM |
| 4 | [illegible] | | [illegible] | [illegible] | [illegible] | PBM |
| 5 | [illegible] | | [illegible] | [illegible] | [illegible] | PBM |
| 6 | [illegible] | | [illegible] | [illegible] | [illegible] | PBM |
| 7 | UNKNOWN | | 723 | 8177 | 0.005 PPM | |
| 8 | UNKNOWN | | 826 | 4444 | 0.003 PPM | |
| 9 | UNKNOWN | | 1045 | 12104 | 0.008 PPM | |

[illegible]

NAME: END15
UPPER TRACE #56 3.02% Aug 10,93 18:48
LOWER TRACE #54 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #57 DATE: Tue Aug 10 19:11:33 1993

NAME: END16 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

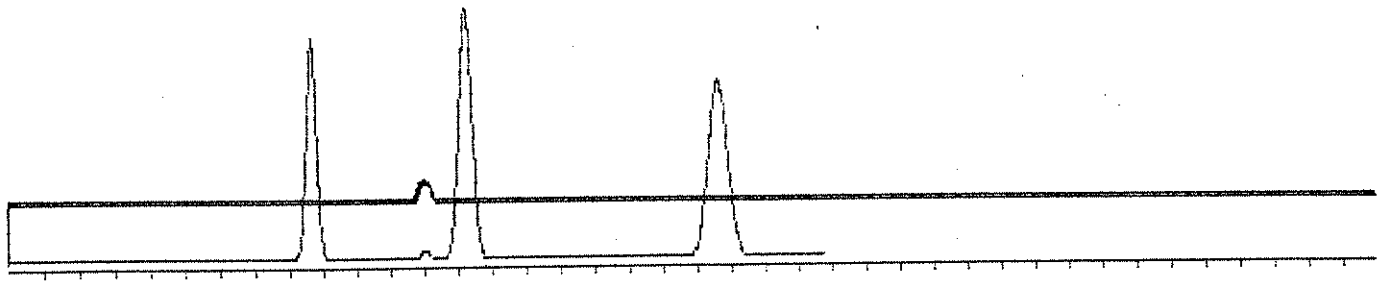
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM |
| 2 | UNKNOWN | 187 | 6163 | 0.004 PPM |
| 3 | [illegible] | [illegible] | [illegible] | [illegible] PPM |
| 4 | UNKNOWN | 752 | 17029 | 0.011 PPM |
| 5 | UNKNOWN | 826 | 1203 | 0.001 PPM |
| 6 | UNKNOWN | 999 | 8737 | 0.005 PPM |
| 7 | UNKNOWN | 1113 | 9443 | 0.006 PPM |

[illegible]

NAME: END16
UPPER TRACE #57 3.02% Aug 10,93 19:11
LOWER TRACE #54 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #62 DATE: Wed Aug 11 10:41:35 1993

NAME: END17 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

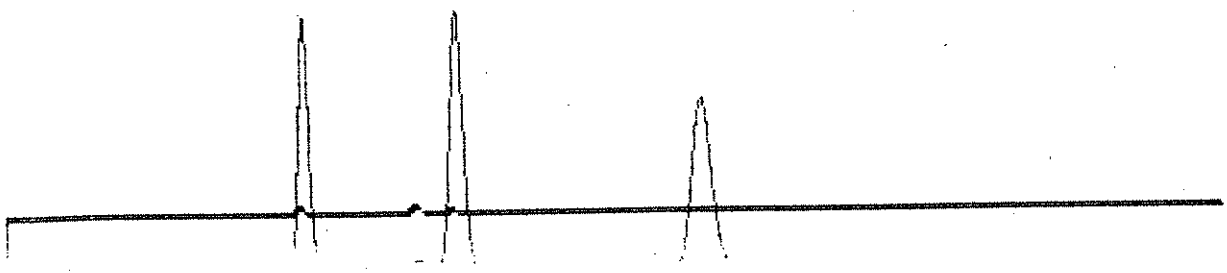
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |
| 2 | UNKNOWN | 68 | 3536 | 0.002 PPM |
| 3 | UNKNOWN | 161 | 10900 | 0.006 PPM |
| 4 | [illegible] | 176 | 2208 | 0.001 PPM PBM |
| 5 | UNKNOWN | 269 | 8391 | 0.005 PPM |
| 6 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |
| 7 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |
| 8 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |
| 9 | UNKNOWN | 523 | 8064 | 0.004 PPM |
| 10 | UNKNOWN | 750 | 3603 | 0.002 PPM |
| 11 | UNKNOWN | 766 | 3651 | 0.002 PPM |
| 12 | UNKNOWN | 871 | 3702 | 0.002 PPM |
| 13 | UNKNOWN | 944 | 4722 | 0.003 PPM |
| 14 | UNKNOWN | 1020 | 2435 | 0.001 PPM |
| 15 | UNKNOWN | 1084 | 4652 | 0.003 PPM |

[illegible]

NAME: END17
UPPER TRACE #62 2.56% Aug 11,93 10:41
LOWER TRACE #61 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #63 DATE: Wed Aug 11 11:00:27 1993

NAME: END18 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM |
| 2 | UNKNOWN | 485 | 4968 | 0.003 PPM |

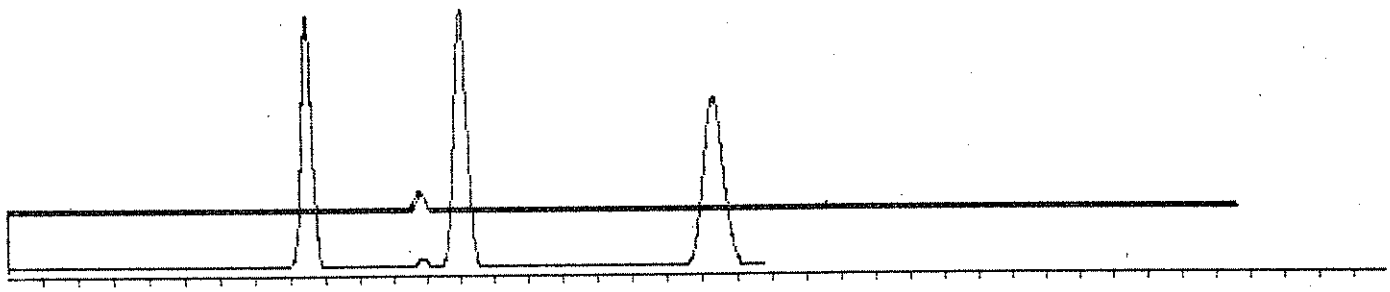
[illegible]

NAME: END18

UPPER TRACE #63 1.56% Aug 11,93 11:00

LOWER TRACE #61 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #64 DATE: Wed Aug 11 11:19:09 1993

NAME: END19 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] ppm |

[illegible]

NAME: END19

UPPER TRACE #64 1.47% Aug 11,93 11:19

LOWER TRACE #61 100.00%

COLUMN: 10%SP1000

COLUMN PRESSURE: 23

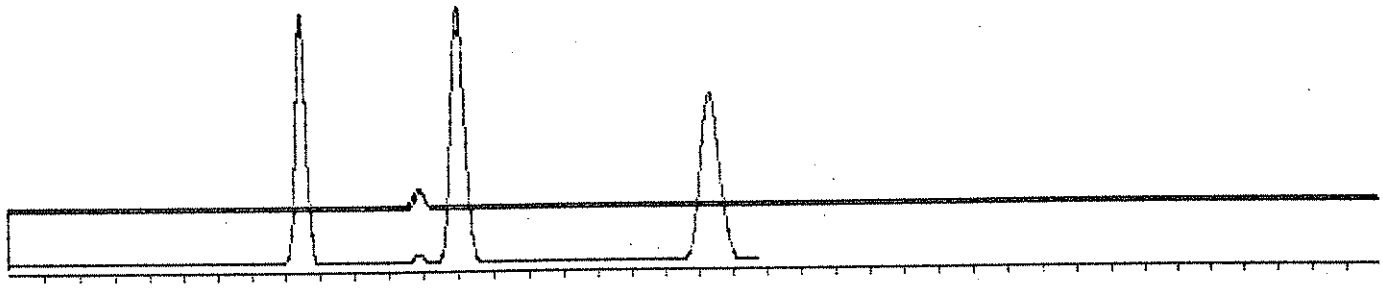
DETECTOR: AID

TEMPERATURE: 100-100, 0 Secs

SAMPLE TIME: 5

COIN: 1.000

DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #66 DATE: Wed Aug 11 11:48:52 1993

NAME: END20 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

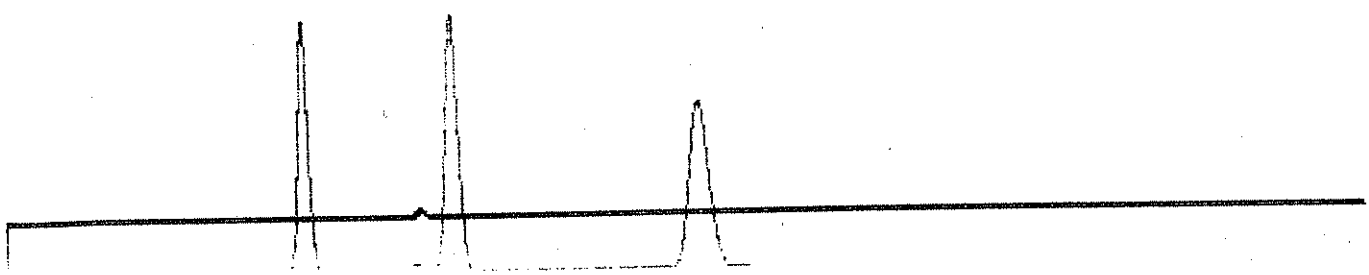
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM |
| 2 | UNKNOWN | 162 | 7897 | 0.004 PPM |
| 3 | UNKNOWN | 171 | 2832 | 0.002 PPM |
| 4 | [illegible] | [illegible] | [illegible] | [illegible] PPM |
| 5 | TOLUENE | 426 | 3181 | 0.002 PPM |
| 6 | UNKNOWN | 494 | 5651 | 0.003 PPM |
| 7 | UNKNOWN | 739 | 10753 | 0.006 PPM |
| 8 | UNKNOWN | 786 | 3181 | 0.002 PPM |
| 9 | UNKNOWN | 825 | 1698 | 0.001 PPM |
| 10 | #O-XYLENE | 850 | 4297 | 0.002 PPM |
| 11 | #O-XYLENE | 861 | 4203 | 0.002 PPM |
| 12 | UNKNOWN | 968 | 7125 | 0.004 PPM |
| 13 | UNKNOWN | 983 | 1966 | 0.001 PPM |
| 14 | UNKNOWN | 1065 | 7180 | 0.004 PPM |
| 15 | UNKNOWN | 1118 | 4237 | 0.002 PPM |

[illegible]

NAME: END20
UPPER TRACE #66 1.53% Aug 11,93 11:48
LOWER TRACE #61 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #67 DATE: Wed Aug 11 12:10:37 1993

NAME: END21 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | UNKNOWN | 71 | 1142 | 0.001 PPM |
| 2 | UNKNOWN | 108 | 5473 | 0.003 PPM |
| 3 | ~~#TOLUENE~~ UNK | 122 | 3363 | 0.002 PPM PBM |
| 4 | UNKNOWN | 187 | 7959 | 0.004 PPM |
| 5 | ~~UNKNOWN~~ | ~~395~~ | ~~170712~~ | ~~0.095 PPM~~ PBM |
| 6 | #TOLUENE | 431 | 14204 | 0.008 PPM |
| 7 | UNKNOWN | 459 | 6156 | 0.003 PPM |
| 8 | UNKNOWN | 473 | 4521 | 0.002 PPM |
| 9 | UNKNOWN | 540 | 3771 | 0.002 PPM |
| 10 | UNKNOWN | 578 | 7511 | 0.004 PPM |
| 11 | UNKNOWN | 598 | 1804 | 0.001 PPM |
| 12 | #M-XYLENE | 678 | 2255 | 0.001 PPM |
| 13 | UNKNOWN | 871 | 4803 | 0.003 PPM |
| 14 | UNKNOWN | 901 | 7075 | 0.004 PPM |

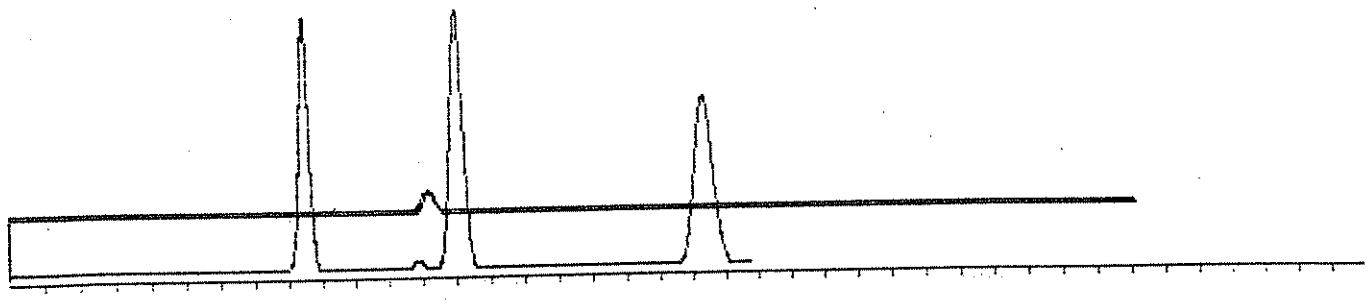
~~TOTAL AREA: 240749~~

NAME: END21

UPPER TRACE #67 3.55% Aug 11,93 12:10

LOWER TRACE #61 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #73 DATE: Wed Aug 11 13:32:23 1993

NAME: END22 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

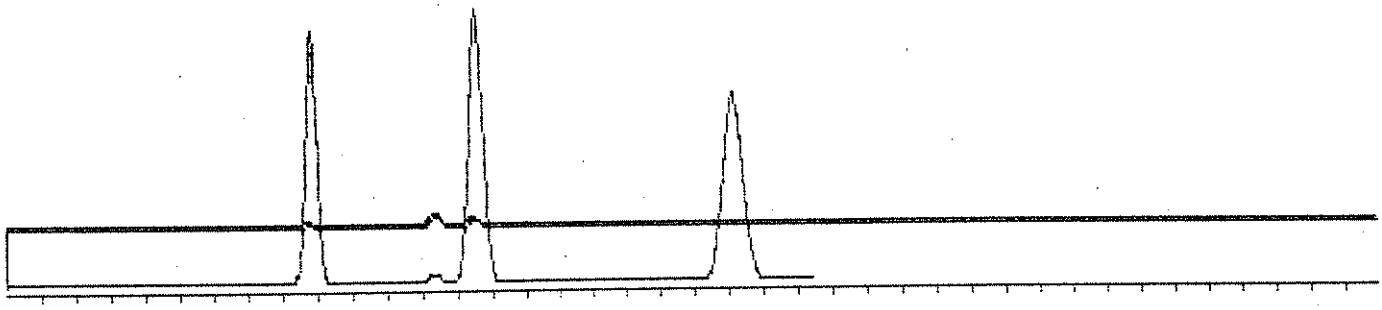
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | ~~BENZENE~~ | ~~295~~ | ~~21561~~ | ~~0.011 PPM~~ PBM |
| 2 | ~~#1122TCA~~ | ~~408~~ | ~~71777~~ | ~~0.037 PPM~~ PBM |
| 3 | ~~TOLUENE~~ | ~~496~~ | ~~55005~~ | ~~0.027 PPM~~ PBM |

~~TOTAL AREA: 148043~~

NAME: END22
UPPER TRACE #73 1.92% Aug 11,93 13:32
LOWER TRACE #72 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #74 DATE: Wed Aug 11 13:53:15 1993

NAME: END23 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

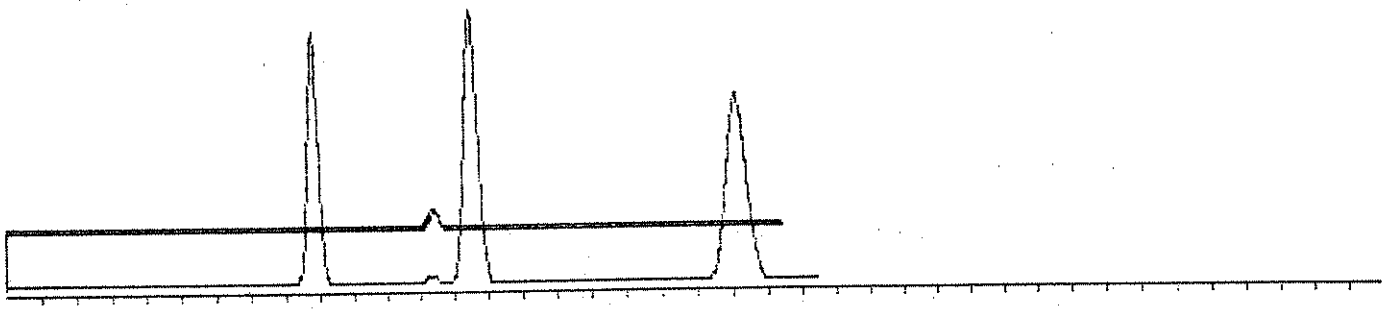
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |
| 2 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |
| 3 | [illegible] | [illegible] | [illegible] | [illegible] PPM PBM |

[illegible]

NAME: END23
UPPER TRACE #74 1.61% Aug 11,93 13:53
LOWER TRACE #72 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE:100-100, 0 Secs
SAMPLE TIME:5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #84 DATE: Wed Aug 11 15:48:59 1993

NAME: END25 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

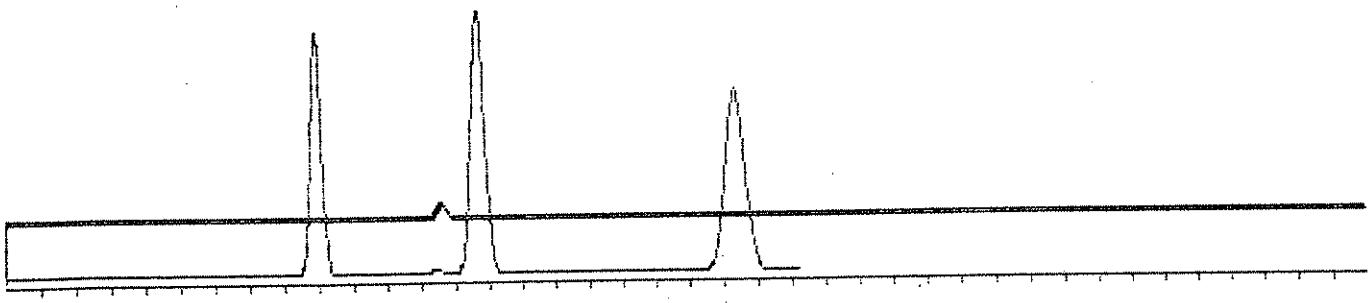
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | ~~UNKNOWN~~ | ~~101~~ | ~~8950~~ | ~~0.300 PPM~~ PBM |
| 2 | UNKNOWN | 112 | 9103 | 0.005 PPM |
| 3 | ~~#METH CL~~ UNK | 258 | 5491 | 0.003 PPM PBM |
| 4 | BENZENE | 297 | 869 | 0.000 PPM |
| 5 | ~~#TETRA CH~~ | ~~410~~ | ~~99504~~ | ~~0.054 PPM~~ PBM |
| 6 | UNKNOWN | 519 | 18909 | 0.010 PPM |
| 7 | UNKNOWN | 534 | 3880 | 0.002 PPM |
| 8 | XYLENE | 680 | 6135 | 0.003 PPM |
| 9 | #M-XYLENE | 714 | 2960 | 0.002 PPM |
| 10 | UNKNOWN | 778 | 5164 | 0.003 PPM |
| 11 | UNKNOWN | 819 | 5772 | 0.003 PPM |
| 12 | #O-XYLENE | 889 | 6690 | 0.004 PPM |
| 13 | #O-XYLENE | 902 | 3095 | 0.002 PPM |

~~TOTAL AREA: 163694~~

NAME: END25
UPPER TRACE #84 2.21% Aug 11,93 15:48
LOWER TRACE #77 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE:100-100, 0 Secs
SAMPLE TIME:5
GAIN: 1.000
DURATION: 20 Minutes



TRACE PRINTOUT

TRACE #85 DATE: Wed Aug 11 16:09:50 1993

NAME: END24-2 CHART DURATION: 20

COLUMN: 10%SP1000 DETECTOR: AID

COLUMN PRESSURE: 23 SAMPLE TIME: 5

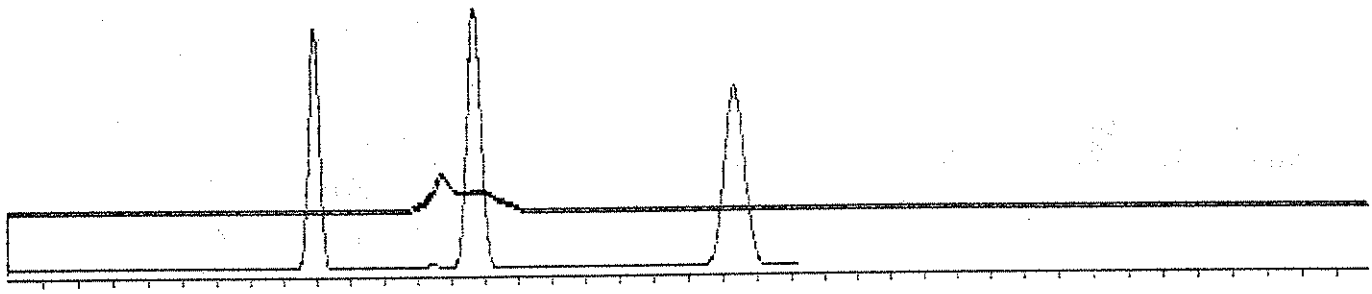
TEMPERATURE: 100 INHIBIT TIME: 30

| PEAK# | NAME | RT | AREA | CONCENTRATION |
|---|---|---|---|---|
| 1 | ~~ACETONE~~ UNK | 182 | 4120 | 0.002 PPM PBM |
| 2 | BENZENE | 300 | 3200 | 0.002 PPM |
| 3 | ~~UNKNOWN~~ | ~~413~~ | ~~663042~~ | ~~0.359 PPM~~ PBM |
| 4 | TOLUENE | 446 | 452856 | 0.237 PPM |
| 5 | UNKNOWN | 767 | 6177 | 0.003 PPM |
| 6 | UNKNOWN | 1117 | 12510 | 0.007 PPM |

~~TOTAL AREA: 1141905~~

NAME: END24-2
UPPER TRACE #85 15.41% Aug 11,93 16:09
LOWER TRACE #77 100.00%

COLUMN: 10%SP1000
COLUMN PRESSURE: 23
DETECTOR: AID
TEMPERATURE: 100-100, 0 Secs
SAMPLE TIME: 5
GAIN: 1.000
DURATION: 20 Minutes



# APPENDIX C

Endicott School Soil Gas Survey
Ground Water Sample Quality Assurance and Results
August 1993

# APPENDIX C

## Quality Assurance Samples

Soil Gas

Due to site conditions very little contamination was detected in the soil gas samples. Site conditions consisted of high clay and moisture content in the vadose zone which retards the vertical flow of volatile contaminants. Given the site conditions, soil gas was not an appropriate investigative tool.

Because sample results were determined using a portable gas chromatograph all reported analytes are considered tentatively identified and concentrations are estimates. Soil gas quality assurance samples consisted of calibration, duplicates, and blanks. The gas chromatograph was calibrated at least once every five analytical runs with a standard pressurized mixture of 1.0 ppm benzene, 1.3 ppm toluene and 1.5 ppm m-xylene. Duplicate samples (repeat analyses of the same sample) were analyzed for at least 10% of all soil gas samples. Duplicate results were considered qualitative and within expected ranges. Blank samples of ambient air were run frequently to ensure that equipment contamination had not occurred.

Soil and Water Samples

Dickey Huntamer and David Thomson of the Manchester Laboratory evaluated laboratory quality assurance results. The quality of all the results are good. Toluene was detected near the quantitation limit in the transfer and transport blanks. The toluene is attributed to laboratory equipment contamination.

Duplicate samples collected at MW6 provide an estimate of combined sampling and laboratory precision. The numeric comparison of duplicate results is expressed as the relative percent difference or RPD. RPDs are the ratio of the difference and the mean of the duplicate results expressed as a percentage. The RPDs for the duplicate samples were: benzene, 10%; toluene, 7%; ethylbenzene, 9%; xylene, 5%; chloride, 1%; sulfate, 0.3%; total organic carbon, 0%; total dissolved solids, 3%; ammonia, 0%; nitrite-nitrate, 9%; and total phosphorus, 0%. Spike recoveries were within acceptable limits of 75-125%. Relative percent difference (%RPD) for the spike and spike duplicates were within ±20%.

# MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E , Port Orchard Washington 98366

## CASE NARRATIVE

**August 30, 1993**

Subject: Endicott School

Samples: 93 - 338030 to -338038

Case No. DOE-837Y

Officer: Pam Marti

By: Dickey D. Huntamer
Organics Analysis Unit

## *WTPH-G ANALYSIS*

### ANALYTICAL METHODS:

The samples were analyzed for total gasoline using Total Petroleum Hydrocarbon Analytical Methods-WTPH-G, September 27, 1991.

### HOLDING TIMES:

The samples were analyzed within the recommended holding times.

### BLANKS:

No gasoline was detected in the laboratory blank.

### DUPLICATES:

Sample -338033 was analyzed in duplicate. The Relative Percent Difference (RPD) was 3.4%. No RPD criteria have been established for this method.

### ANALYTICAL COMMENTS:

No problems were encountered in the analysis of these samples. The data is acceptable to use without additional qualifiers.

**DATA QUALIFIER CODES:**

| | | |
|---|---|---|
| U | - | The analyte was not detected at or above the reported value. |
| J | - | The analyte was positively identified. The associated numerical value is an estimate. |
| UJ | - | The analyte was not detected at or above the reported estimated result. |
| REJ | - | The data are unusable for all purposes. |
| EXP | - | The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals $3 \times 10^6$. |
| NAF | - | Not analyzed for. |
| N | - | For organic analytes there is evidence the analyte is present in this sample. |
| NJ | - | There is evidence that the analyte is present. The associated numerical result is an estimate. |
| E | - | This qualifier is used when the concentration of the associated value exceeds the known calibration range. |
| * | - | The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.) |

*** Lab Analysis Report ***

Transaction #: 08260701 Seq #: 01 (40) Organics - General
(WE) Ecology, Manchester Lab
Project: (DOE-837Y) ENDICOTT SCHOOL D3E20 PZM
Param: ( 100064 S) WTPH-G

QA Code: ( ) Normal Data
Instrument: (PEPIDFID) Perkin-Elmer PID/FID
Method: (WTPH-G ) Washington Total Petroleum Hydrocarbon-Gas
Chemist: (JRF) Ratmeyer Folkerts, J. DO Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (10) Water-Total Date Preprd:
Units: (10) mg/l Date Anlyzd: 930819

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338030 | 0.024U | MW5 | 930811 ( 8) |
| 2 | 93 338031 | 0.024U | MW7 | 930811 ( 8) |
| 3 | 93 338032 | 0.024U | MW4 | 930811 ( 8) |
| 4 | 93 338033 | 0.057 | MW3 | 930812 ( 7) |
| 5 | 93 338034 | 0.024U | MW6 | 930812 ( 7) |
| 6 | 93 338035 | 0.024U | MW6 | 930812 ( 7) |
| 7 | 93 338036 | 0.48 | 3MW | 930812 ( 7) |
| 8 | 93 338037 | 0.024U | TRANSFER | 930812 ( 7) |
| 9 | 93 338038 | 0.024U | TRANSPOR | 930812 ( 7) |

Record Type: TRNIN2 Date Verified: 8/27/93 By: JRF
Transaction Status: New Transaction...First Printing...Unverified.
Processed: 26-AUG-93 07:16:56 Status: N Batch: (In CUR DB)

*** Lab Analysis Report ***

Transaction #: 08260701 Seq #: 02 (40) Organics - General
(WE) Ecology, Manchester Lab
D3E20 PZM

Project: (DOE-837Y) ENDICOTT SCHOOL
Param: ( 100064 S) WTPH-G

QA Code: (LDP1) Lab Duplicate Sample #1
Instrument: (PEPIDFID) Perkin-Elmer PID/FID
Method: (WTPH-G ) Washington Total Petroleum Hydrocarbon-Gas
Chemist: (JRF) Ratmeyer Folkerts, J. DO Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (10) Water-Total Date Preprd:
Units: (10) mg/l Date Anlyzd: 930819

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338033 | 0.059 | MW3 | 930812 ( 7) |

Record Type: TRNIN2 Date Verified: 8/27/93 By: JRFolkerts
Transaction Status: New Transaction...First Printing...Unverified.
Processed: 26-AUG-93 07:16:56 Status: N Batch: (In CUR DB)

*** Lab Analysis Report ***

Transaction #: 08260701 Seq #: 03 (40) Organics - General
(WE) Ecology, Manchester Lab
Project: (DOE-837Y) ENDICOTT SCHOOL D3E20 PZM
Param: ( 100064 S) WTPH-G

QA Code: (LBK1) Lab Blank Sample #1 Blank ID: BW3231
Instrument: (PEPIDFID) Perkin-Elmer PID/FID
Method: (WTPH-G ) Washington Total Petroleum Hydrocarbon-Gas
Chemist: (JRF) Ratmeyer Folkerts, J. DO Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (10) Water-Total Date Preprd:
Units: (10) mg/l Date Anlyzd: 930819

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338030 | 0.024U | MW5 | 930811 ( 8) |

Record Type: TRNIN2 Date Verified: 8/27/93 By: [signature]
Transaction Status: New Transaction...First Printing...Unverified.
Processed: 26-AUG-93 07:16:56 Status: N Batch: (In CUR DB)

# MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E , Port Orchard Washington 98366

## CASE NARRATIVE

**August 30, 1993**

Subject: Endicott School

Samples: 93 - 338030 to -338038

Case No. DOE-837Y

Officer: Pam Marti

By: Dickey D. Huntamer
Organics Analysis Unit

## *BETX ANALYSIS*

### ANALYTICAL METHODS:

The samples were analyzed by EPA Method SW-846 - 8020. Normal laboratory QA/QC procedures were performed with the analyses.

### HOLDING TIMES:

The samples were analyzed within the recommended holding times.

### BLANKS:

The EPA five times rule was applied to all target compounds which were found in the blank. Compounds that were found in the sample and in the blank were considered real and not the result of contamination if the levels in the sample are greater than or equal to five times the amount of compounds in the associated method blank. No target compounds were detected in the laboratory blank.

### SURROGATES:

All surrogate recoveries were within acceptable limits.

### MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

A matrix spike and spike duplicate was analyzed using samples -338030 and -338031 due to insufficient sample. Recoveries ranged from 97% to 104% and the Relative Percent Differences (RPD) ranged from 0% to 7%. All recovery and precision data were within acceptable limits.

Washington State Department of Ecology
*** Lab Analysis Report ***



==> Transaction #: 08260756 Laboratory: (WE) Ecology, Manchester Lab

Work Group: (51) VOA - PP Scan

Instrument: (PEPIDFID) Perkin-Elmer PID/FID

Method: (RX1-GO ) Organics, General

Chemist: (JRF) Ratmeyer Folkerts, J. DO Hours Worked: _____

Project: DOE-837Y ENDICOTT SCHOOL Prg Ele#: D3E20

Prj Off: Marti, Pam DOE Analysis Due: 930812 Revised Due:

*** Sample Records in Transaction ***

| Seq# | Sample # | QA | Date/Time | Description | Alternate Keys | | |
|---|---|---|---|---|---|---|---|
| 01 | 93338030 | LBK1 | 930811 | MW5 | | | |
| 02 | 93338030 | LBK2 | 930811 | MW5 | | | |
| 03 | 93338030 | | 930811 | MW5 | | | |
| 04 | 93338030 | LMX1 | 930811 | MW5 | | | |
| 05 | 93338031 | LMX2 | 930811 | MW7 | | | |
| 06 | 93338031 | | 930811 | MW7 | | | |
| 07 | 93338032 | | 930811 | MW4 | | | |
| 08 | 93338033 | | 930812 | MW3 | | | |
| 09 | 93338034 | | 930812 | MW6 | | | |
| 10 | 93338035 | | 930812 | MW6 | | | |
| 11 | 93338036 | | 930812 | 3MW | | | |
| 12 | 93338037 | | 930812 | TRANSFER | | | |
| 13 | 93338038 | | 930812 | TRANSPOR | | | |

Record Type: TRNIN3 Date Verified: 8/27/93 By: [signature]
Transaction Status: Edited Transaction...First Printing...Unverified.
Processed: 26-AUG-93 08:03:39 Status: E Batch: (In CUR DB)

## ANALYTICAL COMMENTS:

No problems were encountered in the analysis of these samples. The data is acceptable to use without additional qualifiers.

## DATA QUALIFIER CODES:

| | | |
|---|---|---|
| U | - | The analyte was not detected at or above the reported value. |
| J | - | The analyte was positively identified. The associated numerical value is an estimate. |
| UJ | - | The analyte was not detected at or above the reported estimated result. |
| REJ | - | The data are unusable for all purposes. |
| EXP | - | The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals $3 \times 10^6$. |
| NAF | - | Not analyzed for. |
| N | - | For organic analytes there is evidence the analyte is present in this sample. |
| NJ | - | There is evidence that the analyte is present. The associated numerical result is an estimate. |
| E | - | This qualifier is used when the concentration of the associated value exceeds the known calibration range. |
| * | - | The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.) |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 01 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Blank ID : BW3231
Sample No.: 93 338030 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: (LBK1) Lab Blank Sample #1 Peaks Total:
Date Extracted: Date Analyzed: 930819 # Days to Ext/Anal: 0/ 8

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 0.2U | |
| 2 | 108883 | Toluene | ug/l | 0.2U | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 104 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 02 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Blank ID : BW3235
Sample No.: 93 338030 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds: _____
QA Code: (LBK2) Lab Blank Sample #2 Peaks Total: _____
Date Extracted: Date Analyzed: 930823 # Days to Ext/Anal: 0/ 12

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 0.2U | |
| 2 | 108883 | Toluene | ug/l | 0.2U | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 104 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 03 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338030 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930819 # Days to Ext/Anal: 0/ 8

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 0.2U | |
| 2 | 108883 | Toluene | ug/l | 0.2U | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 105 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 04 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338030 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (94) % Recov %Slds:
QA Code: (LMX1) Lab Mtrx Spike #1 (% Rec Peaks Total:
Date Extracted: Date Analyzed: 930824 # Days to Ext/Anal: 0/ 13

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | % Recov | 104 | |
| 2 | 108883 | Toluene | % Recov | 103 | |
| 3 | 100414 | Ethylbenzene | % Recov | 104 | |
| 4 | 1330207 | Total Xylenes | % Recov | 104 | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 104 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 05 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338031 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (94) % Recov %Slds:
QA Code: (LMX2) Lab Mtrx Spike #2 (% Rec Peaks Total:
Date Extracted: Date Analyzed: 930824 # Days to Ext/Anal: 0/ 13

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | % Recov | 103 | |
| 2 | 108883 | Toluene | % Recov | 102 | |
| 3 | 100414 | Ethylbenzene | % Recov | 97 | |
| 4 | 1330207 | Total Xylenes | % Recov | 103 | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 104 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 06 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338031 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930819 # Days to Ext/Anal: 0/ 8

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 0.2U | |
| 2 | 108883 | Toluene | ug/l | 0.2U | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 105 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 07 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338032 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930823 # Days to Ext/Anal: 0/ 12

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 17 | |
| 2 | 108883 | Toluene | ug/l | 1.1 | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 103 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 08 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338033 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930819 # Days to Ext/Anal: 0/ 7

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 585 | |
| 2 | 108883 | Toluene | ug/l | 2.8 | |
| 3 | 100414 | Ethylbenzene | ug/l | 1.3 | |
| 4 | 1330207 | Total Xylenes | ug/l | 3.2 | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 102 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 09 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338034 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 930820 # Days to Ext/Anal: 0/ 8

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 370 | |
| 2 | 108883 | Toluene | ug/l | 0.26 | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.24 | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.88 | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 102 | (Surr) PR |

Washington State Department of Ecology
*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 10 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338035 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930820 # Days to Ext/Anal: 0/ 8

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 333 | |
| 2 | 108883 | Toluene | ug/l | 0.28 | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.22 | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.84 | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 102 | (Surr) PR |

Transaction #: 08260756 Seq #: 11 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338036 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930820 # Days to Ext/Anal: 0/ 8

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 500 | |
| 2 | 108883 | Toluene | ug/l | 2.4 | |
| 3 | 100414 | Ethylbenzene | ug/l | 1.3 | |
| 4 | 1330207 | Total Xylenes | ug/l | 12.5 | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 103 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 12 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338037 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930819 # Days to Ext/Anal: 0/ 7

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 0.2U | |
| 2 | 108883 | Toluene | ug/l | 0.32 | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 104 | (Surr) PR |

*** Lab Analysis Report ***

Transaction #: 08260756 Seq #: 13 (51) VOA - PP Scan
Proj Code : DOE-837Y ENDICOTT SCHOOL PE # : D3E20

Sample No.: 93 338038 Alternate Keys:

Samp Matrix: (10) Water-Total Units: (11) ug/l %Slds:
QA Code: ( ) Unspecifed Peaks Total:
Date Extracted: Date Analyzed: 930819 # Days to Ext/Anal: 0/ 7

| Line | Par # | Parameter Description | Units | Value | |
|---|---|---|---|---|---|
| 1 | 71432 | Benzene | ug/l | 0.2U | |
| 2 | 108883 | Toluene | ug/l | 0.28 | |
| 3 | 100414 | Ethylbenzene | ug/l | 0.2U | |
| 4 | 1330207 | Total Xylenes | ug/l | 0.6U | |
| 5 | -540363 | p-Difluorobenzene | % Recov | 104 | (Surr) PR |

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
MANCHESTER ENVIRONMENTAL LABORATORY
7411 Beach Drive East • Port Orchard, Washington 98366-8204 • (206) 871-8860 • SCAN 871-8860

September 29, 1993

TO: Pam Marti, Project Officer

FROM: David A. Thomson

SUBJECT: Endicott School Results

**SAMPLE RECEIPT:**

The samples were received by the Manchester Laboratory on August 12, 1993 in good condition.

**HOLDING TIMES:**

The analyses were performed by Weyerhaeuser Analysis and Testing Services within the specified holding times using the following methods;

Total P-EPA method 365.3
NH3-EPA method 350.1
NO2/NO3-EPA method 353.2

**PROCEDURAL BLANKS:**

The procedural blanks associated with these samples showed no analytically significant levels of analytes.

**STANDARD REFERENCE MATERIAL:**

Standard reference material or external verification standards were all within the windows established for each method.

**SPIKE RECOVERY:**

Spike sample analyses were performed on sample number 338030 (NO2/NO3 and NH3) and sample number 338031 (T-P). All spike recoveries were within limits of +/- 12%.

**PRECISION DATA:**

The results of samples run in duplicate were used to evaluate precision on this sample set. The Relative Percent Difference (RPD) for all analytes was within the +/- 2% window.

**SUMMERY:**

The data generated by the analysis of Endicott School samples can be used without qualification.

If you have any questions about the results or the methods used to obtain these results please call me at (206) 871-8822.

WEYERHAEUSER TECHNOLOGY CENTER
Analytical Laboratories
Tacoma, Washington

Report

Service Request 12697

Department of Ecology
Endicott School

| Sample Description | Analytical Lab Code | NH3-N mg/L | NO3/NO2-N mg/L | TP mg/L |
|---|---|---|---|---|
| 338030 | 14507 | <0.02 | 3.78 | 0.31 |
| 338031 | 14508 | <0.02 | 3.50 | 1.1 |
| 338032 | 14509 | <0.02 | 6.68 | 0.26 |
| 338033 | 14510 | <0.02 | 6.94 | 0.15 |
| 338034 | 14511 | <0.02 | 2.26 | 0.16 |
| 338035 | 14512 | <0.02 | 2.48 | 0.16 |
| 338036 | 14513 | <0.02 | 5.57 | 0.25 |

Approved Maxine Kasta Date 9-14-93
kas

*** Lab Analysis Report ***

Transaction #: 08231055 Seq #: 01 (80) Ion Chromatography
(WE) Ecology, Manchester Lab
Project: (DOE-837Y) ENDICOTT SCHOOL D3E20 PZM
Param: ( 940 S) Chloride mg/l

QA Code: ( ) Normal Data
Instrument: (IC-2020I) Dionex #IC-2020 Ion Chromatography
Method: (EPA-300.0 ) Inorganic Anions, Ion Chromatography
Chemist: (CGT) Tupas, Cyma DOE Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (11) Water-Filtered Date Preprd:
Units: (10) mg/l Date Anlyzd: 930819

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338030 | 11.3 | MW5 | 930811 ( 8) |
| 2 | 93 338031 | 7.6 | MW7 | 930811 ( 8) |
| 3 | 93 338032 | 21.6 | MW4 | 930811 ( 8) |
| 4 | 93 338033 | 39.5 | MW3 | 930812 ( 7) |
| 5 | 93 338034 | 19.7 | MW6 | 930812 ( 7) |
| 6 | 93 338035 | 19.5 | MW6 | 930812 ( 7) |
| 7 | 93 338036 | 28.5 | 3MW | 930812 ( 7) |

Record Type: TRNIN2 Date Verified: 8-24-93 By: Debbie Lacey
Transaction Status: New Transaction...First Printing...Unverified.
Processed: 23-AUG-93 10:58:09 Status: N Batch: (In CUR DB)

*** Lab Analysis Report ***

Transaction #: 08231057 Seq #: 01 (80) Ion Chromatography
(WE) Ecology, Manchester Lab
Project: (DOE-837Y) ENDICOTT SCHOOL D3E20 PZM
Param: ( 946 S) Sulfate Diss mg/l

QA Code: ( ) Normal Data
Instrument: (IC-2020I) Dionex #IC-2020 Ion Chromatography
Method: (EP1-300.0 ) Inorganic Anions, Ion Chromatography
Chemist: (CGT) Tupas, Cyma DOE Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (11) Water-Filtered Date Preprd:
Units: (10) mg/l Date Anlyzd: 930819

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338030 | 20.7 | MW5 | 930811 ( 8) |
| 2 | 93 338031 | 30.8 | MW7 | 930811 ( 8) |
| 3 | 93 338032 | 67.8 | MW4 | 930811 ( 8) |
| 4 | 93 338033 | 160 | MW3 | 930812 ( 7) |
| 5 | 93 338034 | 32.2 | MW6 | 930812 ( 7) |
| 6 | 93 338035 | 32.3 | MW6 | 930812 ( 7) |
| 7 | 93 338036 | 97.3 | 3MW | 930812 ( 7) |

Record Type: TRNIN2 Date Verified: 8-24-93 By: Debbie Tacoma
Transaction Status: Edited Transaction...First Printing...Unverified.
Processed: 23-AUG-93 11:01:05 Status: E Batch: (In CUR DB)

Washington State Department of Ecology
*** Lab Analysis Report ***

Transaction #: 08240819 Seq #: 01 (18) Demand - Specified
(WE) Ecology, Manchester Lab
Project: (DOE-837Y) ENDICOTT SCHOOL D3E20 PZM
Param: ( 680 S) T-Org-C Total mg/l

QA Code: ( ) Normal Data
Instrument: (OI700TOC) O.I. Model 700 TOC
Method: (EP1-415.1 ) Organic Carbon, Total, Combustion or Oxidation
Chemist: (DJL) Lacroix, Debbie J. DOE Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (10) Water-Total Date Preprd:
Units: (10) mg/l Date Anlyzd: 930823

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338030 | 1.8 | MW5 | 930811 ( 12) |
| 2 | 93 338031 | 4.4 | MW7 | 930811 ( 12) |
| 3 | 93 338032 | 2.5 | MW4 | 930811 ( 12) |
| 4 | 93 338033 | 2.9 | MW3 | 930812 ( 11) |
| 5 | 93 338034 | 3.4 | MW6 | 930812 ( 11) |
| 6 | 93 338035 | 3.4 | MW6 | 930812 ( 11) |
| 7 | 93 338036 | 2.8 | 3MW | 930812 ( 11) |

Record Type: TRNIN2 Date Verified: 8/24/93 By: Donna J Lacroix
Transaction Status: New Transaction...First Printing...Unverified
Processed: 24-AUG-93 08:26:54 Status: N Batch: (In CUR DB)

*** Lab Analysis Report ***

Transaction #: 08191551 Seq #: 01 (15) Solids - Specified
(WE) Ecology, Manchester Lab
Project: (DOE-837Y) ENDICOTT SCHOOL D3E20 PZM
Param: ( 70300 S) Solids T-Dissol mg/l

QA Code: ( ) Normal Data
Instrument: (GRAV ) Gravimetric Measurement
Method: (EPl-160.1 ) Residue, Filterable, Gravimetric, Dried at 180 Deg
Chemist: (CAB) Bickle, Kitty DOE Hours Worked:
Lab Prep: ( ) Unspecifed
Matrix: (10) Water-Total Date Preprd:
Units: (10) mg/l Date Anlyzd: 930816

| Line | Sample # | Result | Sample Location/Description | #Days to Anl |
|---|---|---|---|---|
| 1 | 93 338030 | 443 | MW5 | 930811 ( 5) |
| 2 | 93 338031 | 511 | MW7 | 930811 ( 5) |
| 3 | 93 338032 | 679 | MW4 | 930811 ( 5) |
| 4 | 93 338033 | 900 | MW3 | 930812 ( 4) |
| 5 | 93 338034 | 638 | MW6 | 930812 ( 4) |
| 6 | 93 338035 | 618 | MW6 | 930812 ( 4) |
| 7 | 93 338036 | 763 | 3MW | 930812 ( 4) |

Record Type: TRNIN2 Date Verified: 8/20/93 By: MJensen
Transaction Status: New Transaction...Reprint...Unverified.
Processed: 19-AUG-93 16:02:09 Status: P Batch: (In CUR DB)

# APPENDIX D

Distance of Influence near a Trench

APPENDIX D

DATE: December 21, 1994

TO: Pam Marti

FROM: Denis Erickson DE

SUBJECT: Distance of Influence near a Trench

At your request I estimated the distance of influence from a recovery trench in a water table setting. I used a method described in McWhorter and Sunada (1977) which, originally was developed to determine drain spacing. The steady-state configuration of the water table can be described by the following equation:

$$h^2 = h_o^2 - \frac{W}{K}(x^2 - (\frac{L}{2})^2)$$

where,

W = recharge rate (L/t)
K = Hydraulic conductivity (L/t)
and other terms are shown in Figure D-1.

Hydraulic conductivity was estimated by others from slug tests to be about 0.57 feet/day. The height of the water table above the trench ($h_{max}$, at x=0) ranged from 1 to 4.5 feet using water levels from on-site monitoring wells. I used daily precipitation records from Pullman, Washington for the period from January 1, 1970 through December 31, 1984 to estimate the annual precipitation (Hermanson, 1992). Water-table configurations were calculated for three recharge rates assuming 100%, 50%, and 25% infiltration.

The results are summarized in Table D-1.

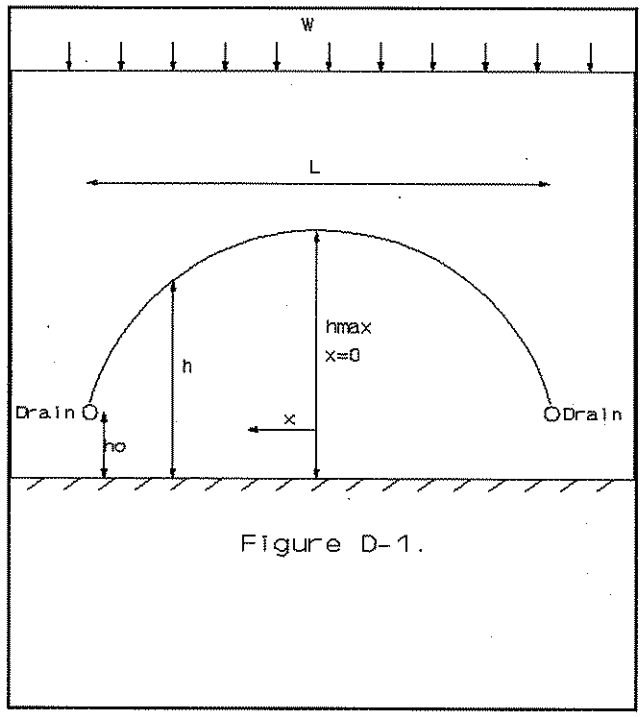


Figure D-1.

Table D-1. Estimated distances of influence from a trench.

| W,feet/day | % Infiltration | $h_{max}$,feet | Distance,feet |
|---|---|---|---|
| 0.0047 | 100 | 1 | 11 |
| 0.0024 | 50 | 1 | 16 |
| 0.0012 | 25 | 1 | 22 |
| 0.0047 | 100 | 4.5 | 49 |
| 0.0024 | 50 | 4.5 | 70 |
| 0.0012 | 25 | 4.5 | 98 |

In conclusion, using extreme conditions the distance of influence of the recovery trench ranged between 10 and 100 feet. Using average conditions the distance of influence is probably less than 50 feet.