FINAL

Confirmation Sampling and Analysis Report
POL Yard, Sites SS-06 and ST-40

Wurtsmith Air Force Base
Michigan

Prepared For

Air Force Center for Environmental Excellence
Brooks Air Force Base,
Texas

and

Air Force Base Conversion Agency/OL-T
Oscoda, Michigan

April 1999

PARSONS
PARSONS ENGINEERING SCIENCE, INC.
1700 Broadway, Suite 900 • Denver, Colorado 80290

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Contract F41624-92-8036, Delivery Order 17

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Prepared by:

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ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
COC	chain of custody
COPC	chemical of potential concern
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MS	matrix spike
MS/MSD	matrix spike/matrix spike duplicate
NFRAP	no-further-response-action-planned
Parsons ES	Parsons Engineering Science, Inc.
PCE	perchloroethene
POL	petroleum, oils, and lubricants
PQL	practical quantitation limit
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SAI	Specialized Assays, Inc.
SAP	Sampling and Analysis Plan
TMB	trimethylbenzene
TVH	total volatile hydrocarbon
TVHA	total volatile hydrocarbon analyzer
UCL	upper confidence limit
US	United States
USEPA	US Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

SECTION 1

INTRODUCTION

1.1 PURPOSE

This confirmation sampling and analysis report for the Petroleum, Oils, and Lubricants (POL) Yard, Sites SS-06 and ST-40, at Wurtsmith Air Force Base (AFB), Michigan, has been prepared by Parsons Engineering Science, Inc. (Parsons ES) for submittal to the Michigan Department of Environmental Quality (MDEQ); the United States (US) Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, Texas; and the Air Force Base Conversion Agency/OL-T (AFBCA), Oscoda, Michigan. MDEQ provides oversight of underground storage tank (UST) work at Wurtsmith AFB. This report has been prepared as part of the AFCEE Extended Bioventing Project (Contract F41624-92-8036, Delivery Order 17).

Soil sampling for laboratory analysis was conducted at the sites by Parsons ES in October 1998 in accordance with the MDEQ- and US Environmental Protection Agency (USEPA)-approved Confirmation Sampling and Analysis Plan (SAP) for Sites SS-06 and ST-40 (included as Appendix A of this report). The objective of the confirmation soil sampling and analysis was to determine if soils contaminated with petroleum hydrocarbons had been sufficiently remediated following 2 years of expanded-scale bioventing, and to determine whether a no-further-response-action-planned (NFRAP) decision could be pursued, or additional soil remediation or other actions were required. This report summarizes field activities, field observations, and data collected during the October 1998 sampling event, and evaluates the reduction of petroleum hydrocarbon contamination in soil as a result of 2 years of bioventing system operation. The purpose of this report is to document the effectiveness of remediation of soil contaminated with petroleum hydrocarbons; to compare the recently collected soil analytical results to MDEQ risk-based generic cleanup criteria; and make recommendations based on these results.

The focus of the confirmation soil sampling and analysis was on the chemicals of potential concern (COPCs) that were identified during previous investigations (ICF Kaiser, 1998; Parsons ES, 1996) at Sites SS-06 and ST-40. COPCs previously identified for Site SS-06 were benzene, ethylbenzene and total xylenes; COPCs previously identified for Site ST-40 were benzene, total xylenes, acetone, carbon disulfide, and tetrachloroethene (or perchloroethene [PCE] (Appendix A, Table 3.1).

1.2 SITE/PROJECT BACKGROUND

Wurtsmith AFB, located near Oscoda, Michigan, is presently undergoing base closure activities. Site SS-06, a former POL bulk storage facility, is located in the eastern portion of the base as shown on Figure 1.1. A detailed layout of Site SS-06, which is inclusive of Site ST-40, is shown on Figure 1.2. With the exception of three active aboveground storage tanks (ASTs), which are located northwest of the main bermed area, the site is vacant and inactive. The four largest ASTs (Tanks 7000, 7001, 7039, and 7040), which were located within the bermed areas and contained JP-4 jet fuel, were removed between 1992 and 1996. Two USTs, located immediately north of the bermed areas, also have been removed from the site. A waste oil UST, formerly located east of Building 351, was removed in 1990, and a waste JP-4 UST located on the west side of Building 361 was removed in 1996. The three active ASTs (Tanks 7002, 7003, and 7004) that remain on the site provide JP-4 for current airport activities. A groundwater pump-and-treat system (referred to as the Benzene Plant), located approximately 400 feet northeast of the POL Yard, was installed to treat groundwater contaminated with benzene, toluene, ethylbenzene, and xylenes (BTEX), and a free-phase product plume originating at the POL Yard.

A full-scale bioventing system was designed and installed by Parsons ES in July and August 1996 and was operated for over 2 years prior to conducting confirmation soil sampling in October 1998. A detailed description of the bioventing system design and initial site activities are provided in the *Bioventing Pilot Test Results and Full-Scale System Installation Report for POL Yard, Sites SS-06 and ST-40* (Parsons ES, 1996). Performance of the full-scale bioventing system is presented in the *Two-Year Soil Gas Sampling and In Situ Testing Results Report for POL Yard, Sites SS-06 and ST-40* (Parsons ES, 1998). A more complete summary of the site history, geology, hydrology, previous investigations, and other remedial activities is presented in the SAP (Appendix A).

1.3 SUMMARY OF CONFIRMATION SOIL SAMPLING RESULTS

Confirmatory soil sampling was conducted at the sites on 13 through 16 October 1998. Boreholes were advanced at 18 locations, and 28 soil samples (25 primary samples and 3 replicates) were submitted to the laboratory for volatile organic compound (VOC) analysis. Soil sample analyses indicate that residual fuel hydrocarbons are confined mainly to smear-zone soils in the western portion of the POL Yard. Several contaminants (i.e. benzene, ethylbenzene, xylenes, 1,2,4-trimethylbenzene (TMB), 1,3,5-TMB, bromomethane, naphthalene, and n-propylbenzene) were detected in site soils at maximum concentrations exceeding their respective cleanup criteria (i.e. MDEQ generic residential drinking water protection criteria).

1.4 REPORT ORGANIZATION

This site confirmation sampling and analysis report consists of five sections, including this introduction, and three appendices. Section 2 is a description of the

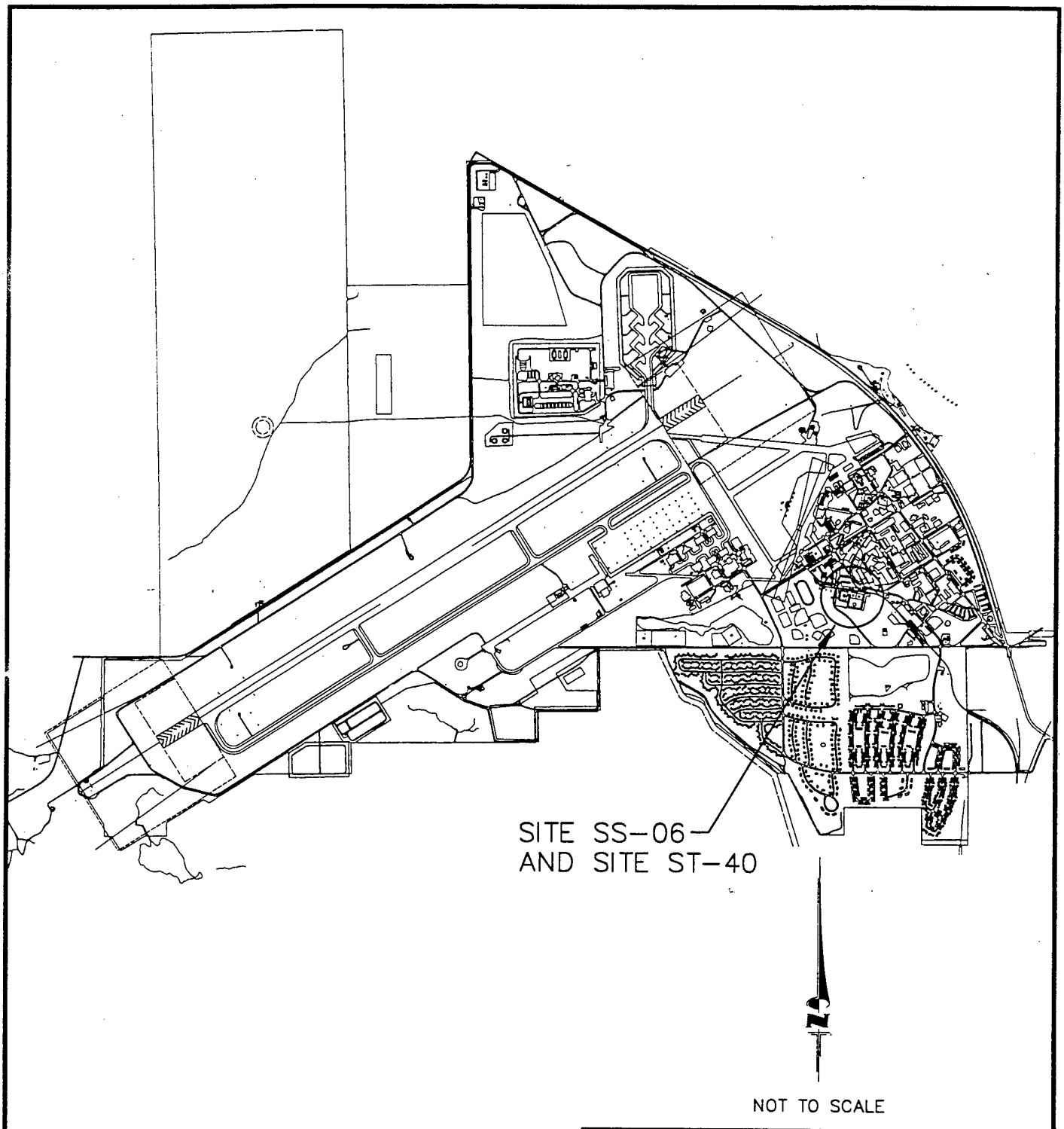

FIGURE 1.1

LOCATION OF SITES WITHIN WURTSMITH AFB

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

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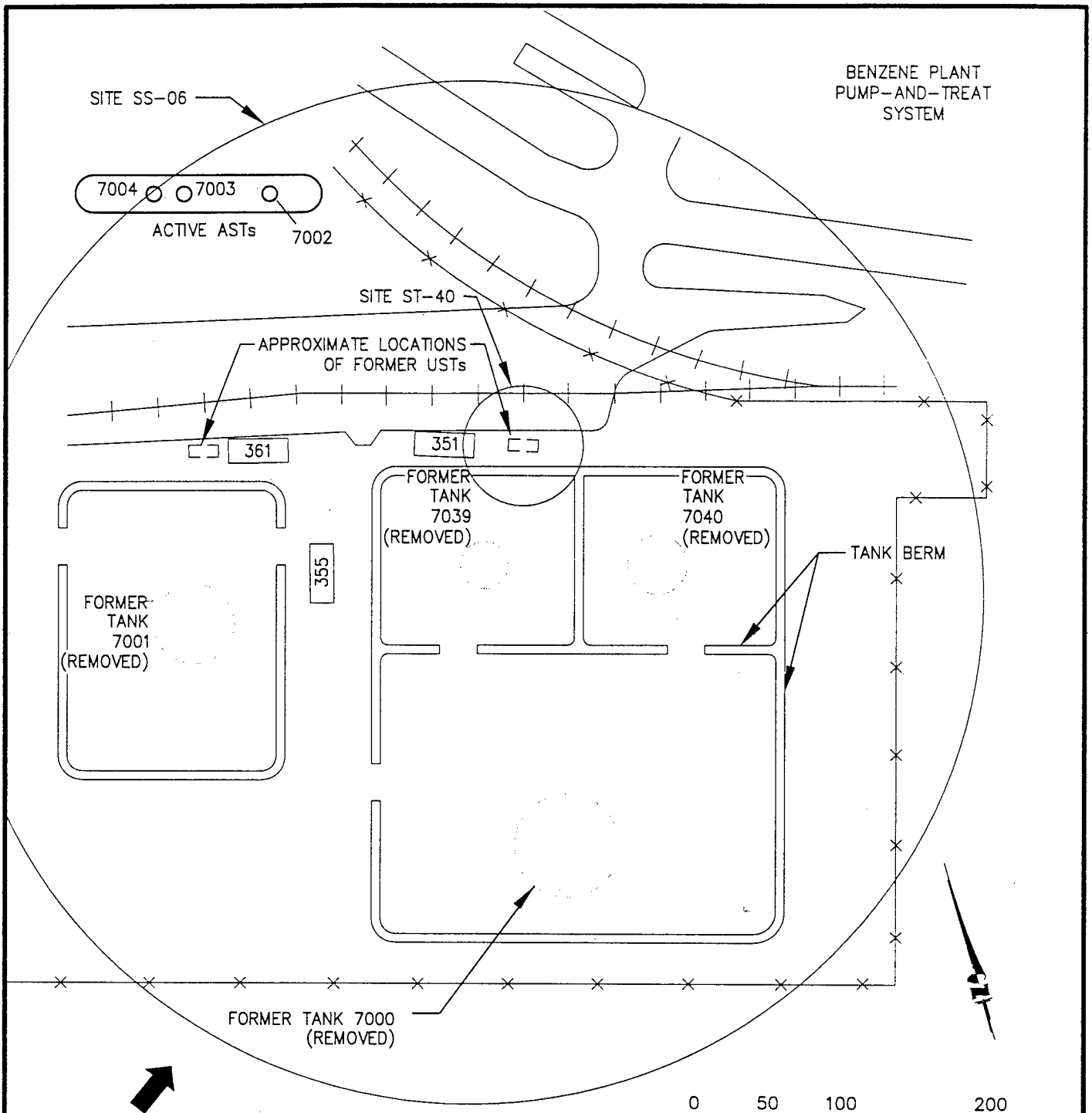

FIGURE 1.2

POL YARD LAYOUT

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

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Denver, Colorado

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confirmation soil sampling activities conducted at the site. Section 3 summarizes confirmation sampling analytical results and compares these results to the MDEQ generic cleanup criteria. Section 4 presents conclusions and recommendations for the site. References used in preparation of this report are provided in Section 5.

Appendix A presents a copy of the final confirmation SAP for Sites SS-06 and ST-40 that includes a detailed summary of previous site investigations. Borehole logs are included in Appendix B, and Appendix C provides the laboratory analytical results and chain-of-custody (COC) forms.

SECTION 2

SITE CONFIRMATION SAMPLING AND ANALYSIS ACTIVITIES

The purpose of this section is to summarize confirmatory soil sampling activities, including sampling locations and sampling depths, sampling procedures, analytical methods used, and field and laboratory quality assurance/quality control (QA/QC) procedures followed. These methods/procedures are described in more detail in the confirmation SAP (see Appendix A). The confirmation SAP was implemented by qualified Parsons ES scientists trained in conducting soil sampling, records documentation, and chain-of-custody procedures. Environmental sample analyses were provided by Specialized Assays, Inc. (SAI), of Nashville, Tennessee.

2.1 SAMPLING STRATEGY

The sampling strategy presented in the confirmation SAP (Appendix A) was designed to provide sufficient soil analytical data to characterize the nature and extent of petroleum hydrocarbons remaining in site soil and, based on a comparison with MDEQ generic cleanup criteria, to determine if a NFRAP decision can be supported. The sampling strategy combined a statistically random strategy with a biased strategy that targeted previously-identified hot spots (zones with high contaminant concentrations). The statistically random strategy implemented at the site followed recommendations described in the Guidance Document (Michigan Department of Natural Resources [MDNR], 1994). This strategy employs the use of gridding to facilitate the unbiased selection of sampling locations, and statistical tools for evaluating the resulting data. Because of the relatively large size of the POL Yard site, the goal of the sampling strategy was to provide a 95-percent confidence level of determining any hot spot concentrations of residual fuel hydrocarbons remaining in site soils after 2 years of bioventing remediation. To meet this goal, soil samples were collected at 18 locations (27 percent of the 66 grid stations) which exceeds the minimum number of samples (25 percent of the grid stations) recommended in the Guidance Manual. Thirteen soil boring locations were selected at random, four soil boring locations (SB1, SB2, SB5, and SB13) were selected in areas with previously identified high concentrations of fuel hydrocarbons, and one soil boring (SB18A) was advanced at the location of a former UST at the request of Ms. Rose Forbes, the AFCEE field engineer. The purpose of boring 18A was to determine if contaminated soil remained in the vicinity of the former UST following tank removal. In addition to this one additional boring, the only other deviation from the SAP was that boring SB4 was moved approximately 25 feet south of the proposed location to avoid an aboveground pipeline and valves.

2.2 SOIL SAMPLING PROCEDURES

2.2.1 Sampling Locations

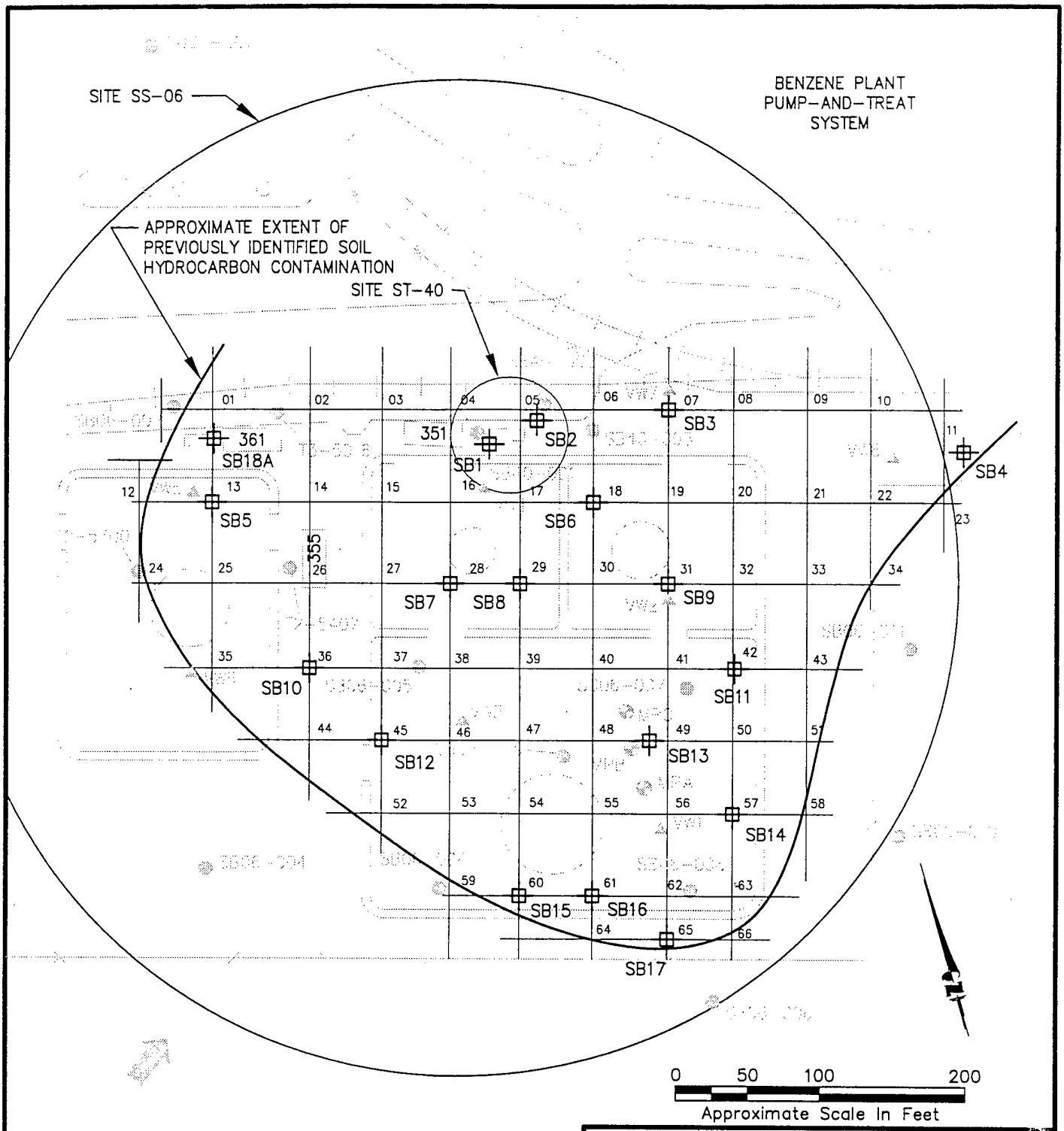
Confirmatory soil sampling was conducted at the sites on 13 through 16 October 1998. Soil samples were collected at 18 locations (SB1 through SB18A) at the sites to determine whether or not residual hydrocarbon compounds in soils have been remediated to concentrations equal to or less than the targeted MDEQ generic cleanup criteria. Soil borings SB1 and SB2 were advanced in the immediate vicinity of the former waste oil UST (Site ST-40). The remaining 16 borings (SB3 through SB18A) were located throughout Site SS-06. Figure 2.1 shows the locations of the 18 confirmatory soil sampling locations in relation to the previously identified estimated area of soil hydrocarbon contamination requiring remediation.

2.2.2 Sample Collection

Soil samples were collected using a Geoprobe® system, a hydraulically powered percussion/probing machine capable of advancing sampling tools through unconsolidated soil. Depending on subsurface conditions encountered during sampling, soil samples were collected using either a Large-Bore® sampler to collect discrete subsurface samples or a Macro-Core® sampler, which collects continuous sample cores. The soil cores were retained within clear acetate liners inside the sampling barrels.

Because the greatest extent and highest concentrations of fuel hydrocarbons were previously detected in the groundwater smear zone, soil sampling focused on this zone. Contamination was previously detected in soils above the smear zone only in a few areas, which are likely the locations of former fuel releases. Outside the suspected fuel release areas, vadose zone soil contamination was restricted to within approximately 5 feet of the groundwater surface.

Each borehole was advanced to no less than 1 foot above the groundwater surface; maximum sampling depths were between 19 and 26 feet below ground surface (bgs). At locations where shallow contamination had previously been identified or was suspected due to the close proximity of former USTs or ASTs (sampling locations SB1, SB2, SB5, SB9, SB13, SB14, SB15 and SB16), soil samples were collected at 5-foot intervals from ground surface to the top of the groundwater surface. With the exception of boring SB13, two soil samples were selected from each of these boreholes for laboratory analysis; one sample was collected from the groundwater smear zone, and one sample collected from shallower soil based on apparent contamination and field headspace screening results. Only the smear-zone sample from boring SB13 was submitted to the laboratory because soil samples from the more shallow sample intervals at this location had low field headspace screening results and no visible evidence of contamination. At sampling locations where contamination was limited to the smear zone only, based on results of previous investigations (SB3, SB4, SB6, SB7, SB8, SB10, SB11, SB12, SB17, and SB18A), the probe was driven directly to the smear zone, and one soil sample was collected.



LEGEND

- PARSONS ES (1996b) SOIL GAS MONITORING POINT
- PARSONS ES (1996b) AIR INJECTION WELL
- SOIL BORING LOCATION (ICF TECHNOLOGY, 1995; AND BROWN & ROOT ENVIRONMENTAL, 1995)
- SB1 OCTOBER 1998 SOIL SAMPLING LOCATION
- CHAIN LINK FENCE
- GROUNDWATER FLOW DIRECTION
- FORMER AS LOCATION

FIGURE 2.1

GRID AND SOIL SAMPLING LOCATIONS OCTOBER 1998

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

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All soil samples were field-screened for total volatile hydrocarbons (TVH) and examined for physical evidence of contamination. A portion of each Geoprobe® core soil sample was used for field screening using a TVH analyzer (TVHA). The soil was placed into a new, self-sealing plastic bag and after approximately 20 minutes, the TVH concentration in the headspace was measured by inserting the TVHA probe through the seal of the plastic bag. Soil headspace TVH screening results were recorded on the field borehole logs (Appendix B).

Samples selected for laboratory analysis were transferred directly from the Geoprobe® core sampler to EnCore™ samplers and sealed according to manufacturer-recommended procedures. Soil samples for laboratory analysis were immediately placed in an insulated cooler containing ice. The soil samples were maintained in a chilled condition until delivered to the analytical laboratory. The remaining soil not included in the laboratory sample was removed from the Geoprobe® sampler for field TVH screening and lithologic logging. In the laboratory, soil samples were transferred from the EnCore™ samplers to soil sample vials and preserved with methanol within 48 hours of sample collection, as described in USEPA Method SW5035. After the samples for laboratory analysis were collected, chain-of-custody procedures were followed to establish a written record of sample handling and movement between the sampling site and the laboratory as described in the SAP (Appendix A). COCs are included in Appendix C.

2.2.3 Soil Sample Analyses

Twenty-eight soil samples, including three field replicates, were submitted to the laboratory and analyzed using USEPA Method SW8260B for VOCs including BTEX, TMBs, butylbenzenes, and isopropylbenzenes. In addition, the four soil samples collected from Site ST-40 (from borings SB1 and SB2) were also analyzed for acetone, carbon disulfide and PCE. All samples were analyzed by SAI, a State of Michigan-certified laboratory.

2.2.4 Field and Laboratory Data Quality Assurance/Quality Control

Samples were collected, preserved, transported, and analyzed in such a manner that sampling results yield information that provides a reliable representation of the soil quality at the site. To meet this requirement, the procedures described in the Quality Assurance Project Plan of the SAP (Appendix A) were followed during sample collection, handling, and analysis. In addition, laboratory and field QC samples were prepared and analyzed. Quality control (QC) samples were analyzed to assess laboratory methods. Laboratory QC samples included matrix spikes (MS), matrix spike/matrix spike duplicate (MS/MSD) pairs, and blanks. Three MS/MSD pairs for soil were prepared and analyzed as part of this project. Field QC samples consisted of two trip blanks and two equipment rinseate blanks.

2.3 EQUIPMENT DECONTAMINATION PROCEDURES

All sampling and downhole equipment were decontaminated before use and between boreholes to prevent cross-contamination, as described in the SAP (Appendix A).

Boreholes were backfilled with granular bentonite and hydrated with potable water following sample collection.

2.4 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

Investigation-derived wastes were handled following the base-wide procedures established by ICF Technology, Inc. (1994) and approved by MDEQ and USEPA. The use of the Geoprobe® for collecting soil samples did not generate soil cuttings. Decontamination water was containerized, transported to Building 5092, and discharged into the oil/water separator.

SECTION 3

CONFIRMATION SAMPLING RESULTS

This section summarizes the analytical results of the October 1998 soil sampling activities. This section also compares these sampling results to the MDEQ generic cleanup criteria for soils.

3.1 LABORATORY RESULTS

Soil sample analyses indicate that residual fuel hydrocarbons are confined mainly to smear-zone soils. Borehole logs from the confirmatory soil sampling activities are included in Appendix B. Table 3.1 presents a summary of compounds detected in site soils during the October 1998 soil sampling event and compares the sample results to the MDEQ (1998) generic residential drinking water protection criteria. The highest concentrations of organic compounds were detected in soil samples collected at depths between 18 and 23 feet bgs from borings SB2, SB4, SB5, SB6, SB7, SB9, SB10, SB13, SB14, SB16, and SB18A. Benzene, toluene, ethylbenzene and total xylenes were measured at maximum concentrations of 5,700 micrograms per kilogram (μg/kg), 222 μg/kg, 140,000 μg/kg, and 575,000 μg/kg, respectively. Maximum concentrations of 1,2,4-TMB, 1,3,5-TMB, n-propylbenzene, and isopropylbenzene were 287,000 μg/kg, 94,300 μg/kg, 46,000 μg/kg, and 25,300 μg/kg, respectively. Naphthalene, which was detected in several samples, was measured at a maximum concentration of 41,400 μg/kg. Bromomethane was detected in one sample at a concentration of 930 μg/kg. Acetone, carbon disulfide, and PCE were not detected in any samples above their respective laboratory reporting limits.

The only significant concentrations of organic compounds detected in shallow soils (above the smear zone) were 1,3,5-TMB at SB14 (from 10 to 12 feet bgs) and SB16 (from 6 to 8 feet bgs), and xylenes at SB14 (from 10 to 12 feet bgs). These results indicate that the long-term potential source for groundwater contamination by partitioning of fuel hydrocarbons from shallow soil to groundwater has been greatly reduced by bioventing treatment of site soils. However, the relatively high concentrations of several fuel hydrocarbon compounds measured in smear-zone soils indicate that this zone continues to be a potential source of groundwater contamination.

Bioventing appears to have been less effective at treating smear zone soils than shallower subsurface soils. Bioventing treatment relies on supplying air (oxygen) to unsaturated soil to enhance biodegradation of fuel hydrocarbons. During much of the 2 years of bioventing treatment, the lower portion of the smear zone (where many of the soil samples listed in Table 3.1 were collected) was saturated and largely isolated from treatment. Therefore, smear zone soils are being remediated at a slower rate than the

TABLE 3.1
SUMMARY OF SOIL SAMPLING ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Sample Location	Sample Depth (feet bgs)[a]	Benzene (µg/kg)[b]	Toluene (µg/kg)	Ethylbenzene (µg/kg)	m,p-Xylene (µg/kg)	o-Xylene (µg/kg)	Total Xylenes (µg/kg)	1,2,4-Trimethyl-benzene (µg/kg)	1,3,5-Trimethyl-benzene (µg/kg)	n-Butyl-benzene (µg/kg)	sec-Butyl-benzene (µg/kg)	tert-Butyl-benzene (µg/kg)	Isopropyl-benzene (µg/kg)	n-Propyl-benzene (µg/kg)	Carbon disulfide (µg/kg)	Acetone (µg/kg)	Tetrachloro-ethene (µg/kg)	Bromo-methane (µg/kg)	4-Isopropyl-toluene (µg/kg)	Naphthalene (µg/kg)
Cleanup Criteria[c]		100	16,000	1,500	NA[d]	NA	5,600	5,100	460	1,600	1,600	1,600	90,000	1,600	16,000	15000	100	200	NA	17,000
SITE ST- 40																				
SB1	14-16	2.1 U[e]	5.2 U	3.1 U	3.1 U	5.2 U	5.2 U	7.3 U	3.1 U	5.2 U	7.3 U	7.3 U	8.3 U	2.1 U	1.5 U	9.2 U	7.3 U	5.2 U	6.2 U	2.1 U
SB1	18-19	2.1 U	5.2 U	3.1 U	3.1 U	5.2 U	5.2 U	7.3 U	2,450	5.2 U	7.3 U	7.3 U	8.3 U	2.1 U	1.5 U	9.2 U	7.3 U	5.2 U	26	2.1 U
SB2	14-16	2.1 U	5.2 U	3.1 U	3.1 U	5.2 U	5.2 U	7.3 U	3.1 U	5.2 U	7.3 U	7.2 U	8.3 U	2.1 U	1.5 U	9.2 U	7.3 U	5.2 U	6.2 U	2.1 U
SB2	18-20	1,090 U	2,720 U	12,000	175,000	62,000	237,000	117,000	43,500	2,720 U	3,800 U	3,800 U	4,350	4,890	761 U	4780 U	3,800 U	2,720 U	7,610	7,070
SITE SS- 06																				
SB3-22	20-22	2.1 U	5.2 U	3.1 U	3.1 U	5.2 U	5.2 U	7.2 U	3.1 U	5.2 U	7.2 U	7.2 U	8.2 U	2.1 U	----[f]	----	7.2 U	5.2 U	6.2 U	2.1 U
SB4-22	20-22	222 U	222 J[g]	21,000	109,000	10,400	119,400	82,200	34,400	556 U	778 U	778 U	6110	6,100	----	----	778 U	556 U	8,780	5,560
SB5	10-12	10.5 U	26.3 U	15.8 U	15.8 U	26.3 U	26.3 U	36.8 U	15.8 U	26.3 U	36.8 U	36.8 U	42.1 U	10.5 U	----	----	36.8 U	26.3 U	31.6 U	10.5 U
SB5	21-23	278 U	694 U	2,360	10,800	694 U	10,800	972 U	2,220	694 U	556 J1	972 U	1,110 U	278 U	----	----	972 U	694 U	833 U	972
SB25 (Rep)[h]	21-23	278 U	694 U	3,470	14,000	694 U	14,000	7,220	2,500	694 U	972 U	972 U	1,110 U	278 U	----	----	972 U	694 U	833 U	1,250
SB6	21-23	281 U	702 U	16,300	51,100	702 U	51,100	26,800	9,410	702 U	983 U	983 U	1,120 U	281 U	----	----	983 U	702 U	1,830	3,370
SB7	18-20	263 U	658 U	395 U	26,200	8,950	35,150	27,100	10,900	658 U	921 U	921 U	1,050 U	263 U	----	----	921 U	658 U	1,970	3,030
SB8	19-21	294 U	735 U	588	1,760	735 U	1,760	1,030	441	735 U	1,030 U	1,030 U	1,180 U	294 U	----	----	1,030 U	735 U	882 U	294
SB28 (Rep)	19-21	11.4 U	28.4 U	17 U	17 U	28.4 U	28.4 U	39.8 U	17 U	28.4 U	39.8 U	39.8 U	45.5 U	11.4 U	----	----	39.8 U	28.4 U	34.1 U	11.4 U
SB9	12-14	10.3 U	25.8 U	15.5 U	15.5 U	25.8 U	25.8 U	36.1 U	15.5 U	25.8 U	36.1 U	36.1 U	41.2 U	10.3 U	----	----	36.1 U	25.8 U	30.9 U	10.3 U
SB9	20-22	5,700	581 U	68,000	306,000	1,050	307,050	193,000	61,600	581 U	814 U	814 U	930 U	233 U	----	----	814 U	581 U	11,500	23,300
SB10	21-23	225 U	562 U	12,900	42,600	562 U	42,600	18,000	12,200	562 U	787 U	787 U	3,930	7,080	----	----	787 U	562 U	2,130	5,390
SB11	19-21	2.1 U	5.2 U	3.1 U	417	6.2	423	521 J	208 J	5.2 U	7.3 U	7.3 U	8.3 U	2.1 U	----	----	7.3 U	5.2 U	47.9	45.8
SB12	20-22	2.3 U	5.8 U	105	414	3.5 J1	418	123	23.3	5.8 U	8.1 U	8.1 U	15.1	24.4	----	----	8.1 U	5.8 U	7.0	30.2
SB13	19-21	465	581 U	5,810	22,800	581 U	22,800	21,900	7,790	581 U	814 U	814 U	1,860	3,600	----	----	814 U	930	1,740	3,370
SB14	10-12	233 U	581 U	1,400	7,670	581 U	7,670	4,650	1,980	581 U	814 U	814 U	349 J1	698	----	----	814 U	581 U	465 J1	581
SB14	19-21	4,600	5,750 U	67,800	282,000	5,750 U	282,000	198,000	69,000	5,750 U	8,050 U	8,050 U	17,200	28,700	----	----	8,050 U	5,750 U	13,800	27,600
SB15	10-12	10.3 U	25.8 U	15.5 U	15.5	25.8 U	15.5	36.1	10.3 J	25.8 U	36.1 U	36.1 U	41.2 U	10.3 U	----	----	36.1 U	25.8 U	30.9 U	10.3 U
SB15	20-22	11.1 U	27.8 U	33.3	133	27.8 U	133	1,060	422	27.8 U	38.9 U	38.9 U	94.4	172	----	----	38.9 U	27.8 U	156	55.6
SB16	6-8	106 U	266 U	160 U	904	585	1,489	2,230	2,020	266 U	372 U	372 U	426 U	106 U	----	----	372 U	266 U	851	106
SB16	19-21	2,300 U	5,750 U	116,000	444,000	131,000	575,000	287,000	94,300	5,750 U	8,050 U	8,050 U	25,300	46,000	----	----	8,050 U	5,750 U	18,400	41,400
SB26 (Rep)	19-21	2,300 U	5,750 U	140,000	279,000	159,000	438,000	218,000	77,000	5,750 U	8,050 U	8,050 U	9,200 U	37,900	----	----	8,050 U	5,750 U	14,900	34,500
SB17	24-26	2.1 U	5.2 U	3.1 U	3.1 U	5.2 U	5.2 U	7.3 U	3.1 U	5.2 U	7.3 U	7.3 U	8.3 U	2.1 U	----	----	7.3 U	5.2 U	6.2 U	2.1 U
SB18A	20-22	272 U	679 U	815	6,520	679 U	6,520	9,380	5,840	679 U	951 U	951 U	1,090 U	272 U	----	----	951 U	679 U	815 U	543

NOTE: Analytes detected at concentrations that exceed a MDEQ-defined soil cleanup criterion have been shaded for easy reference.
Outlined results indicate that the laboratory practical quantitation limit (PQL) exceeded the MDEQ-defined soil clean up criteria.

[a] feet bgs = feet below ground surface.

[b] µg/kg = micrograms per kilogram.

[c] MDEQ generic residential drinking water protection criteria (MDEQ, 1998).

[d] NA= Not applicable. An MDEQ-defined soil cleanup criterion has not been established for this analyte.

[e] U = compound analyzed for but not detected above the practical quantitation limit (PQL). Number shown represents the laboratory reporting limit (RL).

[f] ---- = Not analyzed.

[g] J = Estimated value. The analyte was positively identified at a concentration between the PQL and the RL.

[h] (Rep) = Field replicate of preceeding sample.

shallower soils. During the October 1998 sampling event, water levels during the soil sampling event were approximately 2 to 3 feet lower than during installation of the full-scale bioventing system in August 1996.

A comparison of analytical results for soil samples collected prior to and following approximately 2 years of bioventing system operation indicates an overall reduction in BTEX concentrations. Table 3.2 presents the BTEX results for several pairs of soil samples collected before and after bioventing treatment. Samples from each pair were collected in close proximity to each other and were collected from the same or similar depth intervals. With the exception of sample pair SB40-002/SB2 (collected at depths between 19 and 21 feet bgs and 18 and 20 feet bgs, respectively) and sample pair VW5/SB5 in which ethylbenzene and total xylene concentrations were higher after 2 years of bioventing, concentrations of toluene, ethylbenzene, and xylenes were significantly lower following bioventing treatment. The increased concentrations noted for sample pair SB40-002/SB2 (collected at approximately 20 feet bgs) is likely the result of changing groundwater levels smearing free-phase petroleum hydrocarbons onto the soil. The increased concentrations for sample pair VW5/SB5 may be the result of the October 1998 sample being collected from a deeper portion of the smear zone, and does not accurately represent changes in BTEX concentrations for this location. Also, it must be noted that conventional soil sampling techniques were used during the 1995 and 1996 sampling events, while USEPA Method SW5035 was used during the October 1998 sampling event. USEPA Method SW5035 involves sample collection using EnCore™ samplers, and extraction and preservation with methanol within 48 hours of sample collection. The improvement in sample collection techniques could partially account for apparent contaminant increases in smear zone soils. The overall reduction in soil fuel hydrocarbon concentrations presented in Table 3.2 indicates that operation of the bioventing system is effectively reducing residual fuel hydrocarbon concentrations in site soils.

3.2 COMPARISON OF SOIL SAMPLING RESULTS TO CLEANUP CRITERIA

Land use assumptions and potential exposure pathways for site contaminants used to determine appropriate MDEQ cleanup criteria are described in the SAP (see Appendix A) and in the Final Feasibility Report for Sites SS-06, ST-40, SS-13, and OT-46 (ICF Kaiser, 1998). Although the current and projected future land use of Sites SS-06 and ST-40 is industrial, groundwater contamination resulting from fuel hydrocarbon releases at the site have migrated beyond the POL Yard. Because generic residential drinking water criteria must be met at the Base boundary, generic soil cleanup criteria which are designed to ensure contaminants do not leach from site soils and cause groundwater to exceed residential drinking water protection criteria have been identified as the targeted cleanup criteria for Sites SS-06 and ST-40.

Soil sampling results were compared to the MDEQ (1998) residential drinking water protection criteria to determine whether the sites meet closure requirements or if further remediation is required. As shown in Tables 3.1 and 3.3, several contaminants (i.e. benzene, ethylbenzene, xylenes, 1,2,4-TMB, 1,3,5-TMB, bromomethane, naphthalene, and n-propylbenzene) were detected in site soils at maximum concentrations exceeding their respective MDEQ residential drinking water protection criteria. Table 3.3 also

TABLE 3.2
COMPARISON OF PRE- AND POST-BIOVENTING SOIL ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Sample number	Sample Depth (feet bgs)[a/]	Date Sampled[b/]	Analytical Results: Benzene (µg/kg)[c/]	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Total Xylenes (µg/kg)
SB40-001	19-21	1995	ND[d/]	ND	ND	6,900
SB1	18-19	Oct. 1998	< 2.1[e/]	< 5.2	< 3.1	< 5.2
SB40-002	14-16	1995	ND	ND	ND	35,000
SB2	14-16	Oct. 1998	< 2.1	< 5.2	< 3.1	< 5.2
SB40-002	19-21	1995	ND	ND	ND	6,200
SB2	18-20	Oct. 1998	< 1090	< 2720	12,000	23,700
VW7	20-22	Aug. 1996	< 110	250	3,710	15,600
SB3	20-22	Oct. 1998	< 2.1	< 5.2	< 3.1	< 5.2
VW5	17-19	Aug. 1996	< 51	85 J	2,300	9,820
SB5	21-23	Oct. 1998	< 278	< 694	2,360	10,800
VW2	15-17	Aug. 1996	60 J	160 J	2,680	12,900
SB9	12-14	Oct. 1998	< 10.3	< 25.8	< 15.5	< 25.8
MPB	17-19	Aug. 1996	< 100	< 210	7,080	34,500
SB13	19-21	Oct. 1998	465	< 581	5,810	22,800

[a/] feet bgs = feet below ground surface.

[b/] 1995 - pre-bioventing soil sampling by ICF Kaiser (1995). Aug. 1996 - soil samples collected during installation of bioventing system (Parsons ES, 1996).
Oct. 1998 - confirmation soil sampling.

[c/] µg/kg = micrograms per kilogram.

[d/] ND = Not detected.

[e/] < = compound analyzed for but not detected above the practical quantitation limit (PQL). Number shown represents the laboratory reporting limit (RL).

TABLE 3.3
IDENTIFICATION OF CRITERIA EXCEEDANCES FOR UNSATURATED SOILS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Compound	Units	Maximum Site Concentration[a/]	MDEQ Generic Residential Drinking Water Protection Criteria[b/]	Number of Detections Exceeding Criteria[c/]	Number of Times Reporting Limits Exceeded Criteria Compound Not Detected[c/]
SITE SS-06					
Volatile Organic Compounds					
Benzene	µg/kg[d/]	5,700	100	3	10
Toluene	µg/kg	5,750 U	16,000		
Ethylbenzene	µg/kg	140,000	1,500	8	
Total Xylenes	µg/kg	575,000	5,600	11	
1,2,4-Trimethylbenzene	µg/kg	287,000	5,100	10	
1,3,5-Trimethylbenzene	µg/kg	94,300	460	12	
n-Butylbenzene	µg/kg	5,750 U	1,600		2
sec-Butylbenzene	µg/kg	5,750 U	1,600		2
tert-Butylbenzene	µg/kg	8,050 U	1,600		2
Isopropylbenzene	µg/kg	25,300	90,000		
n-Propylbenzene	µg/kg	46,000	1,600	5	
Tetrachloroethene	µg/kg	8,050 U	100		13
Bromomethane	µg/kg	930	200	1	12
4-Isopropyltoluene	µg/kg	18,400	NA[f/]		
PAHs					
Naphthalene	µg/kg	41,400	17,000	3	
SITE ST-40					
Volatile Organic Compounds					
Benzene	µg/kg	1,090 U	100		1
Toluene	µg/kg	2,720 U	16,000		
Ethylbenzene	µg/kg	12,000	1,500	1	
Total Xylenes	µg/kg	237,000	5,600	1	
1,2,4-Trimethylbenzene	µg/kg	117,000	5,100	1	
1,3,5-Trimethylbenzene	µg/kg	43,500	460	2	
n-Butylbenzene	µg/kg	2,720 U	1,600		1
sec-Butylbenzene	µg/kg	3,800 U	1,600		1
tert-Butylbenzene	µg/kg	3,800 U	1,600		1
Isopropylbenzene	µg/kg	4,350	90,000		
n-Propylbenzene	µg/kg	4,890	1,600	1	
Carbon Disulfide	µg/kg	761 U	16,000		
Acetone	µg/kg	4,780 U	15,000		
Tetrachloroethene	µg/kg	3,800 U	100		1
Bromomethane	µg/kg	2,720 U	200		1
4-Isopropyltoluene	µg/kg	7,610	NA		
PAHs					
Naphthalene	µg/kg	7,070	17,000		

NOTES. Site maximum concentrations that exceed a MDEQ-defined soil cleanup criterion have been shaded for easy reference.

Outline indicates that the maximum PQL exceeded a MDEQ-defined soil cleanup criterion.

[a/] Maximum concentration detected during the October 1998 soil sampling event.

[b/] Soil leaching criterion that is protective of underlying groundwater for residential potable use (MDEQ, 1998).

[c/] Criteria does not include field replicate samples.

[d/] µg/kg = micrograms per kilogram

[e/] J = Estimated value. The analyte was positively identified at a concentration between the PQL and the RL.

[f/] NA = Not applicable. An MDEQ-defined soil cleanup criterion has not been established for this analyte.

[g/] U = compound analyzed for but not detected. Number shown represents the RL.

lists the number of samples in which detected concentrations of specific analytes exceeded their respective criterion. Typically, a statistical analysis would be performed to determine whether the 95-percent upper confidence limit (UCL) on the arithmetic mean of the concentrations of each analyte was above or below the respective cleanup criterion. However, these statistical analyses were not performed for this data set because the relatively large number of exceedances compared with the total number of samples, indicated that the 95-percent UCL would likely be exceeded for several analytes (i.e. benzene, toluene, ethylbenzene, total xylenes, 1,2,4-TMB, 1,3,5-TMB, and n-propylbenzene).

3.3 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES AND RESULTS

Laboratory and field QA/QC procedures established for the site were followed to ensure that the analytical data were accurate and reproducible.

3.3.1 Laboratory QA/QC Procedures and Results

Data were evaluated for QC criteria in accordance with the USEPA (1994) *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, and the USEPA (1983) *Methods for Chemical Analysis of Water and Wastes*. The QC criteria results were in accordance with method protocol, laboratory control samples and duplicates (LCS/LCSD), MS/MSD, surrogates, method blanks, and holding times. All additional method QC criteria (i.e., calibrations) were in control. No additional QC criteria are discussed as "out of control conditions" in the narrative review provided by SAI.

An overall assessment of the QA criteria indicated that the data are of valid quality, accurate, and precise. All reviewed method QC criteria were met. Analytical results for the QC samples are included in Appendix C.

3.3.2 Field QA/QC Procedures and Results

To assess sample variability, three replicate soil sample pairs (sample pairs SB5/SB25, SB8/SB28, and SB16/SB26) were collected and analyzed by Methods 8260B. To determine the representativeness and precision of the sample analysis, either the relative percent difference (RPD) or the difference between analyte concentrations in the sample and its duplicate can be determined. USEPA procedures recommend that the RPD of duplicate analyses be determined for analyte concentrations greater than five times the reporting limit. RPD was calculated for ethylbenzene, n-propylbenzene, 4-isopropyltoluene, naphthalene, 1,2,4-TMB, 1,3,5-TMB, m,p-xylenes, and o-xylene. The RPD for m,p-xylene (46 percent) in the replicate pair SB16/SB26 was the only value exceeding the acceptable QC limit. Out-of-control analytes are believed to be related to matrix interference. Overall, precision of the field replicate results was in control.

Two trip blanks and two equipment rinseate blanks were collected and analyzed during the field investigation. The trip blanks, prepared and supplied by the

laboratory, consisted of pure distilled water. The trip blanks accompanied the sample containers to the site and was returned to laboratory with the samples. The trip blanks were analyzed for VOCs by USEPA Method 8260B. No target analytes were detected in the trip blanks. The equipment rinseate blanks were collected at the site from the distilled water used to rinse soil sample core barrels. The equipment rinseate blanks were analyzed for VOCs by USEPA Method 8260B. No target analytes were detected in the equipment blanks.

SECTION 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Results from the October 1998 soil sampling event indicate that, although contaminant reduction has occurred in site soils as the result of 2 years of bioventing treatment, significant fuel hydrocarbons remain in smear-zone soils. The potential source for groundwater contamination as a result of fuel hydrocarbons partitioning from shallow soil to groundwater has been greatly reduced by bioventing treatment of site soils. Results of soil gas sampling performed at the site following 2 years of bioventing system operation (Parsons ES, 1998) are additional evidence of contaminant reduction. Relatively high concentrations of several fuel hydrocarbons in smear-zone soils indicate that this zone continues to be a potential source for groundwater contamination. Benzene, ethylbenzene, total xylenes, 1,2,4-TMB, 1,3,5-TMB, n-propylbenzene, and naphthalene were measured at concentrations exceeding the most stringent MDEQ generic soil cleanup criteria (residential drinking water protection criteria) in multiple soil samples. Bromomethane exceeded cleanup criteria in one soil sample.

Bioventing appears to have been less effective at reducing fuel hydrocarbon concentrations in smear-zone soils than in shallower subsurface soils. Because bioventing treatment relies on supplying air (oxygen) to unsaturated soil to enhance biodegradation of fuel hydrocarbons, the deeper smear zone soils are being effectively remediated by bioventing only during times of relatively low groundwater levels when the smear zone is unsaturated. Therefore, smear-zone soils are being remediated at a slower rate than the more shallow petroleum-hydrocarbon contaminated soils.

4.2 RECOMMENDATIONS

Continued operation and monitoring of the bioventing system at the POL Yard, followed by additional soil sampling, is recommended to further reduce fuel hydrocarbon concentrations in site soils. Because the deeper smear zone soils will continue to be effectively treated by the bioventing system only during times of relatively low groundwater levels, several additional years of bioventing system operation may be required to reduce concentrations of fuel hydrocarbons in these soils to below MDEQ generic residential drinking water protection criteria. The following specific actions are recommended for Sites SS-06 and ST-40:

- Continue operation and monitoring of the bioventing system;

- Conduct annual soil gas sampling and respiration testing during low water table conditions to monitor remediation progress; and

- Collect and analyze additional soil samples after soil gas TVH concentrations and respiration rates asymptotically reach low levels.

SECTION 5

REFERENCES

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APPENDIX A

FINAL CONFIRMATION SAMPLING AND ANALYSIS PLAN

FINAL

Confirmation Sampling and Analysis Plan
POL Yard, Sites SS-06 and ST-40

Wurtsmith Air Force Base
Michigan

Prepared For

Air Force Center for Environmental Excellence
Brooks Air Force Base
San Antonio, Texas

and

Air Force Base Conversion Agency/OL-T
Oscoda, Michigan

September 1998

PARSONS
PARSONS ENGINEERING SCIENCE, INC.
1700 Broadway, Suite 900 • Denver, Colorado 80290

FINAL

CONFIRMATION SAMPLING AND ANALYSIS PLAN FOR POL YARD, SITES SS-06 AND ST-40 WURTSMITH AIR FORCE BASE MICHIGAN

Prepared for:
Air Force Center for Environmental Excellence
Brooks Air Force Base, San Antonio, Texas

and

Air Force Base Conversion Agency/OL-T
Oscoda, Michigan

September 1998

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Denver, Colorado 80290

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
AS	Air Station
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees centigrade
cfm	cubic feet per minute
COPC	chemical of potential concern
DOT	US Department of Transportation
DQO	data quality objective
DRO	diesel-range organics
ES	Engineering-Science, Inc.
FSP	Field Sampling Plan
GC	gas chromatography
GRO	gasoline-range organics
HPLC	high-performance liquid chromatography
IDW	investigation-derived waste
IRP	Installation Restoration Program
IS	internal standard
JP	jet propulsion
LCS	laboratory control sample
LNAPL	light nonaqueous-phase liquid
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MDEQ	Michigan Department of Environmental Quality
MDL	method detection limit
MDNR	Michigan Department of Natural Resources
MP	monitoring point
msl	mean sea level
MS/MSD	matrix spike/matrix spike duplicate
NBS	National Bureau of Standards
NFRAP	no further response action planned
PAH	polynuclear aromatic hydrocarbon
Parsons ES	Parsons Engineering Science, Inc.
PCE	tetrachloroethene
PID	photoionization detector
POL	petroleum, oils, and lubricants
ppmv	parts per million, volume per volume

PQL	practical quantiation limit
PR	percent recovery
PRL	project reporting limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RBCA	risk-based corrective action
RF	response factor
RPD	relative percent difference
RT	retention time
SAP	sampling and analysis plan
SDG	sample delivery group
SQL	sample quantition limit
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TCE	trichloroethene
TEH	total extractable hydrocarbons
TMB	trimethylbenzene
TRPH	total recoverable petroleum hydrocarbons
TVH	total volatile hydrocarbons
TVHA	total volatile hydrocarbon analyzer
UCL	upper confidence limit
US	United States
USCS	Unified Soil Classification System
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
UST	underground storage tank
VOC	volatile organic compound
VW	vent well

SECTION 1

INTRODUCTION

This confirmation sampling and analysis plan (SAP) for the Petroleum, Oils, and Lubricants (POL) Yard, Sites SS-06 and ST-40, at Wurtsmith Air Force Base (AFB), Michigan, has been prepared by Parsons Engineering Science, Inc. (Parsons ES) for submittal to the Michigan Department of Environmental Quality (MDEQ); the United States (US) Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, Texas; and the Air Force Base Conversion Agency/OL-T (AFBCA), Oscoda, Michigan. MDEQ provides oversight of underground storage tank (UST) work at Wurtsmith AFB. This SAP is intended to guide soil sampling at Sites SS-06 and ST-40 to document the effectiveness of remediation of petroleum-hydrocarbon-contaminated soils. Site SS-06, which encompasses the POL Yard, is the location of several former aboveground storage tanks (ASTs) and USTs which contained JP-4 (jet propulsion) fuel. Site ST-40, situated in the north-central portion of Site SS-06, is the location of a former UST that contained waste oil. At each site, petroleum products have been released to the subsurface environment and have contaminated site soils and groundwater.

In 1995, Site SS-06 was selected as a pilot test and full-scale remediation site for the AFCEE Extended Bioventing Program. This ongoing program involves 52 *in situ* bioventing sites at 32 military installations nationwide and provides funding for pilot- and full-scale bioventing system installation, extended operation of installed bioventing systems, and completion of confirmatory soil sampling and site closure documents, if extended bioventing testing results indicate adequate site remediation has been achieved.

The pilot-scale bioventing system was installed and initial pilot testing was performed at Site SS-06 in July 1996 (Parsons ES, 1996a and 1996b). The purpose of the pilot test was to evaluate the effectiveness of bioventing in remediating unsaturated soils contaminated with petroleum hydrocarbons (JP-4) released from the former ASTs and USTs. Following initial testing, a full-scale bioventing system was designed and installed at the site in July and August 1996. The full-scale bioventing system was optimized, and system operation continued for 1 year. One-year testing was performed in September 1997 to assess system performance and remediation progress. Based on the results of the 1-year test, *in situ* bioventing appeared to have reduced petroleum-hydrocarbon contamination in site soils, but additional bioventing treatment was required to further reduce contaminant concentrations to meet MDEQ (1998c) generic residential drinking water protection criteria for several compounds. Following 1-year testing, the bioventing system was restarted to continue soil remediation for an additional year (September 1997 to September 1998). Based on the results of 1-year

testing and the estimated additional remediation to be achieved during the second year of system operation, it is anticipated that the concentration of all petroleum hydrocarbons in site soils will be reduced to levels below MDEQ (1998c) generic cleanup criteria.

The soil sampling effort is being performed as part of the AFCEE Extended Bioventing project. The objective of the confirmation soil sampling is to document the effectiveness of soil remediation at Sites SS-06 and ST-40, and to demonstrate compliance with MDEQ requirements for closure. The proposed confirmation sampling described in Section 5 targets vadose zone (unsaturated) soils beneath and adjacent to the bermed areas of the POL Yard. If soil confirmation sampling results demonstrate that MDEQ (1998c) generic residential drinking water protection criteria (see Section 3 of this SAP) have been met for all analytes of concern, then the data will be used to support a no-further-response-action-planned (NFRAP) decision. In this event, Parsons ES will prepare an NFRAP decision document for vadose zone soils at the POL Yard, and will recommend that the bioventing system be shut down and decommissioned. However, if soil confirmation sampling results demonstrate that any analyte exceeds the MDEQ generic residential drinking water protection criteria, then Parsons ES will prepare a results report in which the recommendation will be made to continue operating the bioventing system until generic residential cleanup criteria are met for all analytes.

This SAP consists of 10 sections, including this introduction, and four appendices. Section 2 includes a site description, site history, and summaries of previous investigations and remediation activities. Section 3 summarizes MDEQ cleanup criteria and requirements. Section 4 describes the soil gas sampling and *in situ* respiration testing to be performed following the second full year of bioventing treatment. Detailed sampling and analysis procedures for confirmation soil sampling are presented in Section 5. Analytical results from the soil sampling effort will be presented in a confirmation sampling report as described in Section 6. Section 7 lists Wurtsmith AFB support requirements, and Section 8 presents the proposed project schedule. Air Force, regulatory, and contractor points of contact are provided in Section 9, and the cited references are provided in Section 10. Appendix A contains the Soil Sampling Grid Determination, the Field Sampling Plan (FSP) is included as Appendix B, Appendix C contains the Standard Operating Procedures for USEPA Method SW8260B, and the Quality Assurance Project Plan (QAPP) is included as Appendix D.

SECTION 2

SITE DESCRIPTION

2.1 SITE LOCATION AND HISTORY

Wurtsmith AFB, located near Oscoda, Michigan, is presently undergoing base closure activities. Site SS-06, a former POL bulk storage facility, is located in the eastern portion of the base as shown on Figure 2.1. A detailed layout of Site SS-06, which is inclusive of Site ST-40, is shown on Figure 2.2. With the exception of three active ASTs, which are located northwest of the main bermed area, the site is vacant and inactive. The four largest ASTs (Tanks 7000, 7001, 7039, and 7040), which were located within bermed areas and contained JP-4 jet fuel, were removed between 1992 and 1996. Two USTs, located immediately north of the bermed areas, also have been removed from the site. A waste oil UST, formerly located east of Building 351, was removed in 1990, and a waste JP-4 UST located on the west side of Building 361 was removed in 1996. The three active ASTs (Tanks 7002, 7003, and 7004) that remain on the site provide JP-4 for current airport activities. A groundwater pump-and-treat system (referred to as the Benzene Plant), located approximately 400 feet northeast of the POL Yard, was installed to treat groundwater contaminated with benzene, toluene, ethylbenzene, and xylenes (BTEX), and a free-phase product plume originating at the POL Yard.

Several investigations were conducted at and downgradient from Sites SS-06 and ST-40 between 1979 and 1997 to characterize the nature and extent of fuel hydrocarbons in subsurface media. The primary contaminants at this site are fuel-related petroleum hydrocarbons, which have been detected in the soil gas, soils, and groundwater. The source of the hydrocarbon contamination is thought to be leaks from the former JP-4 tanks and underground JP-4 pipelines. In 1996, bioventing pilot testing was performed, and a full-scale bioventing system was installed by Parsons ES to remediate site soils. In September 1997, Parsons ES collected additional soil gas samples and performed *in situ* respiration testing to evaluate soil remediation progress. These investigations and remedial actions are described in Section 2.3.

In the fall of 1997, Amtech performed a soil vapor extraction (SVE) and air sparging pilot test between Site SS-06 and the Benzene Plant to determine the effectiveness of these technologies at remediating petroleum-contaminated unsaturated soils and groundwater, respectively (Paul Rekowski, 1998). Additional sampling to further delineate the area to be remediated and full-scale SVE/air sparging system installation was performed in the summer of 1998. The system was installed approximately 100 to 300 feet northeast of Site SS-06, and is scheduled for startup in December 1998 (John Ratz, 1998).

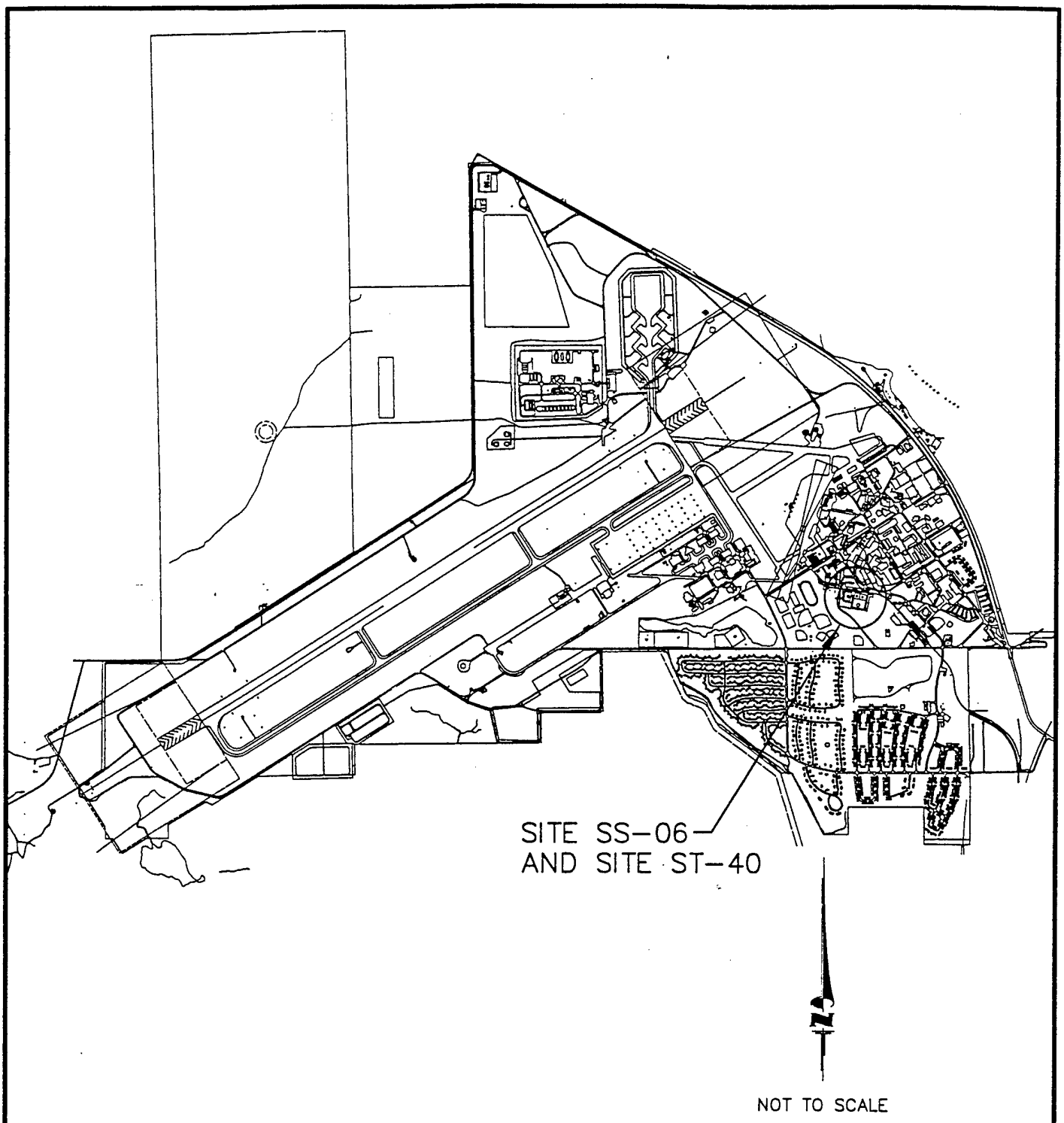

FIGURE 2.1

LOCATION OF SITES WITHIN WURTSMITH AFB

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

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Denver, Colorado

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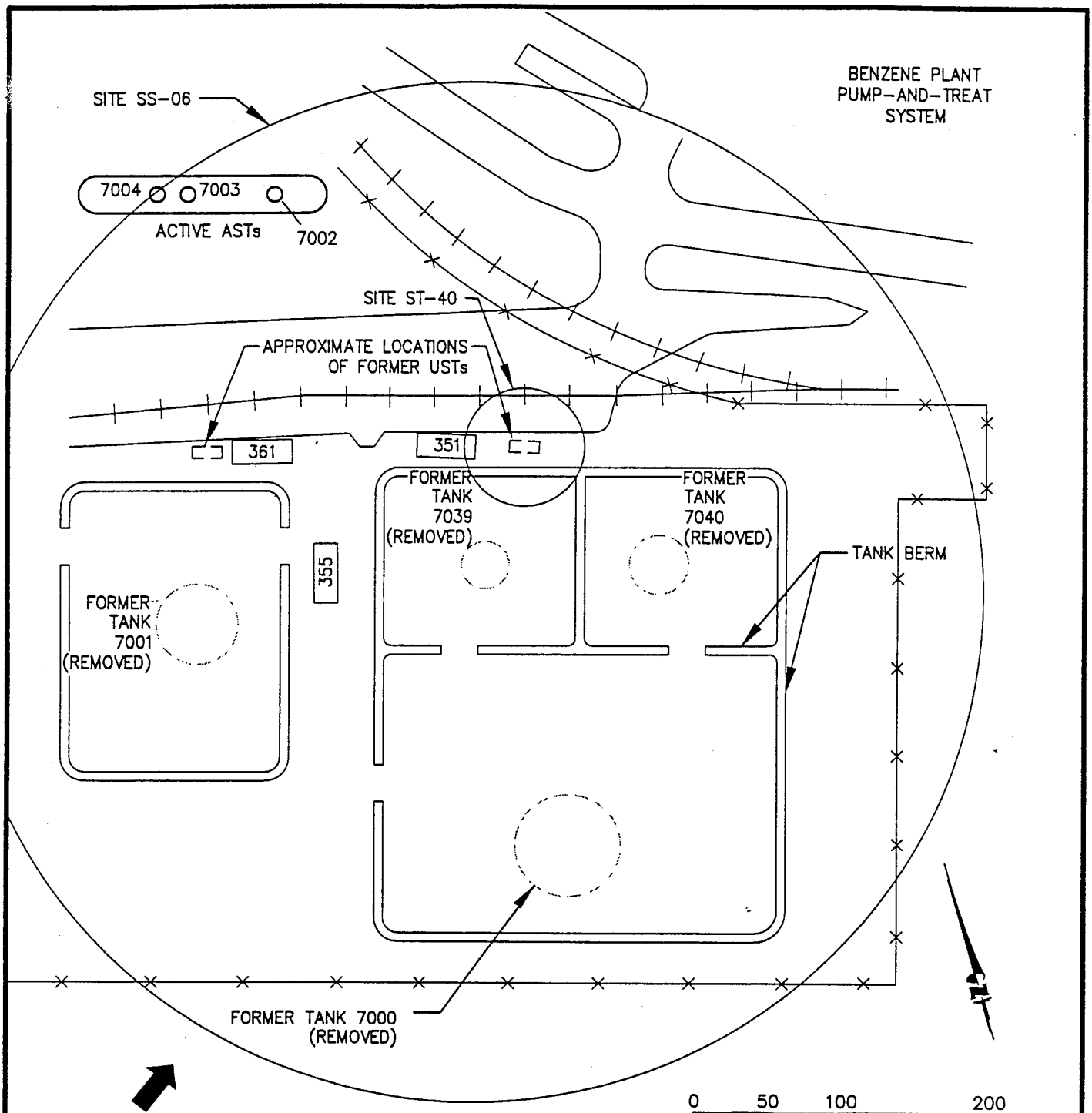

FIGURE 2.2

POL YARD LAYOUT

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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2.2 SITE GEOLOGY AND HYDROGEOLOGY

The geology of Wurtsmith AFB consists of approximately 140 to 200 feet of unconsolidated deposits overlying the Mississippian-aged Marshall Formation sandstone and Coldwater Shale bedrock (US Geological Survey [USGS], 1990). Based on soil borings drilled in 1996 during installation of the full-scale bioventing system, the shallow unconsolidated deposits underlying Sites SS-06 and ST-40 consist predominantly of fine- to medium-grained sand (Parsons ES, 1996b).

Shallow groundwater at the site is unconfined (i.e., under water table conditions) and occurs at a depth of approximately 20 feet below ground surface (bgs). The groundwater flow direction beneath Sites SS-06 and ST-40 is to the northeast, toward the Benzene Plant pump-and-treat system. There is no surface water in the immediate vicinity of Sites SS-06 and ST-40.

2.3 PREVIOUS INVESTIGATIONS

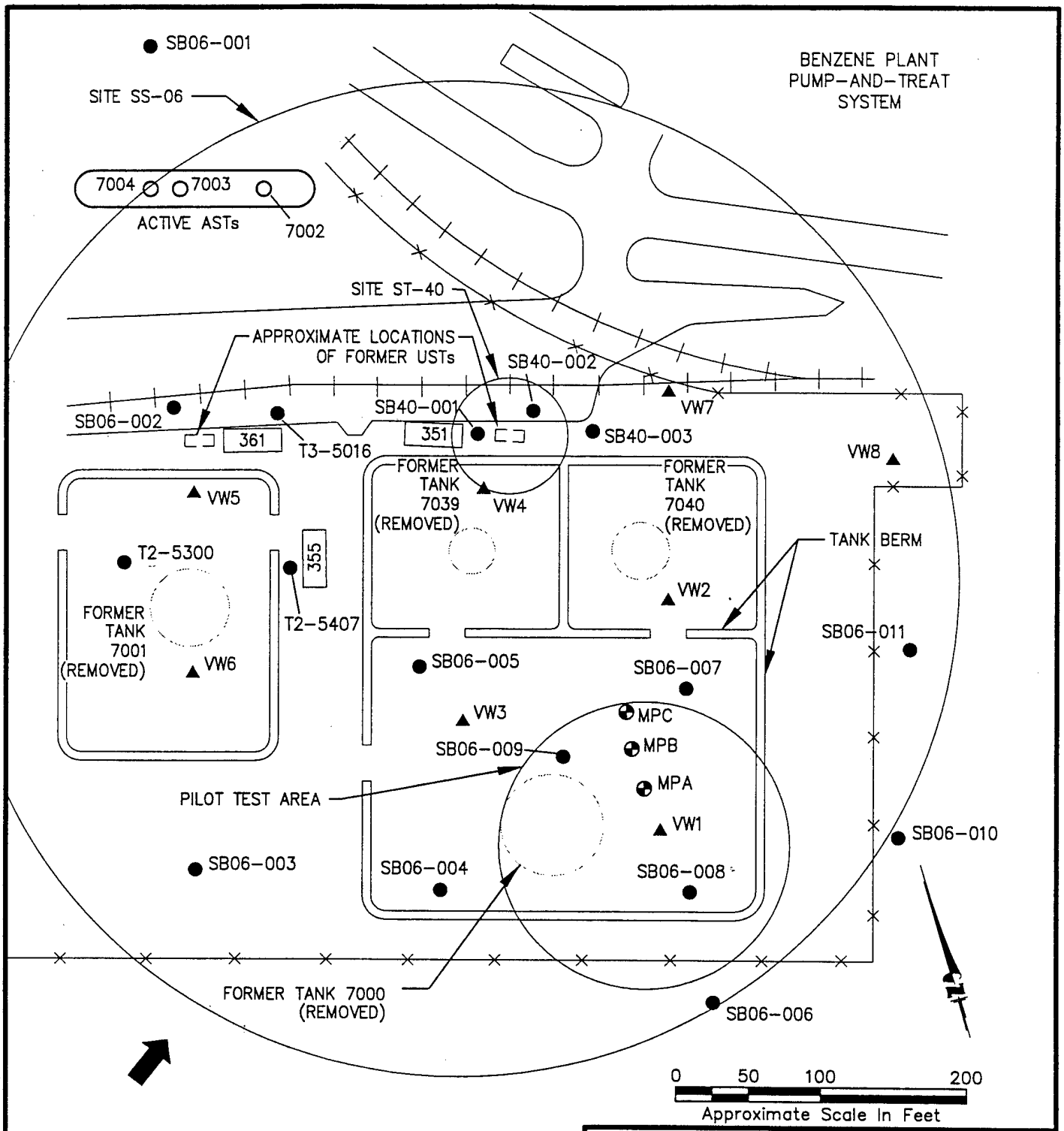
2.3.1 Investigations from 1979 Through 1985

A USGS investigation conducted at Wurtsmith AFB in 1979 detected benzene, toluene, and other organic compounds in groundwater in the vicinity of Site SS-06 (Cummins and Twenter, 1986). Subsequent investigations characterized the nature and extent of the dissolved petroleum hydrocarbon plume, which apparently originated at the POL Yard. Soil contamination at the POL Yard was not investigated during these early investigations.

2.3.2 1995 Investigations by ICF Technology and Brown & Root Environmental

In July 1994, a passive soil gas survey was conducted by ICF Technology (1995) to assess the extent of JP-4 jet fuel contamination in the soils at the POL Yard. The survey was conducted by installing sorbent collection devices 3 feet bgs at 83 locations within and adjacent to the POL Yard. The devices were retrieved after 1 month and analyzed for BTEX and other selected hydrocarbons. Soil gas results from the ICF Technology survey indicated high concentrations of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) within the bermed area, immediately adjacent to the former location of Tank 7000.

In 1995, ICF Technology (1995) and Brown & Root Environmental (1995) collected soil samples from borings within and adjacent to the POL Yard to further delineate the extent of soil contamination at the site. Soil samples collected by Brown & Root were primarily from borings completed near the buried JP-4 fuel lines, and soil samples collected by ICF Technology were concentrated near the former AST locations. Soil boring locations are shown on Figure 2.3. Soils were analyzed for VOCs, polynuclear aromatic hydrocarbons (PAHs), and lead. Analytical results indicated detectable concentrations of BTEX, PAH, lead, and carbon disulfide in soil. Soil analytical results for the ICF Technology and Brown & Root investigations are included on Table 2.1.



LEGEND

- PARSONS ES (1996b) SOIL GAS MONITORING POINT
- PARSONS ES (1996b) AIR INJECTION WELL
- SOIL BORING LOCATION (ICF TECHNOLOGY, 1995; AND BROWN & ROOT ENVIRONMENTAL, 1995)
- CHAIN LINK FENCE
- GROUNDWATER FLOW DIRECTION
- FORMER AST LOCATION

FIGURE 2.3

1995 AND 1996 SOIL SAMPLING LOCATIONS

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 2.1
SUMMARY OF 1995 AND 1996 SOIL ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Detected Analytes / Units	Sample Depth (feet bgs)	TEH[c] (mg/kg)[b]	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Total Xylenes (µg/kg)	Acenaphthene (µg/kg)	Anthracene (µg/kg)	Chrysene (µg/kg)	Fluoranthene (µg/kg)	Fluorene (µg/kg)	Naphthalene (µg/kg)	Phenanthrene (µg/kg)	Pyrene (µg/kg)	Carbon Disulfide (µg/kg)	Lead (mg/kg)	Acetone (µg/kg)	PCE[c] (µg/kg)
MDEQ Criteria[c]		No[d]	100	16,000	1,500	5,600	300,000	41,000	NLL[e]	720,000	390,000	17,000	12,000	470,000	16,000	21[f]	15,000	100
Parsons ES (1996b) Data																		
VW1-18	18 - 20	523	----[g]	----	2,030	18,900	----	----	----	----	----	1,110	----	----	NA[h]	NA	NA	NA
MPA-11	10 - 12	309	----	----	580	4,190	----	----	----	----	----	379	----	----	NA	NA	NA	NA
MPB-18	17 - 19	751	----	----	7,080	34,500	----	----	----	----	----	1,170	----	----	NA	NA	NA	NA
MPC-18	17 - 19	669	----	----	3,600	18,500	----	----	----	----	----	1,370	----	----	NA	NA	NA	NA
VW2-16	15 - 17	499	60J[h]	160J	2,680	12,900	----	----	----	228	78.3	828	425	----	NA	NA	NA	NA
VW3-19	19 - 20	246	----	57J	870	4,580	----	----	----	109		406	204	----	NA	NA	NA	NA
VW4-19	18 - 20	535	----	----	9,630	41,800	----	87.8	----	172	47	2,910	332	----	NA	NA	NA	NA
VW5-18	17 - 19	220	----	85J	2,300	9,820	----	----	----			473	102	----	NA	NA	NA	NA
VW7-21	20 - 22	746	----	250	3,710	15,600	----	----	10.9	589	92.6	616	587	----	NA	NA	NA	NA
VW8-21	20 - 22	2,960	----	----	24,600	161,000	----	----	----	478	205	5,670	1,060	----	NA	NA	NA	NA
ICF (1995) Data																		
SITE SS-06																		
SB06-001	4 - 6	NA	----	----	----	----	----	----	----	----	----	----	----	----	3.7J	----	----	----
	9 - 11	NA	----	----	----	----	----	----	----	----	----	----	----	----		0.94	----	----
	14 - 16	NA	----	3.0J	----	----	----	----	----	----	----	1,300	320	----	14	1.2	----	----
SB06-002	9 - 11	NA	----	----	----	910	----	----	----	----	----	----	----	----	----	0.88	----	----
	14 - 16	NA	----	----	----	3,900	----	----	----	----	----	----	110	110	----	0.87	----	----
	19 - 21	NA	----	----	----	830	----	----	----	----	----	----	----	----	----	----	----	----
SB06-003	4 - 6	NA	----	----	----	4,000	----	----	----	----	300	740	430	----	----	----	----	----
	9 - 11	NA	----	----	----	3,000	----	----	----	----	150	130	110	----	----	----	----	----
	14 - 16	NA	----	----	----	18,000	----	----	----	----	240	640	300	----	----	----	----	----
SB06-004	4 - 6	NA	----	----	----	----	----	----	----	----			----	----	----	29.2	----	----
SB06-005	14 - 16	NA	----	----	----	1,200	100	----	----	----	140	860	----	----	----	4.7	----	----
SB06-006	9 - 11	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	0.9	----	----
	19.5 - 21.5	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	2.8	----	----
SB06-007	4 - 6	NA	----	----	----	5.6	----	----	----	----	----	----	----	----	7.1	----	----	----
	9 - 11	NA	----	----	8.3	45.0	----	----	----	----	----	----	----	----	13	----	----	----
	14 - 16	NA	----	----	----	11.0	----	----	----	----	----	----	----	----	10	----	----	----
SB06-008	4 - 6	NA	----	----	----	13,000	----	----	----	----	270	660	270	----	----	----	----	----
	9 - 11	NA	----	----	----	20,000	----	----	----	----	260	520	190	----	----	2.2	----	----
	14 - 16	NA	----	----	----	21,000	----	----	----	----	150		----	----	----	----	----	----
(Duplicate)	14 - 16	NA	----	----	----	37,000	----	----	----	----	130	240	----	----	----	2.4	----	----
SB06-009	4 - 6	NA	----	----	----	50,000	----	----	----	----		6,400	----	----	----	22.6	----	----
	9 - 11	NA	----	----	----	30,000	----	----	----	----	320	3,300	----	----	----	0.92	----	----
	14 - 16	NA	----	----	----	23,000	----	----	----	----	390	3,300	----	----	----	----	----	----
SB06-011	4 - 6	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	1.0	----	----
	9 - 11	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	1.1	----	----
	19 - 21	NA	----	----	----	1,400	----	----	----	----	----	----	----	----	----	----	----	----
SB06-012	4 - 6	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	1.3	----	----
	9 - 11	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	1.1	----	----
(Duplicate)	9 - 11	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	18	----	----

TABLE 2.1 (Continued)
SUMMARY OF 1995 AND 1996 SOIL ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Detected Analytes / Units	Sample Depth (feet bgs)	TEH[a] (mg/kg)[b]	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Total Xylenes (µg/kg)	Acenaphthene (µg/kg)	Anthracene (µg/kg)	Chrysene (µg/kg)	Fluoranthene (µg/kg)	Fluorene (µg/kg)	Naphthalene (µg/kg)	Phenanthrene (µg/kg)	Pyrene (µg/kg)	Carbon Disulfide (µg/kg)	Lead (mg/kg)	Acetone (µg/kg)	PCE[a] (µg/kg)
MDEQ Criteria[c]		No[d]	100	16,000	1,500	5,600	300,000	41,000	NLL[e]	720,000	390,000	17,000	12,000	470,000	16,000	21[f]	15,000	100
Sample Location																		
SITE ST-40																		
SB40-001	4 - 6	NA	----[g]	----	----	----	----	----	----	----	----	----	----	----	9.9	7.9	----	----
	9 - 11	NA	----	----	----	69,000[h]	----	----	----	----	----	----	----	----	----	7.4	----	----
	14 - 16	NA	----	----	----	2,200	----	----	----	----		650	----	----	----	1.1	----	----
	19 - 21	NA	----	----	----	6,900	----	----	----	----	170	2,000	400	----	----	7.6	----	----
SB40-002	4 - 6	NA	----	----	----	----	----	----	----	----	----	----	----	----	----	0.98	36J[i]	6.3
	9 - 11	NA	----	----	----	670	----	----	----	----	----	----	----	----	19,000	1.4	----	----
	14 - 16	NA	----	----	----	35,000	----	----	----	----	----	870	110	----	----	1.0	----	----
	19 - 21	NA	----	----	----	6,200	----	----	----	----	110	920	210	----	----	0.87	----	----
SB40-003	4 - 6	NA	2.9J	----	----	----	----	----	----	----	----	----	----	----	4.8	1.2	----	----
	9 - 11	NA	2.4J	----	----	----	----	----	----	----	----	----	----	----	8.0	0.97	----	----
(Duplicate)	9 - 11	NA	2.7J	----	----	----	----	----	----	----	----	----	----	----	31	13.6	----	----
Brown & Root (1995)																		
SITE SS-06																		
T2-5300	Unknown	----	----	----	----	----	----	----	----	----	----	----	----	----	NA[j]	----	NA	NA
T2-5407	Unknown	----	----	----	----	----	----	----	----	----	----	----	----	----	NA	----	NA	NA
T3-5016	10	2,720[k]	----	550	----	29,000	----	----	----	7,200	----	5,800	8,100	6,400	NA	21	NA	NA

Note. Analytical results that exceeded generic MDEQ and soil cleanup criteria have been outlined

[a] TEH = total extractable hydrocarbons; PCE = perchloroethene or tetrachloroethene.

[b] mg/kg-milligrams per kilogram; µg/kg = micrograms per kilogram

[c] Generic soil criteria for residential drinking water protection (MDEQ, 1998a, 1998c)

[d] No = No MDEQ criterion has been established for this compound.

[e] NLL = Chemical is not likely to leach under most soil conditions (MDEQ, 1998a).

[f] Value represents state-wide background level.

[g] ---- = Sample result less than method detection limit.

[h] Outlined results exceed MDEQ criteria shown.

[i] NA = sample not analyzed for this compound.

[j] J = Indicates a laboratory estimated value; compound was detected, but below the laboratory reporting limit.

[k] Sample result is the sum of the diesel-range organic (DRO) fraction (1,900 mg/kg) and the gasoline-range organic (GRO) fraction (820 mg/kg).

2.3.3 1996 and 1997 Investigations and Bioventing System Installation and Operation by Parsons ES

Between July 1996 and September 1997, Parsons ES (1996b and 1997) conducted a soil gas survey; installed and tested a pilot-scale bioventing system; designed, installed, and optimized a full-scale bioventing soil remediation system at Sites SS-06 and ST-40, and monitored the system for 1 year. Soil and soil gas sampling activities were performed during installation of the pilot- and full-scale bioventing systems. Additional soil gas sampling and *in situ* respiration testing were conducted in September 1997, following 1 year of full-scale bioventing system operation. A detailed description of the bioventing system design and initial site activities is provided in the *Bioventing Pilot Test Results and Full-Scale System Installation Report for POL Yard, Sites SS-06 and ST-40* (Parsons ES, 1996b), and 1-year testing results are described in the *1-Year Results Report for Full-Scale Bioventing at the POL Yard, Sites SS-06 and ST-40* (Parsons ES, 1997). Bioventing pilot testing and soil gas and soil sampling results are summarized in the following subsections.

2.3.3.1 Soil Gas Survey

A soil gas survey of the POL Yard was conducted by Parsons ES in July 1996, prior to conducting the bioventing pilot test, to determine the extent of soil contamination and determine the optimum locations for bioventing air injection vent wells (VWs) and vapor monitoring points (MPs). Soil contamination was evaluated in July 1996 by measuring oxygen and total volatile hydrocarbon (TVH) concentrations in soil gas samples collected from 26 locations (SG-1 through SG-5 and SG-7 through SG-27) in the vicinity of the former ASTs and USTs. A truck-mounted, direct-push Geoprobe® was used to collect soil gas samples. Soil gas survey results and sampling locations are shown on Figure 2.4.

The majority of soil gas samples were collected approximately 1 to 2 feet above the groundwater surface, at sampling depths ranging from 16 to 19 feet bgs. Soil gas samples collected from within the bermed areas surrounding the former ASTs and from locations immediately north and east of the bermed areas had depleted oxygen concentrations (< 3 percent), elevated carbon dioxide concentrations (> 5 percent), and TVH concentrations exceeding 2,000 parts per million, volume per volume (ppmv). Anoxic conditions in subsurface soil gas are indicative of significant soil contamination and increased biological activity. Figure 2.4 presents the results of the soil gas survey and delineates the approximate extent of source area soils designated for bioventing remediation. The full extent of "smear zone" soil contamination northeast of the site, in the direction of the Benzene Plant pump-and-treat system, was not determined by the soil gas survey.

2.3.3.2 Bioventing System

In July 1996, a pilot-scale bioventing system was installed and tested at Sites SS-06 and ST-40 by Parsons ES as part of the AFCEE Extended Bioventing program (Contract No. F41624-92-D-8036, Order 17). Under this program, Site SS-06 (including Site ST-40) was funded for pilot-scale bioventing system installation and testing, installation of a full-scale bioventing system, and 2 years of extended system

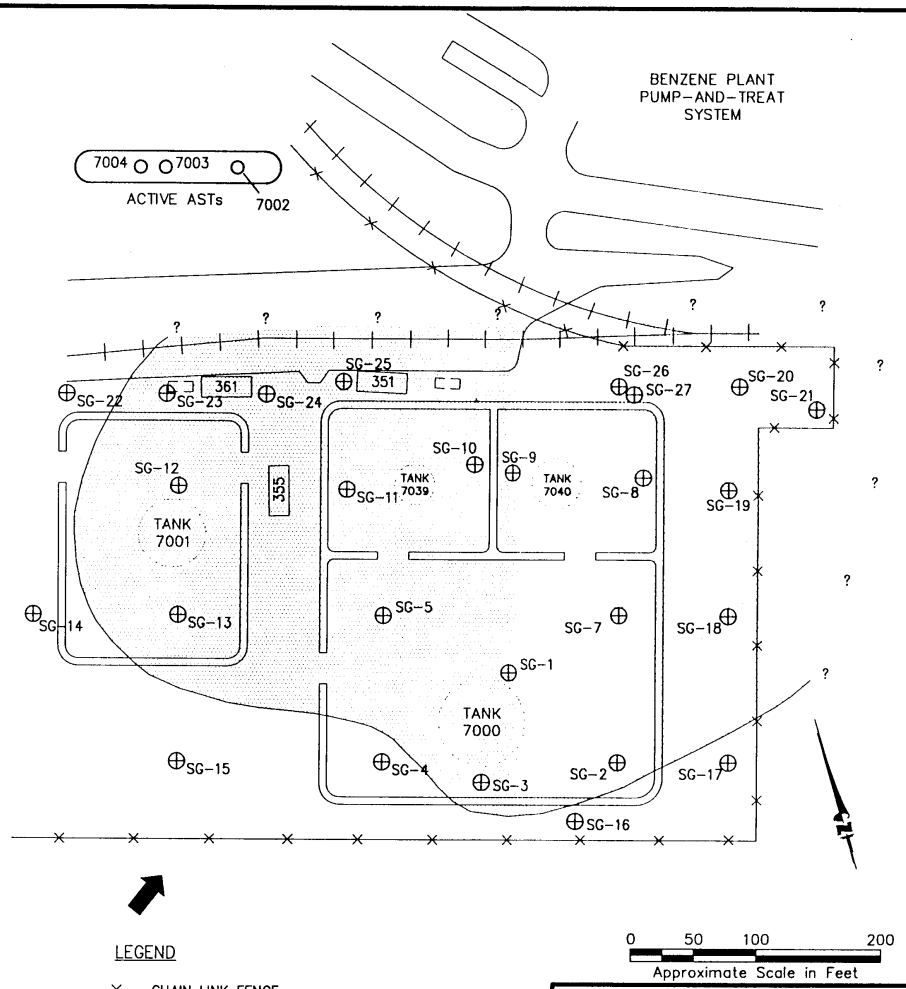
SOIL GAS SAMPLING RESULTS
PARSONS ENGINEERING SCIENCE – JULY 22–23, 1996 INVESTIGATION
SITES SS–06 AND ST–40
WURTSMITH AFB, MICHIGAN

LOCATION	DEPTH (ft bgs)a/	O_2(%)	CO_2(%)	TVH (ppmv)b/
SG–1	18	0.0	12.0	11,600
SG–2	18	0.0	9.5	12,800
SG–3	18	0.0	12.0	10,400
SG–4	18	8.5	4.5	400
SG–5	18	0.0	12.9	9600
SG–7	19	0.0	13.2	10,400
SG–8	18	0.0	13.0	6,800
SG–10	18	0.0	12.7	11,200
SG–11	18	0.0	9.0	>20,000 c/
SG–12	18	0.0	12.5	19,200
SG–13	18	0.0	13.0	1,800
SG–14	18	10.0	6.3	1,240
SG–15	17	17.8	1.2	720
SG–16	16	4.2	11.5	1,160
SG–17	17	3.6	12.0	500
SG–18	18	0.0	13.5	5,200
SG–19	18	0.0	11.0	6,800
SG–20	18	0.0	14.0	2,400
SG–21	18	0.0	16.0	5,200
SG–22	20	12.0	6.8	560
SG–23	20	0.0	14.0	8,800
SG–24	18	0.0	11.5	>20,000
SG–25	18	0.0	13.0	20,000
SG–26	19	0.0	13.0	10,000
SG–27	11	14.0	5.0	1,480

a/ APPROXIMATE DEPTH IN FEET BELOW GROUND SURFACE

b/ TVH = TOTAL VOLATILE HYDROCARBONS; ppmv= PARTS PER MILLION, VOLUME PER VOLUME. TVH CONCENTRATIONS OVER 10,000 ppmv WERE MEASURED USING A DILUTION VALVE AT THE INLET OF THE TVH ANALYZER.

c/ FIELD READING EXCEEDS DISPLAY LIMIT FOR METER OF 20,000 ppmv.



LEGEND

- CHAIN LINK FENCE
- GROUNDWATER FLOW DIRECTION
- SG–15 SOIL GAS SAMPLING LOCATION
- AREA OF FUEL–CONTAMINATED SOIL DESIGNATED FOR REMEDIATION BASED ON ESTIMATED EXTENT OF OXYGEN–DEPLETED (LESS THAN 3 PERCENT) SOILS. QUERIED WHERE LIMIT NOT DEFINED BY SOIL GAS SURVEY.
- FORMER AST LOCATION

FIGURE 2.4

SOIL GAS SURVEY SAMPLING LOCATIONS AND RESULTS JULY 1996

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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operation with maintenance and monitoring. In anticipation that 2 years of full-scale bioventing system operation would effectively reduce petroleum-hydrocarbon contamination in unsaturated soils, funding also was provided for confirmatory soil sampling and site closure documents.

Following the successful testing of the pilot-scale bioventing system, a full-scale system was designed and installed in July and August 1996. The full-scale bioventing system is shown on Figure 2.5. The full-scale bioventing system consists of eight VWs, nine MPs, and a blower unit. During installation of the pilot-scale system, respiration and air permeability testing and soil and soil gas sampling were performed. Based on the results of the oxygen influence and air permeability test performed during installation of the pilot-scale system, the long-term radius of oxygen influence was expected to exceed 65 feet at depths between 5 and 14 feet bgs and 100 feet at depths between 14 and 20 feet bgs.

The full-scale bioventing system was started and optimized in September 1996, and was operated continuously from September 1996 until August 1997. In August 1997, the system was shut down for 36 days to allow soils and soil gas to return to equilibrium conditions in order to compare initial and 1-year site conditions. Following the 36-day shutdown period, soil gas samples were collected and *in situ* respiration testing was performed from 15 through 18 September 1997. The blower system was restarted following 1-year testing to continue bioventing treatment of site soils. Results of the initial soil sampling, initial and 1-year soil gas sampling, and initial and 1-year respiration testing are presented in the following subsections.

2.3.3.2.1 Initial Soil Sampling Results

Soil samples were collected from borings completed at 11 locations during installation of bioventing VWs and MPs. Soil samples were collected at 5-foot intervals during drilling and field-screened using a direct-reading TVH meter for headspace analysis. Headspace analysis results were used to determine the presence of contamination and to select soil samples for laboratory analysis. Contaminated soils were identified based on odor, staining, and headspace TVH field screening results. The locations of two hydrogeologic cross-sections for the full-scale bioventing system are shown on Figure 2.6, and the cross-sections are depicted on Figure 2.7.

Soil samples were analyzed for several parameters, including total extractable hydrocarbons (TEH), BTEX, and PAHs. Analytical results indicated significant fuel hydrocarbon contamination in all 10 samples submitted for laboratory analysis. Xylenes and ethylbenzene were the only compounds detected above MDEQ (1998a) generic cleanup criteria of 5,600 micrograms per kilogram (µg/kg) and 1,500 µg/kg, respectively. Table 2.1 summarizes the laboratory results and highlights those results that exceed MDEQ generic soil cleanup criteria for groundwater protection (i.e., the most stringent of the generic soil cleanup criteria). PAHs and other BTEX compounds also were detected, but at concentrations below MDEQ criteria. TEH results ranged

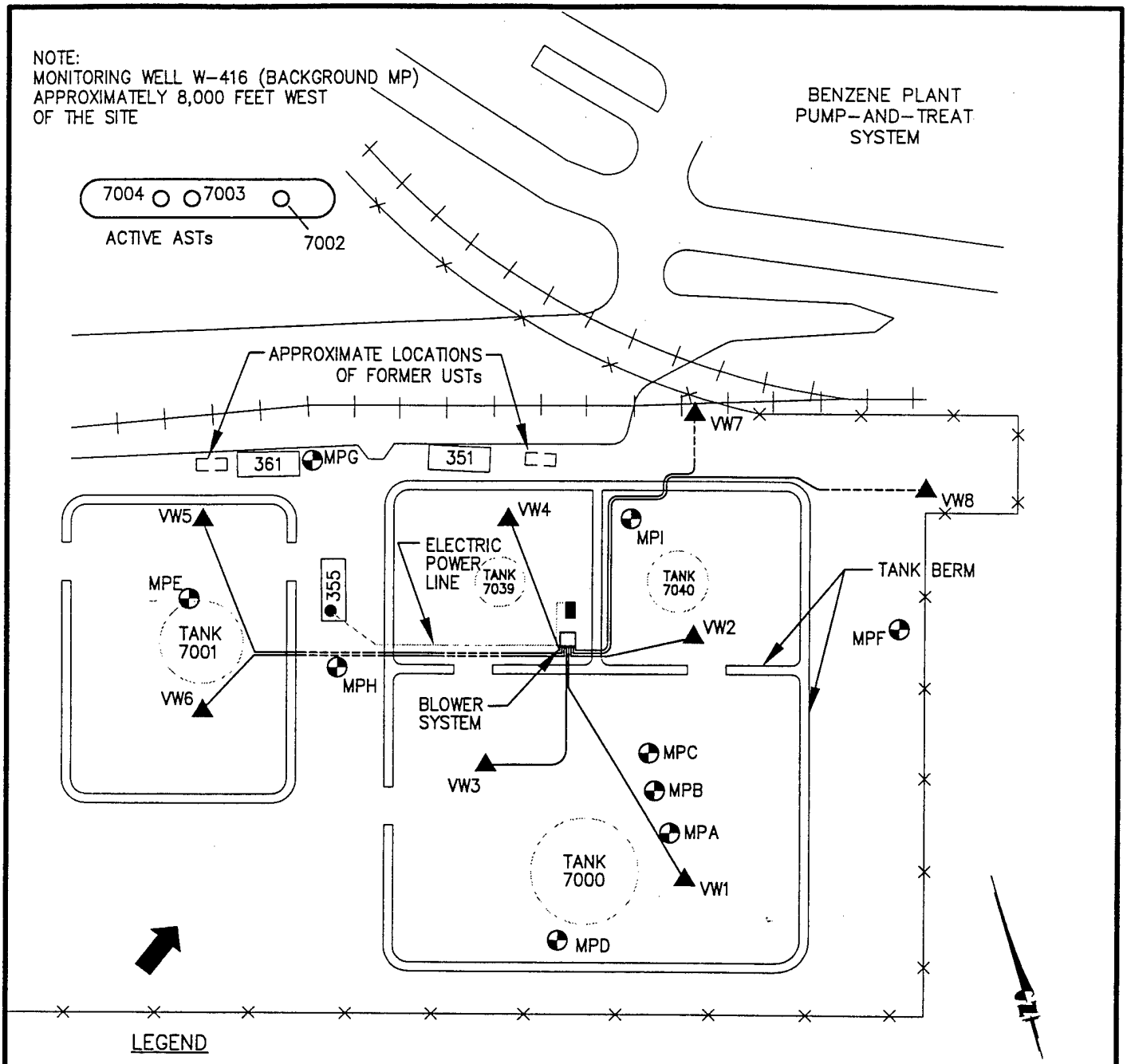

FIGURE 2.5

AS-BUILT FULL-SCALE BIOVENTING SYSTEM LAYOUT

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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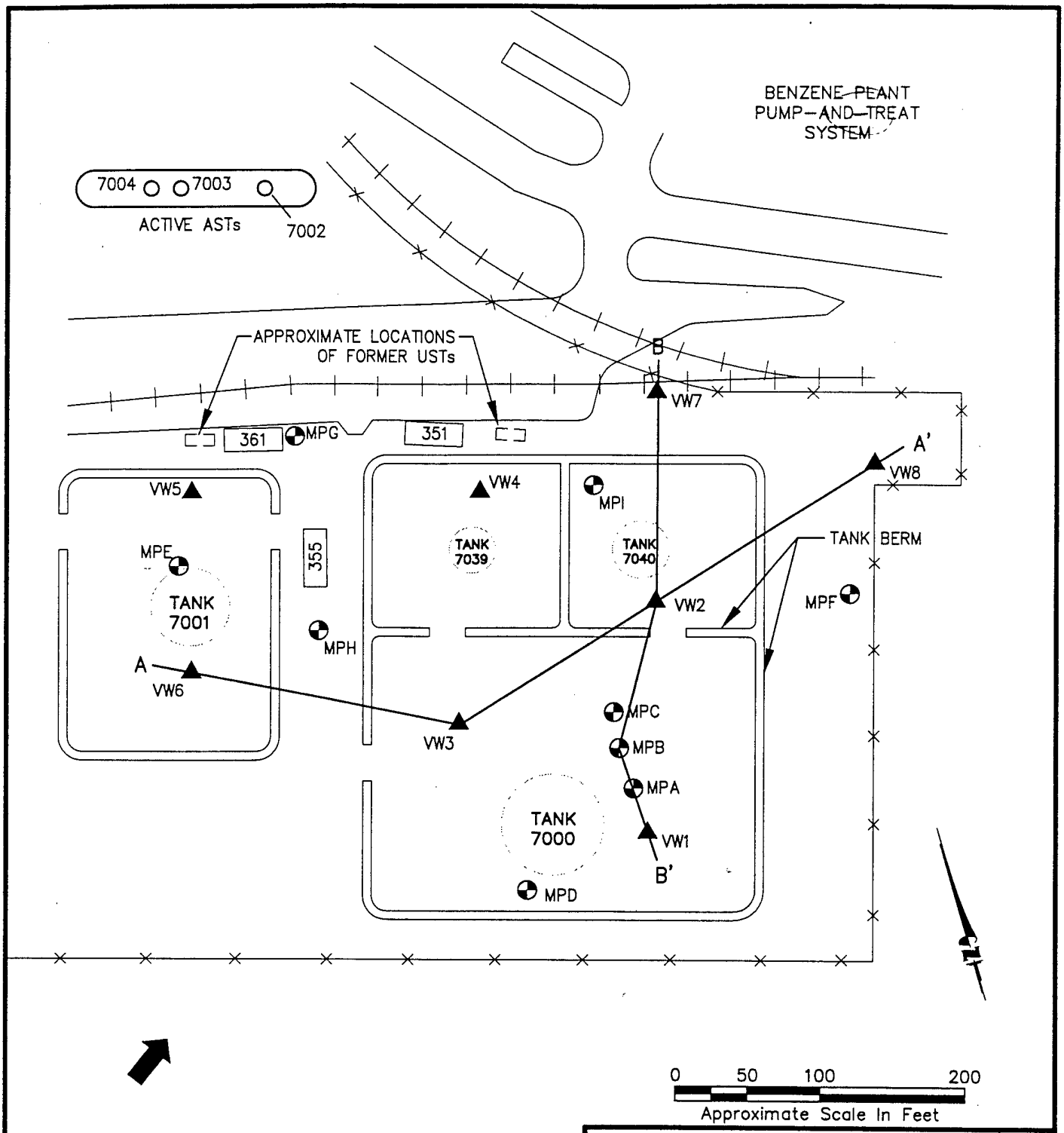

LEGEND

A——A' LOCATION OF HYDROGEOLOGIC CROSS-SECTIONS (SEE FIGURE 2.7)

VW3 ▲ AIR INJECTION WELL

MPA ⊕ VAPOR MONITORING POINT

FORMER AST LOCATION

FIGURE 2.6

LOCATION OF HYDROGEOLOGIC CROSS-SECTIONS A-A' AND B-B'

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

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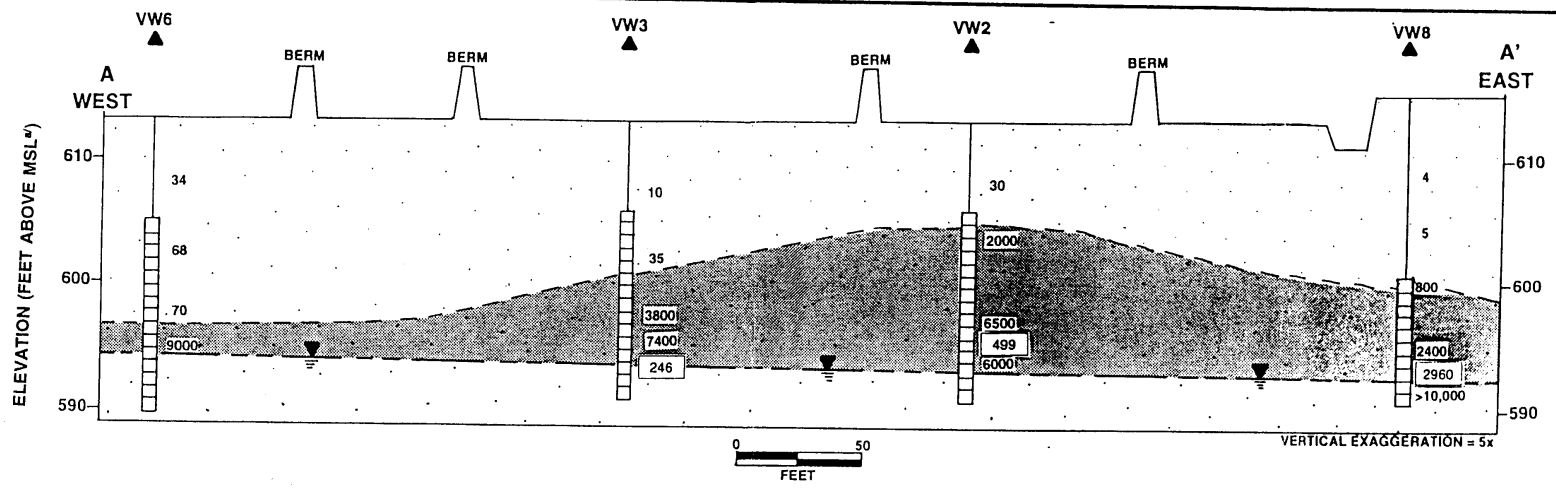
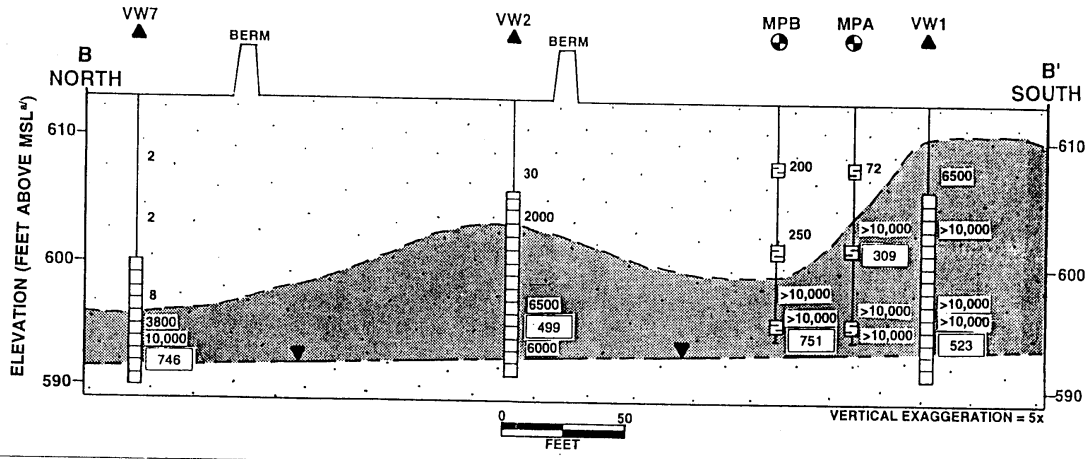




LITHOLOGIC DESCRIPTION

LEGEND

- FINE TO MEDUIM GRAINED SAND
- FUEL-CONTAMINATED SOIL (BASED ON FIELD SCREENING RESULTS)
- MPA — VAPOR MONITORING POINT
- VW1 — AIR INJECTION VENT WELL
- VENT WELL SCREENED INTERVAL
- GROUNDWATER SURFACE, DASHED WHERE INFERRED
- MONITORING POINT SCREENED INTERVAL
- *MSL = MEAN SEA LEVEL
- 200 — FIELD HEADSPACE SCREENING RESULTS FOR TOTAL VOLATILE HYDROCARBONS (ppmv)
- 751 — LABORATORY RESULTS FOR TOTAL PETROLEUM HYDROCARBONS (mg/kg)
- BERM

FIGURE 2.7

HYDROGEOLOGIC CROSS-SECTIONS A-A' AND B-B'

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

from 220 milligrams per kilogram (mg/kg) at VW5-18 to 2,960 mg/kg at VW8-21. Soil cleanup criteria for TEH have not been established by MDEQ.

2.3.3.2.2 Initial and 1-Year Soil Gas Chemistry Results

During bioventing system pilot testing and prior to starting the full-scale bioventing system, initial soil gas samples were collected from the VWs and MPs to establish baseline values. Soil gas oxygen, carbon dioxide, and TVH concentrations were measured using direct-reading field instruments, and samples from eight locations were submitted for laboratory analysis of TVH and BTEX. Table 2.2 presents the initial soil gas chemistry results at the full-scale MPs and VWs.

At all sampling locations, soil gas oxygen concentrations were below the atmospheric concentration of approximately 21 percent. Oxygen depletion was evident at VW7 and VW8, but not to the same degree as in the source area soils. The low oxygen concentrations observed at the full-scale system VWs and MPs correspond to high TVH concentrations (ranging from 2,400 to greater than 20,000 ppmv). Similarly, the results indicate significant soil contamination and biological activity in contaminated soils.

Field screening and collection of 1-year soil gas samples for laboratory analyses were performed from 15 through 17 September 1997, following approximately 1 year of system operation and 1 month of system shutdown. Soil gas samples were collected from the VWs, each MP screened interval, and groundwater monitoring wells MW-A64 and MW-A66. Samples were field-screened to assess soil gas concentrations of oxygen, carbon dioxide, and TVH. As can be seen from the results presented in Table 2.2, field TVH measurements and laboratory results indicate petroleum-hydrocarbon contamination in unsaturated soils decreased significantly at most locations as the result of the first year of full-scale bioventing system operation.

Static oxygen concentrations in soil gas samples collected from three of the VWs (VW2, VW3, and VW6) have increased considerably with continued bioventing at the site, while static oxygen concentrations have remained at or less than 0.5 percent at VW1, VW4, VW5, and all MPs (Table 2.2). One-year oxygen concentrations at VW7 and VW8 were 8.5 and 7.0 percent, respectively; these concentrations are basically the same as initial conditions and reflect the fact that fuel contamination in these locations is limited to a thin smear zone associated with the groundwater surface. Depleted soil gas oxygen concentrations measured at most locations indicate that aerobic hydrocarbon biodegradation rates remain relatively high and exceed the rate at which oxygen can naturally diffuse into the soils from the ground surface and adjacent uncontaminated areas. Natural diffusion of oxygen into the soils is greatly restricted at this site because of the impermeable liners covering most of the site. However, these results suggest that significant substrate (total fuel hydrocarbons) remained in unsaturated site soils at the end of the first year of full-scale bioventing.

Although soil gas field screening results for oxygen suggest that a significant mass of biodegradable fuel hydrocarbons remained in site soils, soil gas field TVH measurements and laboratory results for TVH and BTEX in soil gas indicated a substantial reduction of residual fuel hydrocarbons in soils at most locations following 1

TABLE 2.2
INITIAL AND 1-YEAR SOIL GAS FIELD AND LABORATORY ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

			Field Screening Data			Laboratory Analytical Data[a/]					
Sampling Location	Screen Depth (ft bgs)[c/]	Sampling Event[d/]	Oxygen (percent)	Carbon Dioxide (percent)	TVH[b/] (ppmv)[e/]	TVH (ppmv)	Benzene (ppmv)	Toluene (ppmv)	Ethyl-benzene (ppmv)	Xylenes (ppmv)	Total BTEX (ppmv)
VW1	7-22	Initial	0.0	12.1	> 20,000	----[f/]	----	----	----	----	----
		1-Year	0.0	10.8	17,000	----	----	----	----	----	----
VW2	7-22	Initial	0.0	14.2	8,000	----	----	----	----	----	----
		1-Year	1.8	9.0	----[g/]	----	----	----	----	----	----
VW3	7-22	Initial	0.0	13.0	5,600	----	----	----	----	----	----
		1-Year	5.0	7.0	320	----	----	----	----	----	----
VW4	8-23	Initial	0.0	8.8	> 20,000	----	----	----	----	----	----
		1-Year	0.5	4.5	340	----	----	----	----	----	----
VW5	8-23	Initial	0.0	12.6	> 20,000	----	----	----	----	----	----
		1-Year	0.0	9.5	2,000	----	----	----	----	----	----
VW6	8-23	Initial	0.0	13.4	11,200	----	----	----	----	----	----
		1-Year	8.9	3.5	400	----	----	----	----	----	----
VW7	13-23	Initial	7.8	7.5	4,600	----	----	----	----	----	----
		1-Year	8.5	6.2	260	----	----	----	----	----	----
VW8	14-24	Initial	6.8	9.2	2,400	----	----	----	----	----	----
		1-Year	7.0	7.6	1,120	----	----	----	----	----	----
MPA	5	Initial	0.0	12.2	17,200	----	----	----	----	----	----
		1-Year	0.0	10.8	440	----	----	----	----	----	----
MPA	11	Initial	0.0	12.0	> 20,000	22,000	69 M[h/]	100	31	65	265
		1-Year	0.0	10.9	5,000	1,500	< 0.11	.37	0.25 M	1.4 M	2.02
MPA	18	Initial	0.0	12.3	> 20,000	----	----	----	----	----	----
		1-Year	0.0	10.6	9,800	----	----	----	----	----	----
MPB	5	Initial	2.0	10.2	17,600	----	----	----	----	----	----
		1-Year	0.5	10.5	280	----	----	----	----	----	----
MPB	12	Initial	0.0	12.0	> 20,000	----	----	----	----	----	----
		1-Year	0.0	11.4	1,780	----	----	----	----	----	----
MPB	18	Initial	0.0	12.1	> 20,000	25,000	70	110	33	76	289
		1-Year	0.0	11.5	16,000	7,100	< 0.53	11	23	130	164

TABLE 2.2 (Continued)
INITIAL AND 1-YEAR SOIL GAS FIELD AND LABORATORY ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Sampling Location	Screen Depth (ft bgs)[c/]	Sampling Event[d/]	Field Screening Data: Oxygen (percent)	Carbon Dioxide (percent)	TVH[b/] (ppmv)[e/]	Laboratory Analytical Data[a/]: TVH (ppmv)	Benzene (ppmv)	Toluene (ppmv)	Ethyl-benzene (ppmv)	Xylenes (ppmv)	Total BTEX (ppmv)
MPC	5	Initial	0.0	11.2	> 20,000	24,000	58	120	32	70	280
		1-Year	0.0	12.0	1,240	570	< 0.11	1.7	1.3	3.3	6.3
MPC	12	Initial	0.0	11.0	19,200	----	----	----	----	----	----
		1-Year	0.0	12.5	5,600	----	----	----	----	----	----
MPC	18	Initial	0.0	11.0	> 20,000	20,000	57	94	26	58	235
		1-Year	0.0	12.8	19,200	11,000	< 1.1	25 M	12	64 M	101
MPD	12	Initial	0.0	13.1	6,000	----	----	----	----	----	----
		1-Year	0.0	14.5	10,400	11,000	< 1.1	23 M	14	58	95
MPD	18	Initial	0.0	13.2	4,000	16,000	38	99	34	40	211
		1-Year	NS[i/]	NS	NS	----	----	----	----	----	----
MPE	18	Initial	0.0	11.2	> 20,000	----	----	----	----	----	----
		1-Year	0.0	10.7	4,000	6,300	< 2.66	12	20	130 M	162
MPF	20	Initial	0.0	13.8	3,600	----	----	----	----	----	----
		1-Year	NS	NS	NS	----	----	----	----	----	----
MPG	18	Initial	0.0	10.4	> 20,000	38,000[j/]	145[j/] M	96[j/]	30[j/]	54[j/]	325
		1-Year	0.0	14.0	16,400	18,000	< 1.1	61 M	23 M	110 M	194
MPH	18	Initial	0.0	7.8	19,600	21,000	43	61	14	26	144
		1-Year	0.4	14.0	4,000	----	----	----	----	----	----
MPI	18	Initial	0.0	13.8	9,800	15,000	55	81	20	34	190
		1-Year	0.0	15.0	19,200	32,000	< 5.4	41 M	26	130 M	197
MW-A64	N/A[k/]	Initial	1.0	---	> 20,000	----	----	----	----	----	----
		1-Year	0.0	14.0	16,400	----	----	----	----	----	----
MW-A66	N/A[k/]	Initial	NS	---	NS	----	----	----	----	----	----
		1-Year	0.0	15.2	> 20,000	----	----	----	----	----	----
W-416 (Background)	8-18	Initial	20.5	0.7	16	----	----	----	----	----	----
		1-Year	---	---	---	----	----	----	----	----	----

TABLE 2.2 (Continued)
INITIAL AND 1-YEAR SOIL GAS FIELD AND LABORATORY ANALYTICAL RESULTS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

[a/] Laboratory analysis of soil gas performed using USEPA Method TO-3. Laboratory TVH referenced to jet fuel (MW=156).
[b/] TVH = total volatile hydrocarbons.
[c/] ft bgs = feet below ground surface.
[d/] Soil gas sampling performed in July and August 1996 (Initial), and September 1997 (1-Year).
[e/] ppmv = parts per million, volume per volume.
[f/] ---- = not analyzed.
[g/] Field TVH measurement not documented in the field book.
[h/] M = Laboratory reported value may be biased due to apparent matrix interferences.
[i/] NS = No sample collected; MP was flooded.
[j/] Result averaged with duplicate sample result.
[k/] N/A = Information not available.

year of bioventing system operation. Soil gas field TVH screening results presented in Table 2.2 indicate a 1 to 2 order of magnitude reduction at 9 of 24 VW and MP locations, less than 1 order of magnitude reduction at 10 locations, and an increase at 2 locations (MPD-12 and MPI-18). Comparison between initial and 1-year data for 3 locations (VW2, MPD-18, and MPF-20) could not be made due to insufficient data.

Soil gas samples for laboratory TVH and BTEX analyses were collected at eight locations before bioventing system startup (initial), and at eight locations following 1 year of system operation (1-year). Six of the eight sampling locations were the same for the initial and 1-year sampling events. As can be seen from the results at MPA-11, MPB-18, MPC-5, MPC-18, and MPG-18, total BTEX and TVH concentrations in soil gas were reduced between approximately 40 and 99 percent during the first year of system operation. The only exception to this trend was the soil gas sample for MPI-18, which showed an increase in TVH concentration (15,000 to 32,000 ppmv) and a slight increase in total BTEX concentration (190 to 197 ppmv) after 1 year of system operation. Although an overall decrease in total BTEX concentration was observed, results for xylenes indicate increased concentrations of this compound at 4 locations (MPB-18, MPC-18, MPG-18, and MPI-18). The apparent increase in xylenes at three of these locations may be the result of the 1-year laboratory-reported values being biased due to matrix interference. Field and analytical soil gas results suggested a significant degree of remediation of hydrocarbon contaminants in the unsaturated soils at Sites SS-06 and ST-40. However, these results also indicated that sufficient fuel hydrocarbons remained in unsaturated soils to warrant continued bioventing treatment.

2.3.3.2.3 *In Situ* Respiration Test Results

Initial and 1-year *in situ* respiration (oxygen utilization) testing was performed at the POL Yard in August 1996 and September 1997, respectively. Table 2.3 summarizes initial and 1-year respiration and fuel biodegradation rates at the site. Observed oxygen utilization and calculated fuel biodegradation rates decreased at two locations (MPA-11 and MPE-18) and increased at two locations (MPC-12 and MPC-18) following 1 year of full-scale bioventing system operation. Although the results were mixed, the average rates for these four locations decreased approximately 25 percent compared with the initial rates. Initial respiration testing was not performed at MPG and MPH, so comparisons with the 1-year rates cannot be made for these locations.

Oxygen utilization and fuel biodegradation rates typically decrease with continued bioventing as the lighter, more readily biodegraded hydrocarbons are preferentially destroyed over more biologically recalcitrant, higher-molecular-weight hydrocarbons. As demonstrated by the soil gas results presented in Table 2.2 and *in situ* respiration testing results presented in Table 2.3, fuel hydrocarbon concentrations have been significantly reduced, but sufficient hydrocarbons remained in the unsaturated soils to sustain moderate respiration rates.

2.4 SOIL SAMPLING RESULTS SUMMARY

Soil sampling results for the 1995 and 1996 investigations indicated significant petroleum-hydrocarbon contamination in vadose zone soils beneath Sites SS-06 and ST-40. The greatest extent and generally highest concentrations of soil contamination

MPA-18	0.08	400	1340	-	-	134
MPC-12	0.15	820	----	0.19	1,080	----
MPC-18	0.15	780	----	0.18	1,000	----
MPE-18	0.44	2,100	----	0.19	930	----
MPG-18	----	----	----	0.40	1,910	----
MPH-18	----	----	----	0.35	1,680	----

[a] Location-Depth gives screened interval location and depth below ground surface (bgs).

[b] % O_2/hr = percent oxygen per hour.

[c] Initial and 1-Year biodegradation rates based on moisture content of the soil during initial sampling. 1-year soil sampling was not performed.

[d] mg/kg/year = milligrams of hydrocarbons per kilogram of soil per year.

[e] ---- = not measured or not calculated.

at Sites SS-06 and ST-40 have been detected in a smear zone located approximately between 17 and 21 feet bgs. In localized areas near VW5, VW1, SB06-008, and the former Site ST-40 UST the vertical extent of soil contamination is much greater, with contamination beginning between about 1 foot bgs (VW5) to 9 feet bgs (Site ST-40), and extending downward to the groundwater surface at depths between 18 and 21 feet bgs. The distribution of vadose zone contamination suggests that the areas near VW5, VW1/SB06-008, and the former Site ST-40 UST are locations of previous fuel releases. Petroleum hydrocarbons appear to have migrated vertically from these assumed release locations to the groundwater surface, then have become smeared through capillary fringe soils while migrating horizontally in the direction of groundwater flow (northeast).

Table 2.1 summarizes soil sampling results and highlights values exceeding MDEQ generic soil leaching cleanup criteria for protection of residential groundwater. Pre-bioventing ethylbenzene and total xylenes soil concentrations exceeded the residential soil leaching criteria at several locations, indicating that these petroleum constituents should be considered chemicals of potential concern (COPCs) at Sites SS-06 and ST-40. Based on the general reduction of BTEX concentrations observed during the 1-year soil gas sampling event, it is anticipated that ethylbenzene and xylenes concentrations in site soils will meet applicable MDEQ cleanup criteria after 2 years of full-scale air injection bioventing at the site. MDEQ cleanup criteria applicable to Sites SS-06 and ST-40 are further discussed in Section 3.

SECTION 3

SITE CLEANUP REQUIREMENTS

3.1 SITE CHARACTERIZATION REQUIREMENTS

The objective of confirmatory soil sampling is to support a NFRAP recommendation for the soils contaminated by JP-4 jet fuel in the vicinity of the former ASTs and USTs. These soil sampling results will be used, as appropriate, to pursue formal closure of vadose zone soils at Sites SS-06 and ST-40 with MDEQ. This SAP targets unsaturated soils beneath and in the immediate vicinity of the POL Yard bermed areas.

3.2 STATE SOIL CLEANUP STANDARDS

MDEQ has adopted a tiered, risk-based approach to the remediation of petroleum-hydrocarbon contaminated sites that is similar to the American Society for Testing and Materials (ASTM, 1995) risk-based corrective action (RBCA) process and Air Force strategy outlined in the *Handbook for Remediation of Petroleum-Contaminated Sites* (AFCEE, 1998). This approach allows for the establishment of site-specific corrective action requirements based on an analysis of potential receptor exposures to chemical contamination at or migrating from the release site. Under the RBCA paradigm, both generic cleanup criteria (developed by MDEQ) and site-specific chemical fate and exposure data can be used to identify the most cost-effective remedial strategy for a particular site.

The first level of evaluation in MDEQ's (1998a) approach, a Tier 1 or screening-level assessment, involves comparing contaminant concentrations measured in site media to MDEQ-defined, nonsite-specific generic cleanup criteria. The generic cleanup criteria are based on conservative exposure assumptions and vary depending on current and foreseeable land use scenarios. MDEQ (1998a, 1998c, and 1998d) has defined generic cleanup criteria for unrestricted (i.e., residential) and industrial and commercial (I, II, III, and IV) land use. These criteria were developed by MDEQ (1998a) using standardized algorithms designed to be health protective of potential human receptors under each land use scenario.

The generic cleanup criteria are used to identify which, if any, contaminants and environmental medium may warrant additional evaluation or remediation to protect human receptors. If measured site concentrations do not exceed the applicable generic cleanup criteria, no additional remedial action is necessary. However, institutional controls such as deed restrictions may be appropriate if industrial/commercial cleanup criteria are used. In the event that measured site concentrations exceed the applicable

generic cleanup criteria, additional corrective action, or a more comprehensive evaluation (i.e., Tier 2), must be pursued.

A Tier 2 evaluation is more comprehensive than a Tier 1 analysis because it requires quantitative contaminant fate and transport calculations and development of site-specific cleanup criteria based on site-specific conditions. The Tier 2 evaluation is used to identify if any unacceptable exposures could occur at the site considering existing contaminant concentrations in site media, potentially completed exposure pathways, and possible receptor scenarios. Although Tier 2 evaluations usually involve a more rigorous analysis, they result in a more focused evaluation of those contaminants that actually pose a risk to potential receptors.

3.3 CLEANUP CRITERIA FOR THE POL YARD

3.3.1 Land Use, Migration and Exposure Routes, and Potential Receptors

The current and projected future land use of Sites SS-06 and ST-40 is industrial. A two-lane road and railroad tracks are located north of Sites SS-06 and ST-40, and vacant land is located adjacent to the east, west, and south sides of the site. The sites are planned to remain industrial, with the northwest portion of the site being used as an active bulk fuel storage area for the airport operations. The sites are surrounded by a chain-link fence and locked gates restrict access to only authorized personnel.

It is anticipated that the most significant contaminant migration pathway resulting from soil contamination at Sites SS-06 and ST-40 is leaching of contaminants from soil to groundwater. Currently, there is no on-base beneficial use of groundwater from the shallow aquifer. Wurtsmith AFB obtains its drinking water from the local municipality. As a result, exposure of onsite and off-site human receptors to site contaminants through ingestion of, inhalation of, or dermal contact with contaminants in groundwater extracted for potable use is unlikely. Chemicals in groundwater at Sites SS-06 and ST-40 do not reach surface water because groundwater in the vicinity is pumped and treated before it reaches any surface water body (ICF Kaiser, 1998).

Current and future onsite workers and future construction workers are likely to represent the primary human receptor populations. The potential exposure routes for these population groups include inhalation of fugitive dust, dermal contact with soil, and incidental ingestion of soil. Dermal contact with groundwater is not expected because of the typical depth of the water table at these sites (i.e., 17 to 21 feet bgs). However, the actual exposure potential for current and future onsite workers and future construction workers is expected to be minimal. Site access restrictions will limit exposure to onsite workers. Additionally, the unused USTs and ASTs have been removed, and the associated piping has been abandoned. Therefore, most construction/demolition activities at the site have been completed, and the potential for worker exposure to contaminated soil is minimal. Soil sampling results from previous investigations (Table 2.1) indicate that soil contamination appears to be significant only within soils located greater than 4 feet bgs (Table 2.1; Figure 2.7). No ecological receptors are likely to be exposed to contaminants in impacted site media under current or anticipated future land uses, because the site has been so highly disturbed that adequate permanent habitat does not exist.

3.3.2 Tier 1 Cleanup Criteria

Based on the land use assumptions and potential exposure pathways described in the previous section, the generic MDEQ cleanup criteria appropriate for Tier 1 screening of unsaturated soils at Sites SS-06 and ST-40 include the cleanup criteria for industrial and commercial (II, III, and IV) land uses (MDEQ, 1998d). Site contaminant concentrations measured in soil (maximum concentration, unless noted otherwise), as determined during the 1995 and 1996 sampling efforts are presented in Table 3.1 along with MDEQ-defined cleanup criteria. Generic cleanup criteria for soil that are protective of underlying groundwater and that are health-protective for the direct exposure pathways are provided. As discussed in the *Final Feasibility Report for Sites SS-06, ST-40, SS-13, and OT-46* (ICF Kaiser, 1998), conditions in the POL Yard do not pose unacceptable risks to human health if the Benzene Plant pump-and-treat system continues to operate until generic industrial drinking water criteria are satisfied. However, because generic residential drinking water criteria must be met at the base boundary, soil cleanup criteria which are designed to ensure contaminants do not leach from site soils and cause groundwater to exceed residential drinking water protection criteria have been used as conservative screening criteria to determine the COPCs to be analyzed for during confirmation sampling.

As shown on Table 3.1, the only pre-bioventing contaminants detected in site soils at concentrations exceeding the most stringent cleanup criteria (i.e., soil leaching criteria that affords residential drinking water protection) are ethylbenzene and total xylenes at Site SS-06, and total xylenes and carbon disulfide at Site ST-40. Benzene, acetone, and tetrachloroethene (PCE) were not detected at concentrations above generic soil cleanup criteria; however, some sample reporting limits for these compounds exceeded the most stringent soil cleanup criteria (ICF Kaiser, 1998). The highest reporting limits for these compounds exceeded the MDEQ (1998c) generic residential drinking water protection criteria. The elevated reporting limits presumably are the result of sample dilution that was required due to high concentrations of other analytes (typically xylenes) in these soil samples. Based on this comparison, these nondetected compounds are conservatively considered COPCs. Consequently, benzene, acetone, and PCE, along with ethylbenzene, xylenes, and carbon disulfide, are targeted for the confirmation sampling event, as described in Section 5.

Lead and naphthalene have not been retained as COPCs for Sites SS-06 and ST-40. Although lead concentrations in three subsurface soil samples were at or exceeded the statewide default background level of 21,000 μg/kg, lead was eliminated as a COPC following a statistical analysis of analytical results for lead (ICF Kaiser, 1998). MDEQ (1995a and 1995b) allows for the use of representative concentrations (such as the 95-percent upper confidence limit [UCL]) for comparison with Tier 1 criteria. The 95-percent UCL value for lead at the POL Yard was conservatively calculated in the Final Remedial Investigation report (ICF Kaiser, 1998) to be 5,400 μg/kg, which is well below the state default background level. Naphthalene, which originally was considered a COPC for the site (MDEQ, 1998b), is not included for confirmation sampling because the pre-bioventing maximum site concentration (6,400 μg/kg) is below the revised generic soil cleanup criterion of 17,000 μg/kg for residential drinking water protection (MDEQ, 1998b and 1998c).

TABLE 3.1
IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN FOR UNSATURATED SOILS
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Compound	Units	Site Concentration[a]	MDEQ Generic Residential Drinking Water Protection Criteria[b]	MDEQ Generic Industrial and Commercial Drinking Water Protection Criteria[c]	MDEQ Generic Industrial Direct Contact Criteria[d]	Statewide Default Background Levels[e]	Representative Concentration Exceeds Criteria
SITE SS-06							
Volatile Organic Compounds							
Benzene	µg/kg[f]	6,800[g]	100	100	4.0E+05	NA[h]	Yes
Toluene	µg/kg	550	16,000	16,000	2.5E+05	NA	No
Ethylbenzene	µg/kg	24,600	1,500	1,500	1.4E+05	NA	Yes
Total Xylenes	µg/kg	161,000	5,600	5,600	1.5E+05	NA	Yes
Carbon Disulfide	µg/kg	14	16,000	46,000	2.8E+05	NA	No
Tetrachloroethene	µg/kg	5.0[g]	100	100	8.8E+04	NA	No
PAHs							
Acenaphthene	µg/kg	100	3.0E+05	8.7E+05	8.1E+08	NA	No
Acenaphthylene	µg/kg	130[g]	2,900	8,500	1.6E+07	NA	No
Anthracene	µg/kg	87.8	41,000	41,000	1.0E+09	NA	No
Chrysene	µg/kg	10.9	NLL[i]	NLL	2.1E+07	NA	No
Fluoranthene	µg/kg	7,200	7.2E+05	7.2E+05	5.4E+08	NA	No
Fluorene	µg/kg	390	3.9E+05	8.9E+05	5.4E+08	NA	No
Naphthalene	µg/kg	6,400	17,000	50,000	1.6E+08	NA	No
Phenanthrene	µg/kg	1,060	12,000	34,000	1.6E+07	NA	No
Pyrene	µg/kg	6,400	4.70E+05	4.70E+05	3.4E+08	NA	No
Metals							
Lead	µg/kg	5,400[j]	NA	NA	9.00E+05	21,000	No
SITE ST-40							
Volatile Organic Compounds							
Benzene	µg/kg	28,000[g]	100	100	4.0E+05	NA	Yes
Toluene	µg/kg	1.0[g]	16,000	16,000	2.5E+05	NA	No
Ethylbenzene	µg/kg	1.0[g]	1,500	1,500	1.4E+05	NA	No
Total Xylenes	µg/kg	69,000	5,600	5,600	1.5E+05	NA	Yes
Acetone	µg/kg	280,000[g]	15,000	42,000	7.4E+07	NA	Yes
Carbon Disulfide	µg/kg	19,000	16,000	46,000	2.8E+05	NA	Yes
Tetrachloroethene	µg/kg	28,000[g]	100	100	8.8E+04	NA	Yes
PAHs							
Acenaphthene	µg/kg	100[g]	3.0E+05	8.7E+05	8.1E+08	NA	No
Acenaphthylene	µg/kg	100[g]	2,900	8,500	1.6E+07	NA	No
Anthracene	µg/kg	100[g]	41,000	41,000	1.0E+09	NA	No
Chrysene	µg/kg	100[g]	NLL	NLL	2.1E+07	NA	No
Fluoranthene	µg/kg	100[g]	7.2E+05	7.2E+05	5.4E+08	NA	No
Fluorene	µg/kg	170	3.9E+05	8.9E+05	5.4E+08	NA	No
Naphthalene	µg/kg	920	17,000	50,000	1.6E+08	NA	No
Phenanthrene	µg/kg	400	12,000	34,000	1.6E+07	NA	No
Pyrene	µg/kg	100[g]	4.70E+05	4.70E+05	3.4E+08	NA	No
Metals							
Lead	µg/kg	5,400[j]	1,000	1,000	9.00E+05	21,000	No

NOTE: Site maximum concentrations that exceed a MDEQ-defined soil cleanup criterion have been shaded for easy reference.

[a] Maximum concentration detected during ICF Technology (1995), Brown & Root Environmental (1995), and Parsons ES (1996b) investigations except as noted.

[b] Soil leaching criterion that is protective of underlying groundwater for residential potable use (MDEQ, 1998a; 1998c).

[c] Soil leaching criterion that is protective of underlying groundwater for industrial/commercial potable use (MDEQ, 1998a; 1998d).

[d] Health-protective value to protect workers from long-term, systemic health effects from incidental ingestion and dermal absorption of chemicals in soil (MDEQ, 1998a; 1998d).

[e] Statewide background default levels from Part 201 Training Manual (MDEQ, 1998a).

[f] mg/kg = micrograms per kilogram.

[g] Representative concentration is maximum detection limit for high nondetect value.

[h] NA = Not applicable.

[i] NLL = Chemical is not likely to leach under most soil conditions (MDEQ, 1998a).

[j] Representative concentration is the 95 percent upper confidence limit (UCL) for this compound (ICF Kaiser, 1998).

3.3.3 Additional Evaluation and Actions

Following confirmation soil sampling (Section 5), soil sampling results will be compared to MDEQ (1998d) generic residential soil cleanup criteria. For those soil contaminants with site concentrations below the generic residential cleanup criteria, no further evaluation will be necessary. If some soil contaminants exceed the generic residential cleanup criteria, three options are available; 1) continue bioventing system operation until generic residential criteria are met; 2) develop Tier 2 site-specific cleanup criteria; and 3) pursue closure based on generic industrial cleanup criteria.

Continued operation of the bioventing system until generic residential criteria are met would be the preferable option because it would ultimately result in site closure without restrictions, and it is generally much easier to get regulatory concurrence on meeting generic criteria than with Tier 2 (site-specific) criteria. Pursuing site closure based on generic industrial criteria would involve establishing land-use restrictions, and performing a contaminant fate and transport evaluation and long-term groundwater monitoring to assure that residential groundwater criteria are met at the base boundary.

SECTION 4

2-YEAR TESTING AND SOIL GAS SAMPLING FOR FULL-SCALE BIOVENTING

Prior to performing confirmation soil sampling, *in situ* respiration testing and soil gas sampling will be performed at Sites SS-06 and ST-40. Remediation progress as the result of 2 years of full-scale bioventing system operation will be evaluated by comparing the 2-year testing and soil gas sampling results to the initial and 1-year results. Approximately 30 days prior to soil gas sampling and respiration testing, the blower system will be shut down to allow subsurface conditions to return to equilibrium. Parsons ES will contact Wurtsmith AFB personnel to request that the blower be turned off at the appointed time. Soil gas sampling and *in situ* respiration testing procedures are described in detail in the *Draft Final Bioventing Pilot Test and Full-Scale System Installation Work Plan, Sites SS-06 and ST-40, Wurtsmith Air Force Base, Michigan* (Parsons ES, 1996a) and summarized in this section.

4.1 SOIL GAS SAMPLING

Soil gas samples will be collected from the VW and MPs for field and laboratory analyses. Soil gas from the VWs and all MP screened intervals will be analyzed using direct-reading field instruments for oxygen, carbon dioxide, and TVH. Soil gas samples from eight locations (MPA-11, MPB-18, MPC-5, MPC-18, MPD-12, MPE-18, MPG-18, and MPI-18) will be collected in 1-liter SUMMA® canisters in accordance with the *Field Sampling Plan for AFCEE Bioventing* (Engineering-Science, Inc. [ES], 1992) and the site-specific field sampling plan (Appendix B), and submitted for laboratory analysis of BTEX and TVH by US Environmental Protection Agency (USEPA) Method TO-3, with TVH referenced to jet fuel. The soil gas sampling results will be used to determine reductions in BTEX and TVH concentrations during the 2-year period of operation of the full-scale bioventing system.

Soil gas sample canisters will be placed in a small cooler and packed with foam pellets or other material to prevent excessive movement during shipment. Samples will be shipped at ambient temperatures to prevent condensation of hydrocarbons. A chain-of-custody form will be filled out, and the cooler will be shipped to the laboratory for analysis.

4.2 *IN SITU* RESPIRATION TEST

The objective of the *in situ* respiration test is to determine the rate at which soil bacteria degrade petroleum hydrocarbons. To quantify the changes in respiration rates caused by 2 years of bioventing system operation, respiration tests will be performed at

MPA-11, MPC-12, MPC-18, MPE-18, MPG-18, and MPH-18. Soil gas sampling and respiration testing performed during previous pilot testing and system monitoring events at these six MP locations has provided the following evidence of bacterial biodegradation of petroleum hydrocarbons: depleted oxygen concentrations (0 percent), elevated carbon dioxide concentrations (> 10 percent), and estimated hydrocarbon biodegradation rates > 1,000 mg/kg/year (see Tables 2.2 and 2.3). Using l-cubic-foot-per-minute (cfm) pumps, air will be injected into approximately six MP depth intervals containing low levels (< 2 percent) of oxygen. A 20-hour air injection period will be used to oxygenate contaminated soils in the vicinity of the MP intervals. At the end of the 20-hour air injection period, the air supply will be cut off, and oxygen, carbon dioxide, and TVH concentrations will be monitored for the following 48 to 72 hours. The decline in oxygen and increase in carbon dioxide concentrations over time will be used to estimate rates of bacterial degradation of fuel residuals. The 2-year testing results will be compared with previous results to determine changes in respiration rates resulting from decreases in residual hydrocarbons in unsaturated soils. Additional details on the *in situ* respiration test can be found in the bioventing protocol document (Hinchee *et al.*, 1992).

SECTION 5

CONFIRMATION SOIL SAMPLING AND ANALYSIS PLAN

The following SAP describes the sampling locations and procedures and the analytical methods proposed to collect sufficient data to verify remediation of Sites SS-06 and ST-40 soils to MDEQ (1998c) generic residential cleanup criteria and support a NFRAP recommendation for the sites. The sampling strategy discussed in this section was developed using recommendations in the *Guidance Document for Verification of Soil Remediation* (Guidance Document) (Michigan Department of Natural Resources [MDNR], 1994).

As described in Section 2, soil contamination at Sites SS-06 and ST-40 was characterized during the 1995 and 1996 investigations. Based on results from these investigations, petroleum-hydrocarbon contamination exceeding one or more of MDEQ (1998c) generic residential cleanup criteria appear to have been confined to vadose zone soils between 1 and 21 feet bgs, but predominantly between 17 and 21 feet bgs. To verify that petroleum hydrocarbon contaminants in site soils have been remediated to within acceptable levels, Parsons ES proposes to sample subsurface soils within the area of soil contamination determined based on previous soil and soil gas sampling results.

5.1 SAMPLING STRATEGY

The sampling strategy presented in this SAP combines a statistically random strategy combined with a biased strategy that targets previously-identified hot spots. The statistically random strategy is described in the Guidance Document (MDNR, 1994) and employs the use of gridding to facilitate the unbiased selection of sampling locations, and statistical tools for evaluating the resulting data. Because of the relatively large size of the POL Yard site, the goal of the statistically random strategy is to provide a 95 percent confidence level of determining any hot spot concentrations of residual fuel hydrocarbons remaining in site soils after 2 years of bioventing remediation. In addition to the random strategy, four soil sampling locations are proposed for areas with previously identified high concentrations of fuel hydrocarbons to confirm that these former hot spots have been adequately remediated.

Sampling locations for the random strategy were determined, following procedures described in the Guidance Document (MDNR, 1994), by first establishing a grid for the site, then selecting a subset of grid stations using a random numbers table. Although greater than the calculated value suggested in the Guidance Document (MDNR, 1994), a 50-foot grid interval was selected for this site based on the relatively large size of the site and the continuity and relative consistency of the smear zone.

Only the grid stations within the area of previously detected contamination were included in the set used for selecting the sampling locations. The proposed sampling locations and grid are shown on Figure 5.1. Soil samples for laboratory analysis will be collected at 13 grid stations selected using a random numbers table and at four additional locations (25 percent of the 66 grid stations within the contaminated area) to allow a data pool large enough for statistical analysis. The four additional locations were selected in order to increase the confidence level of determining any hot spots remaining in site soils following remediation, by resampling locations where ethylbenzene and total xylenes previously exceeded their respective MDEQ (1998d) generic cleanup criterion. Supporting calculations for the random sampling strategy are presented in Appendix A.

Because the greatest extent and highest concentrations of fuel hydrocarbons were previously detected in the smear zone, the proposed sampling strategy focuses on this zone. Contamination was detected in soils above the smear zone only in a few areas, which are likely the original fuel release locations. Outside the suspected fuel release areas, vadose zone soil contamination is restricted to within approximately 5 feet of the groundwater surface. Therefore, the majority of soil samples submitted for laboratory analysis will be collected from the smear zone. Soil samples collected above the smear zone will be submitted for laboratory analysis only if field headspace screening results indicate the presence of hydrocarbon contamination, or if the samples are collected in areas where shallow contamination previously has been identified. The number of soil samples, soil sampling procedures, and the analytical methods proposed for the confirmation soil sampling event are described in the following sections.

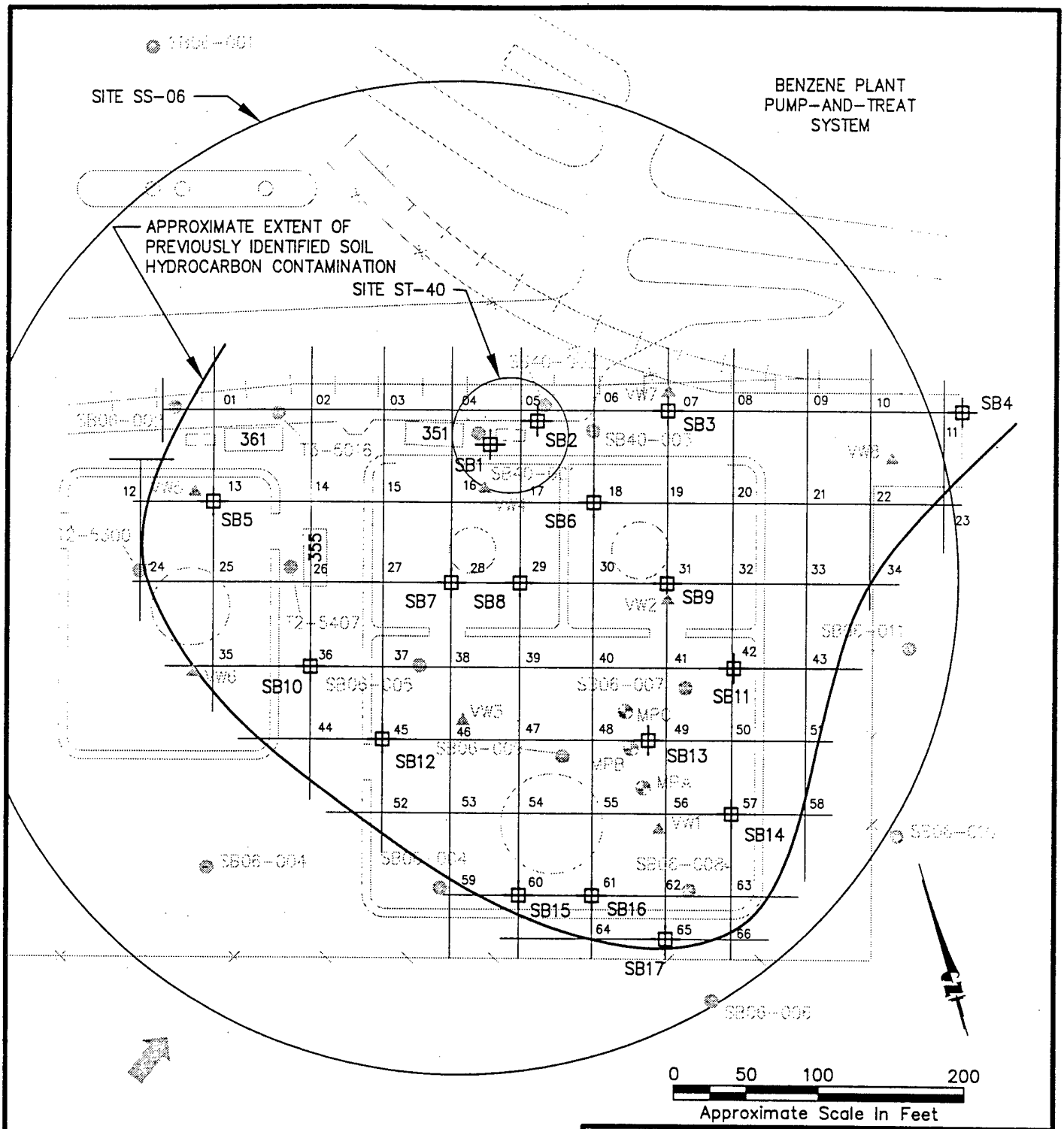
5.2 SOIL SAMPLING

This section describes the scope of work required for collecting confirmation soil samples at Sites SS-06 and ST-40. Soil samples will be collected at an estimated 17 locations. One or two soil samples will be collected at each location. A maximum of two additional locations may be sampled if field screening results indicate significant contamination extending beyond the proposed sampling area. Proposed borehole locations are shown on Figure 5.1.

Soil sampling will be conducted by qualified Parsons ES scientists and technicians trained in the conduct of soil sampling, records documentation, and chain-of-custody procedures. In order to provide complete documentation of the sampling event, detailed records will be maintained by the Parsons ES field hydrogeologist. In addition, sampling personnel will have thoroughly reviewed this SAP prior to sample collection and will have a copy available onsite for reference. Additional details of sampling procedures are presented in Appendix B, the FSP.

5.2.1 Sample Collection

Soil samples will be collected using a Geoprobe® system, a hydraulically powered percussion/probing machine capable of advancing sampling tools through unconsolidated soils. This system provides for the rapid collection of soil samples at



LEGEND

- PARSONS ES (1996b) SOIL GAS MONITORING POINT
- PARSONS ES (1996b) AIR INJECTION WELL
- SOIL BORING LOCATION (ICF TECHNOLOGY, 1995; AND BROWN & ROOT ENVIRONMENTAL, 1995)
- SB1 PROPOSED SOIL SAMPLING LOCATION
- CHAIN LINK FENCE
- GROUNDWATER FLOW DIRECTION
- FORMER AST LOCATION

FIGURE 5.1

PROPOSED GRID AND SOIL SAMPLING LOCATIONS

Sites SS-06 and ST-40
Wurtsmith AFB, Michigan

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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shallow depths while minimizing the generation of investigation-derived waste (IDW) materials.

For the confirmation sampling event, each borehole will be advanced to no less than 1 foot above the groundwater surface; maximum sampling depths are expected to be between 16 and 20 feet bgs. At soil borings where shallow contamination has been identified or is suspected due to the close proximity of former USTs or ASTs (proposed locations SB1, SB2, SB5, SB9, SB13, SB14, SB15 and SB16), soil samples will be collected at 5-foot intervals (5, 10 and 15 feet bgs) from ground surface to the top of the smear zone at 16 feet bgs. These samples will be field-screened for VOCs and examined for physical evidence of contamination. A sample also will be collected from the smear zone between 16 and 20 feet bgs. At soil borings where contamination is present in the smear zone only, based on results of previous investigations (SB3, SB4, SB6, SB7, SB8, SB10, SB11, SB12, and SB17), the probe will be driven to the smear zone, and only one sample will be collected between 16 and 20 feet bgs.

The majority of soil samples submitted for laboratory analysis will be collected from the smear zone (16 to 20 feet bgs). Soil samples collected above the smear zone (0 to 16 feet bgs) will be submitted for laboratory analysis only if field headspace screening results indicate the presence of hydrocarbon contamination or if the samples are collected in areas with previously identified shallow contamination. Based on field screening results, a minimum of one and maximum of two samples with the greatest apparent contamination from each borehole will be selected and submitted for laboratory analysis.

Discrete soil samples collected during the proposed confirmation sampling effort will be classified according to the Unified Soil Classification System (USCS) and described in accordance with the standard Parsons ES soil description format. However, continuous sampling will not be performed because soils at the site have been characterized in previous investigation efforts as uniform, well-sorted silica sands from beneath the berm liner to the groundwater surface. All soil samples will be visually examined and field screened for VOCs using a photoionization detector (PID) or a total volatile hydrocarbon analyzer (TVHA).

Samples selected for laboratory analysis will be transferred directly from the Geoprobe® core sampler to EnCore™ samplers and sealed according to manufacturer-recommended procedures. Soil samples for laboratory analysis will be immediately placed in an insulated cooler containing ice. The soil samples will be maintained in a chilled condition until delivered to the analytical laboratory. The remaining soil not included in the laboratory sample will be removed from the Geoprobe® sampler for field TVH screening and lithologic logging. In the laboratory, soil samples to be submitted for laboratory analysis will be transferred from the EnCore™ samplers to soil sample vials and preserved with methanol in the laboratory within 48 hours of sample collection as described in USEPA Method SW5035. Soil samples will be analyzed using USEPA Method SW8260B for BTEX, trimethylbenzenes, butylbenzenes, isopropylbenzenes, carbon disulfide, acetone, and PCE, as listed in Table 5.1. After the samples for laboratory analysis have been collected, chain-of-custody procedures

TABLE 5.1
PROPOSED SOIL SAMPLE ANALYTICAL METHODS, REPORTING LIMITS, AND NUMBER OF SAMPLES
SITES SS-06 AND ST-40
WURTSMITH AFB, MICHIGAN

Analytical Method	Maximum Number of Samples[a/]	Reporting Limit[b/]	Units[c/]	Field or Fixed-Base Laboratory
USEPA Method SW8260B				
Benzene	23	2.0	µg/kg	Fixed-base
Toluene	23	5.0	µg/kg	Fixed-base
Ethylbenzene	23	3.0	µg/kg	Fixed-base
m-Xylene	23	3.0	µg/kg	Fixed-base
o-Xylene	23	5.0	µg/kg	Fixed-base
p-Xylene	23	7.0	µg/kg	Fixed-base
1,2,4-Trimethylbenzene	23	7.0	µg/kg	Fixed-base
1,3,5-Trimethylbenzene	23	3.0	µg/kg	Fixed-base
n-Butylbenzene	23	5.0	µg/kg	Fixed-base
sec-Butylbenzene	23	7.0	µg/kg	Fixed-base
tert-Butylbenzene	23	7.0	µg/kg	Fixed-base
Isopropylbenzene	23	8.0	µg/kg	Fixed-base
n-Propylbenzene	23	2.0	µg/kg	Fixed-base
Carbon disulfide	4	1.4	µg/kg	Fixed-base
Acetone	4	8.8	µg/kg	Fixed-base
Tetrachloroethene	4	7.0	µg/kg	Fixed-base

[a/] Excludes QC samples. If optional boreholes are required, additional soil samples per optional borehole will be collected and analyzed.

[b/] Project reporting limit as specified in subcontract for analytical services.

[c/] µg/kg = micrograms per kilogram.

will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory as described in the FSP (Appendix B).

5.2.2 Soil Analyses

The proposed soil analytical methods, estimated number of samples, and reporting limits are presented in Table 5.1. A maximum of 23 samples will be collected for laboratory analysis for BTEX and trimethylbenzenes by USEPA Methods SW5035 and SW8260B. The soil samples collected for BTEX analysis also will be analyzed for trimethylbenzene (TMB) isomers (1,2,4-TMB and 1,3,5-TMB), butylbenzenes and propylbenzenes at the request of MDEQ. In addition, four of these samples (from SB-1 and SB-2 in the vicinity of Site ST-40) will be analyzed for PCE, acetone, and carbon disulfide by USEPA Method SW8260B. All samples will be analyzed by Specialized Assays, Inc., State of Michigan-certified, and AFCEE-approved laboratory. Quality control (QC) samples also will be analyzed to assess laboratory methods. The laboratory will perform analyses on a minimum of one matrix spike, one laboratory control, and one laboratory blank for each analytical method requested. Field QC samples will be collected and analyzed as described in Section 5.4. A discussion of laboratory quality assurance (QA)/QC procedures, including matrix spike duplicate (MS/MSD) samples is presented in the QAPP (Appendix D). Two MS/MSD samples will be collected (one pair for every group of 20 samples).

5.2.3 Equipment Decontamination

All sampling and downhole equipment will be decontaminated before use and between boreholes to prevent cross-contamination, as described in the FSP (Appendix B). All decontamination fluids will be stored in 55-gallon, US Department of Transportation (DOT) approved drums for proper disposal (see Section 5.4 and Appendix B).

5.3 FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Field QC for soil will include collection of field replicates, rinseate blanks, and trip blanks. Soil QC sampling will include three replicates (minimum frequency of 10 percent) for VOC analysis; one rinseate blank; and one trip blank for each cooler submitted to the laboratory. Additional field QA/QC procedures are described in the QAPP (Appendix D).

5.4 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

Handling of IDW will follow the base-wide procedures established by ICF Technology, Inc. (1994) and approved by MDEQ and USEPA. Decontamination water will be containerized, transported to Building 5092, and discharged into the oil/water separator. The use of the Geoprobe® for collecting soil samples will not generate significant amounts of soil cuttings, therefore disposal of contaminated soil will be limited to soils used for headspace screening and logging. Additional procedures for management of IDW are described in the FSP (Appendix B).

SECTION 6

CONFIRMATION SAMPLING REPORT FORMAT

Following receipt of the laboratory soil gas analytical results, a letter report will be prepared and submitted to AFCEE and Wurtsmith AFBCA. The letter report will summarize soil gas sampling and respiration testing results, and compare them with previous results to estimate remedial progress over two years of air injection bioventing.

Following receipt of the laboratory soil analytical results, a draft confirmation soil sampling report will be prepared and submitted to Wurtsmith AFBCA and AFCEE.

The report will contain the following information for Sites SS-06 and ST-40:

- Site plot plan showing sampling locations;
- Summary of field activities;
- Assessment of analytical results in comparison to applicable MDEQ soil cleanup criteria for benzene, ethylbenzene, xylenes, PCE, carbon disulfide, and acetone.
- Analytical results for toluene, butylbenzenes, propylbenzenes, and TMBs;
- Laboratory analytical reports and chain-of-custody forms;
- Borehole logs; and
- Conclusions and recommendations. If soil confirmation sampling results demonstrate that MDEQ (1998c) generic residential drinking water protection criteria have been met for all analytes of concern, then the data will be used to support an NFRAP decision document for vadose zone soils at the POL Yard. However, if soil confirmation sampling results demonstrate that any analyte exceeds the MDEQ generic residential drinking water criteria, then Parsons ES will prepare a results report in which the recommendation will be made to continue operating the bioventing system.

If MDEQ approves the closure of vadose zone soils at Sites SS-06 and ST-40, then Wurtsmith AFBCA will need to decommission the bioventing system; the AFCEE Extended Bioventing project does not provide for system decommissioning (i.e., well abandonment, blower system, and shed removal).

SECTION 7

WURTSMITH AFBCA SUPPORT REQUIREMENTS

The following Wurtsmith support is needed prior to the arrival of the drillers and the Parsons ES sampling team:

- Assistance in obtaining drilling and digging permits;
- Provision of a potable water supply for drilling and decontamination activities; and
- Assistance in obtaining access to Building 5092 for disposal of decontamination water.

SECTION 8

PROJECT SCHEDULE

The following schedule is contingent upon approval of this confirmation SAP and fulfillment of the Wurtsmith AFBCA support requirements outlined in Section 7.

Event	Date
Submit Draft Confirmation SAP to AFCEE, Wurtsmith AFBCA, USEPA, and MDEQ	June/July 1998
Receipt of AFCEE and Wurtsmith AFBCA, USEPA, and MDEQ Comments	August 1998
Submit Final SAP, to AFCEE, Wurtsmith AFBCA, USEPA, and MDEQ	September 1998
Perform Confirmation Sampling	October 1998
Submit Draft Confirmation Sampling Report to AFCEE and Wurtsmith AFBCA	December 1998
Receipt of AFCEE and Wurtsmith AFBCA Comments	January 1999
Submit Draft Final Confirmation Sampling Report to AFCEE, Wurtsmith AFBCA, and MDEQ	February 1999

SECTION 9

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SECTION 10

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APPENDIX A

SOIL SAMPLING GRID DETERMINATION

ES ENGINEERING-SCIENCE, INC.

Client AFCEE/ERT; AFBCA/OL-T | Job No. 726876. | Sheet 1 of 1

Subject Soil Cleanup Verification Sampling Strategy Calculations - # & location of samples | By JFH | Date 4/22/98

Checked CDS 5/18/98 | Rev.

Procedure to determine number and location of soil samples - Using Guidance Document, Verification of Soil Remediation [DNR] DEQ Environmental Response Division, Waste Management Division, April 1994. Revision 1

(1) Determine Site Size Category

Previously identified area of contamination

480' x 380' = 182,000 ft² = approx 4.2 ac

∴ "Large Site"

(2) Determine Grid Interval (GI): >30' for large site

$$GI = \sqrt{\frac{A\pi}{SF}} = \sqrt{\frac{182{,}000\ ft^2 \cdot \pi}{480}} = 35'$$

A = area
SF = grid length

Because of continuous & relatively uniform smear zone contamination - use larger GI = 50'

(3) Determine number of sample locations

greater of 12 or 25% of grid nodes

∴ .25 x 66 nodes = 17 locations

(see figure 5.1 for grid layout)

(4) Select 13 grid stations plus 4 additional locations where previous investigations indicate generic cleanup criteria exceedances and with no nearby randomly-selected locations

(5) Random selection of grid stations using column # 2, row # 1 of random numbers table in Guidance Document & proceeding in a downward direction

- selected grid stations 11, 60, 07, 05, 42, 57, 61
  29, 36, 65, 16, 28, 45

4 additional locations - station 13 (near VW5); existing boring SB40-001 - adjacent to MPB; station 31 (near VW2)

∴ Total of 17 soil sampling locations

APPENDIX B

FIELD SAMPLING PLAN

APPENDIX B

FIELD SAMPLING PLAN

B.1 FIELD OPERATIONS

This field sampling plan (FSP) provides guidance for the field procedures to be followed while conducting the activities specified in the Final Confirmation Sampling and Analysis Plan for POL Yard, Sites SS-06 and ST-40, at Wurtsmith AFB, Michigan.

B.1.1 Record Keeping

All field activity information will be recorded in a permanently bound notebook with sequentially numbered pages. The date, job number, and initials will be recorded at the top of each page. Minimum information required for each entry includes:

- Time (recorded in the column under the date),
- Ambient temperature (°F);
- Weather conditions during previous 24 hours;
- Persons performing the drilling, sampling, testing, or other activity;
- Drilling and well construction information;
- Site identification;
- Sampling location;
- Sample number;
- Sample medium (soil or air);
- Sample type (grab, composite, etc.);
- Sample description;
- Chemical analysis to be performed;
- Preservation method;

- Laboratory to which samples were sent and air bill numbers, if applicable;
- Photograph numbers and description;
- Equipment decontaminated and procedures utilized;
- Equipment serial numbers;
- Calibrations;
- Field measurements not recorded on other data sheets;
- Records of pertinent telephone conversations;
- Names, titles, and organization of any visitors entering the site; and
- Comments (suitable for reconstructing incident without memory).

All entries will be made in waterproof ink. Any errors will be corrected by drawing a single line through the mistake, and all corrections will be initialed and dated.

B.1.2 Equipment Decontamination

All downhole equipment will be cleaned before use and between boreholes to prevent cross-contamination. The Geoprobe® drive rods and ancillary equipment will be cleaned using Alconox® detergent, followed by successive potable and distilled water rinses. Prior to sample collection and between each sampling location, the soil sampler(s) and sampling tools will be decontaminated using the following protocol:

- Clean with potable water and phosphate-free laboratory detergent (Alconox® or equivalent);
- Rinse with potable water;
- Rinse with distilled or deionized water; and
- Air dry the equipment prior to use.

All decontamination fluids will be stored in 55-gallon US Department of Transportation (DOT)-approved drums for proper disposal.

B.1.3 Borehole Abandonment

Geoprobe® sampling operations will produce boreholes that are a maximum of 2.5 inches in diameter. Boreholes that do not naturally collapse will be backfilled with bentonite.

B.1.4 Waste Handling

Handling of IDW will follow the base-wide procedures established by ICF Technology, Inc. (1994) and approved by MDEQ and USEPA. IDW will be handled in accordance with the procedures detailed below.

B.1.4.1 General Trash

The general trash that will be generated may include (but is not limited to) such items as packaging material, unused sample containers, cement bags, pallets, wood, and any other non-contaminated trash that may fall under this category. General trash will be disposed of in the same manner as other trash generated on base.

B.1.4.2 Contaminated Clothing, Filters, etc.

The used personal protective equipment and other material that will be generated may include, but are not limited to, such items as Tyvek, clothing, used sample containers, used preservation equipment, used filters, etc. This waste will be placed in heavy-duty plastic bags, removed from the site on a daily basis, and placed in a secured staging area to be designated by Wurtsmith AFB environmental compliance personnel.

B.1.4.2 Drill Cuttings

The use of the Geoprobe® for collecting soil samples will not generate soil cuttings; however, excess soil samples not submitted to the laboratory will be handled in accordance with procedures established by ICF Technology, Inc. (1994) for drill cuttings.

At sites where metal contamination is known or expected based on site history, drill cuttings will be drummed and stored at a central location to be determined by the Base Realignment and Closure (BRAC) Environmental Coordinator (BEC) until procedures for proper disposal are determined. After site work is completed, results of the analysis of soil samples will be reviewed to determine proper disposal. All disposal activities will follow all current state and federal regulations and guidelines. Drums of drill cuttings will be marked with date, site ID, soil boring number, number, and depth interval of cuttings. At other sites, drill cuttings can be spread out at the site as long as they 1) do not have any organic vapor meter readings above background (less than 10 ppmv); 2) are not stained; and 3) do not exhibit any unusual odors. Cuttings which do not meet any one of the three criteria will be drummed and stored as mentioned above, until proper disposal is determined.

At Sites SS-06 and ST-40, soils are not expected to be contaminated with metals. Therefore, cuttings will be screened with an organic vapor meter and examined for physical evidence of contamination (e.g., staining and odors) to determine whether they should be drummed or spread out onsite.

B.1.4.3 Decontamination Water

Decontamination water will be containerized, transported to Building 5092, and discharged into the oil/water separator.

B.2 ENVIRONMENTAL SAMPLING PROCEDURES

B.2.1 Soil Vapor Sampling Procedures

The purpose of soil vapor sampling and analysis is to determine the levels of oxygen (O_2), carbon dioxide (CO_2), and total volatile hydrocarbons (TVH) in the soil gas. These data will be used to estimate levels of contaminants remaining in site soils and to determine *in situ* microbe respiration rates. Soil vapor samples will be collected from all VWs and all MP screened intervals. Soil vapor sampling procedures are described in detail in the *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing* (Hinchee et al., 1992) and summarized below.

Soil vapor samples for both field screening and laboratory analyses initially will be collected in new 3-liter Tedlar® bags. For each sample, the Tedlar® bag will be connected to the sampling point using new Tygon® tubing, and the soil vapor sample will be drawn directly into the bag utilizing a desiccator and vacuum pump. Field measurements for O_2, CO_2, and TVH will be made by connecting the appropriate field instrument to the Tedlar® bag. For laboratory analyses, the sample will be transferred to a 1-liter SUMMA® canister as described below.

Soil vapor samples for laboratory BTEX and TVH analyses will be transferred from a Tedlar® bag to a 1-liter, evacuated, stainless steel SUMMA® canister provided by the analytical laboratory. Because the canisters are evacuated, when they are opened, the sample is collected almost instantaneously by vacuum. According to the laboratory, one does not need to record pressure and temperature because the samples are brought to standard pressure and temperature at the laboratory. Once the sample transfer is complete, the valve on the cylinder will be closed immediately and sealed with tape to prevent reopening. Following is a detailed description of this sampling procedure.

Required Equipment:

Evacuated SUMMA® canisters
A 2-7 micron filter
A 1/2" open end wrench
A 9/16" open end wrench
A hose barb adapter to adapt the threaded fitting on the canister to 3/16" Tygon® tubing.

Assembly of the sampling hardware:

1. Remove the brass cap from the canister.
2. Connect the filter to the canister. Tighten the filter on the canister using the 9/16" wrench.
3. Connect the hose barb to the filter.

4. Connect the well head or the Tedlar® bag to the hose barb using 3/16" Tygon® tubing (using as short a connector as possible).

The assembly is now complete, sampling will commence when the valve on the canister (green handle) is opened.

The Final Step

When the sample interval is complete, close the valve (green handle) on the canister and remove the filter. It is not necessary to over-tighten the valve upon closing. Replace the brass cap. Fill out the sample tracking tag. The canister may now be returned to the laboratory for analysis.

Field soil vapor analyses will be made using a TVH meter for TVH; and an O_2/CO_2 meter for oxygen and carbon dioxide. Laboratory soil vapor samples will be analyzed for specific BTEX and TVH using USEPA Method T0-3.

B.2.2 Field Headspace Screening

A portion of each Geoprobe® core soil sample will be used for field screening for TVH using a TVH analyzer. The soil will be placed into a new, self-sealing plastic bag. After approximately 20 minutes, the TVH concentration in the headspace will be measured by inserting the probe from the TVH analyzer through the plastic bag. Soil samples for laboratory chemical analysis will be chosen based on headspace TVH screening.

B.2.3 Soil Sample Collection and Handling

The purpose of soil sampling and analysis is to determine the concentrations of BTEX and other VOCs in subsurface soils at the two sites. These data will be used to determine whether or not soils have been remediated to levels meeting generic residential criteria (MDEQ, 1998c).

Soil samples will be collected using a Large-Bore® sampler to collect discrete subsurface samples. However, a Macro-Core® sampler, which collects continuous sample cores, may be used in place of, or in addition to, the Large-Bore® sampler, as necessary. The Large-Bore® sampler serves as both the driving point and the sample collection device and is attached to the leading end of the probe rods. To collect a soil sample, the sampler will be pushed or driven to the desired sampling depth, the drive point is retracted to open the sampling barrel, and the sampler is subsequently pushed into the undisturbed soils. The soil cores are retained within clear acetate liners inside the sampling barrel. The probe rods are then retracted, bringing the sampler to the surface. Boreholes will be backfilled with granular bentonite from total depth to the ground surface following extraction of soil samples.

Soil samples for laboratory analysis will be transferred directly form the acetate liners to EnCore™ samplers in preparation for shipment to the laboratory. The following steps will be followed for collecting samples with the EnCore™ samplers:

- Fasten the coring body to the T-handle;
- Using T-handle push sampler into soil until coring body is completely filled;
- Cap coring body while it is still on the T-handle;
- Remove the capped sampler from the T-handle;
- Attach sample label to coring body;
- Return sampler to zipper bag and seal bag; and
- Store on ice.

Soil samples will be properly labeled, wrapped in plastic, placed in a cooler, and maintained at a temperature of approximately 4 degrees centigrade for shipment. A chain-of-custody form will be completed, and the cooler will be shipped to an AFCEE-approved laboratory for sample analysis (see Appendix D).

B.3 FIELD MEASUREMENTS

Typical field parameters that may be measured and the equipment that will be used for the measurements are described in Table B.1. The equipment calibration, maintenance, and decontamination also are described in Table B.1.

B.4 FIELD QA/QC PROGRAM

Field measurement parameters, control checks, control limits, and corrective actions are identified in Table B.2.

B.5 *IN SITU* RESPIRATION TESTING

The *in situ* respiration tests will be conducted as described in the work plan (Parsons ES, 1996a).

TABLE B.1
FIELD MEASUREMENTS

Parameter	Equipment	Calibration	Source of Calibration Standards	Equipment Maintenance
O_2/CO_2	Gastech O_2/CO_2 Meter	two-point calibration	Commercial vendor	Follow manufacturer's procedures
Total Volatile Hydrocarbons	Gastech TVH Meter	two-point calibration	Commercial vendor	Follow manufacturer's procedures

TABLE B.2
FIELD PARAMETERS, CONTROL LIMITS, AND CORRECTIVE ACTIONS

Parameter	Control Checks	Control Limits	Corrective Action [a/]
O_2/CO_2	Calibrate meter	± 0.2 percent	Recalibrate daily, Check battery, Clean filter
Total Volatile Hydrocarbons	Calibrate TVH meter	± 1 ppmv [b/]	Recalibrate daily, Check battery, Clean filter

[a/] Required if control limits not achieved
[b/] ppmv = Parts per million, volume per volume

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APPENDIX C

STANDARD OPERATING PROCEDURES FOR USEPA METHOD SW8260 B

(SPECIALIZED ASSAYS, INC., NASHVILLE, TENNESSEE)

METHOD SW8260B

VOLATILE ORGANIC ANALYSIS BY GC/MS

C1.0 SCOPE AND APPLICATION

This method is suitable for the determination of volatile organics, boiling points less than 200 C, in water and various solid matrices including oils. The estimated quantitation limit will vary with each compound but is about 0.002 mg/L or 0.002 μg/g. For applicable compounds with retention times see chromatogram at end of procedure. This procedure is restricted to use by analysts experienced in purge and trap GC/MS and skilled in the interpretation of mass spectra.

C2.0 SUMMMARY OF METHOD

Volatiles are purged from the matrix using an inert gas, trapped on a solid sorbent, thermally desorbed and quantitated by capillary GC/MS. Identification of targets is accomplished by comparing their mass spectra with the electron impact of spectra of authentic standards. Quantitation is accomplished by comparing the response of a major ion relative to an internal standard.

C3.0 INTERFERENCES

C3.1 Interferences usually consist of elevated SW-846 Method 8260 blanks due to volatiles used in the lab or carryover from a previous sample that was very concentrated. Do not blank subtract. Prep lab personnel are not allowed in volatile lab.

C4.0 APPARATUS AND MATERIALS

C4.1 Gas Chromatograph/Mass Spectrometer - Hewlett Packard 5971 or 5972 MSD. Hewlett Packard 5890-II programmable gas chromatograph. HP Chemstation and Enviroquant software used to control, acquire and process data. Column: DB-VRX 60 m x 0.25mm, 1.4um film thickness.

C4.2 Purge and Trap Device - Tekmar LSC 3000/ALS 2016 or Dynatech PTA30 with Teckmar 3000. Systems must be able to heat soils to 40 C and purge 5.0 ml or 5.0 g of sample.

C4.3 Syringes, Hamilton or equivalent, 10 μl, 25 μl, 50 μl, 100 μl, 500 μl, 1 ml and 5 ml.

C4.4 Balance, top-loading, 0.1 g accuracy, commercial source.

C4.5 Glassware, class A, 10 ml and 100 ml.

C5.0 REAGENTS

C5.1 Methanol - Purge and trap grade or equivalent, commercial source.

C5.2 Reagent Water - Deionized or distilled water in which no interferences are noted at a level above the practical quantitation limit (PQL) for any parameter of interest.

C5.3 Stock VOA Standard - Stock standard solutions (200 µg/ml) may be prepared on a weight/volume basis in methanol using pure standard material, or may be purchased as certified solutions commercially (Ultra DWM-580 or equivalent). Store in amber bottle with a teflon-lined screw cap at -10 C or less. All certified standards are good for 6 months. Second Source Calibration Verification - NSI C-350, 200 µg/ml.

C5.4 Working VOA Standard - Dilute 500 µl of stock VOA standard to 2.0 ml in MeOH for a 50 µg/ml standard. Store at - 10 C or less, good for one week.

C5.5 Synthetic Soil, Sea Sand, precleaned, commercial source.

C5.6 Working Internal and Surrogate Standard - Obtain a 2000 µg/ml internal standard (Ultra STM-341N, chlorobenzene-d5, 1,4-difluorobenzene, 1,4-dichlorobenzene-d4 and pentafluorobenzene) and a 2000 µg/ml surrogate mix (Accustandard M8260A/B-SS, 4-bromofluorobenzene, dibromofluoromethane and toluene-d8). For the working IS/SS standard for the 2016 system dilute 30 µl each to 2.0 ml with MeOH for a 30 µg/ml each standard. Add 5.0 µl to 5.0 ml water sample or to 5.0 g soil for a 30 µg/L or 30 µg/kg solution. For the PTA-30 dilute 2.0 ml of stock to 26.65 ml MeOH for a 150 µg/ml solution. Place in autosample standard syringe, 1.0 µl in 5 ml or 5 g equals 30 µg/L or 30 µg/kg each.

C5.7 4-Bromofluorobenzene (BFB) standard, Accustandard CLP-004-1OOX, 2500 µg/ml or equivalent - dilute 20 µl to 2.0 ml with methanol for a 25 µg/ml standard, use 10 µl per 5.0 ml water for purging (50 µg/L) or inject 2.0 µl for 50 ng.

C5.8 Safety - Treat all chemicals as potential carcinogens. Minimize exposure, wear gloves and prepare all standards in a hood, if possible. MSDS's located in Client Services.

C6.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

C6.1 Aqueous samples should be collected in duplicate using pre-cleaned VOA vials with teflon-lined septa screw cap. Preserve to pH <2 with HCI. Refrigerate at

4 +/- 2 C. Analyze within 14 days. (Non-preserved samples must be analyzed within 7 days).

C6.2 All glassware should be Class A, clean per SOP # 32.

C7.0 PROCEDURE

C7.1 TUNING - The GC/MS system must be tuned to meet the Bromofluorobenzene (BFB) requirements every 12 hours. Inject 2.0 μl of 25 μg/ml BFB working standard onto the GC column and analyze using a 35C to 110 C temperature program ramping at 8 C /min. Display the scan of interest and generate a list of the masses and their percent relative abundances. Compare to the requirements stated below and if the requirements are met, generate a copy of the relevant data. No calibration or sample analysis may begin until a successful tune has been generated.

NOTE: Purging a 50 μg/L BFB standard is acceptable for tuning.

MASS	ION ABUNDANCE CRITERIA
50	15 to 40 % of mass 95
75	30 to 60 % of mass 95
95	BASE PEAK, 100% RELATIVE ABUNDANCE
96	5 to 9 % of mass 95
173	less than 2% of mass 174
174	greater than 50 % of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101 % OF MASS 174
177	5 to 9% of mass 176

C7.2 INITIAL CALIBRATION - A 5 point calibration curve must be generated for every target compound and surrogates. The levels required for initial calibration are 10 ppb, 20 ppb, 50 ppb, 100 ppb and 200 ppb for all surrogates and target compounds. Prepare as follows using the 50 μg/ml working standards:

Each of the five analyses should contain 30 μg/1 of each internal standard.

IS (μl)	SS (μl 50 μg/ml)	VOA Std. (μl of 50 μg/ml)	final vol. (ml)	conc. (μg/L)
5	1	1	5	10
5	2	2	5	20
5	5	5	5	50
5	10	10	5	100
5	20	20	5	200

Analyze each standard and each sample under the same conditions i.e.,: Purge Time: 11.0 minutes; Trap Temp: <30 C; Desorb Time: 2.0 minutes; Desorb Temp: 225 C; Bake Time: 10 minutes; Bake Temp. 250 C; Jacketed Heater: soils to 40 C. Set GC as follows: Init.Temp: 45° C; Time 1: 6.0 minutes; Rate 1: 10.0 C/minute; Final Temp: 190 C; Final Time: 2.0 minutes.

The average response factor and relative standard deviation are calculated for each of the five concentrations, and the 5 point analysis is evaluated for the following:

C7.2.1 The RSD of all target compounds must be less than 15%.

C7.2.2 The 6 CCC compounds (1,1-Dichloroethene, Chloroform, Vinyl Chloride, 1,2-Dichloropropane, Toluene, and Ethylbenzene) must have a relative standard deviation of less than 30 %.

C7.2.3 The 5 SPCC compounds (Chloromethane,1,1-Dichloroethane, Bromoform, 1,1,2,2-Tetrachloroethane, and Chlorobenzene) must have an minimum relative response factor as follows:

Chloromethane and 1,1 DCA	0.1
Bromoform	0.1
Chlorobenzene and TCA	0.3

If the 5 point calibration curve fails to meet these criteria, corrective actions should be taken and the calibration curve re-analyzed. All target compounds are quantitated using linear-regression, the correlation coefficient must be equal or greater than 0.99 or recalibrate. When using regression do not force the line through zero and do not incorporate a zero concentration standard as a sixth point. Verify initial calibration using a 50 ppb second source standard (NSI C-350). Results must be within 20 % or recalibrate.

C7.2.4 Calculate response factor as follows:

RF = (area of ion target x conc. int. std) / (area of ion int. std. x conc. target)

C7.2.5 Calculate final concentration as follows

Conc. (μg/L or μg/kg) = (area target x conc. IS x dilution factor) / (areas IS x RF)

C7.3 DAILY CALIBRATION - After a satisfactory initial calibration curve has been established and verified, the system must be checked every 12 hours using a daily tune standard (50 ng BFB) and a continuing calibration verification standard containing 50 ppb of each target analyte (5 μl of working VOA standard in 5 ml water). After quantitation of the standard, the CCC and SPCC compounds are checked against the 5 point calibration for the criteria described below.

C7.3.1 The 6 CCC compounds must have a relative percent difference of less than or equal to 20 as compared to the 5 point calibration.

C7.3.2 The response factor for the 5 SPCC compounds must be as specified in p.7.2.3.

C7.3.3 The % D ((true calibration.check conc.-measured conc.))(100)/true calibration check conc. of all targets must be equal or less than 20 except for oxygenated compounds which must be equal or less than 40.

C7.3.4 Evaluate the internal standard responses and the retention times. If the RT of any internal standard changes by more than 30 seconds or the area of any internal standard changes by a factor of two, correct problem and reanalyze all affected samples. (see chromatogram at end of SOP)

C7.3.5 If the daily standard does not meet the above criteria, re-prepare the 50 μg/ml solution and re-analyze. If this does not correct the problem, a new 5 point calibration curve must be generated. All data relevant to the 5 point calibration standard and the daily calibration standard should be maintained in the QC data book.

C7.4 METHOD BLANK - Before analysis of each batch of samples, a method blank must be analyzed using 5 ml DI water or 5 g synthetic soil. Fill a 5.0 ml gas tight syringe with DI water, add 5.0 microliters of the IS/SS solution containing 30 μg/ml of each to 5.0 ml of DI water. Fill position on autosampler to be purged. After quantitation, the method blank should not contain any of the analyses of interest at a level greater than the PQL. If any analyte is present at a level greater than the PQL, a new blank must be analyzed until the system is free from any interferences. Surrogate recovery in the blank must conform to at least the criteria listed below:

	WATER	SOIL
4-BFB	86 - 115	74 - 121
DBFM	86 - 118	80 - 120
Toluene-d8	88 - 110	81 - 117
1,2-DCA-d4	80 - 120	80 - 120

If the recovery of the surrogates do not meet the specified criteria, the blank must be reanalyzed. All data relevant to the blank should be filed with other QC data for documentation.

C7.5 SAMPLE ANALYSIS - Allow samples to reach room temperature before analysis. When using the Tekmar 2016 autosampler place 5.0 ml of the sample into the 5.0 ml gas tight syringe and transfer to open position on the 2016 autosampler. Add 5.0 μl of the IS/SS solution containing 30 μg/ml of each internal standard and surrogate standard to the unknown and purge the sample as described above. For soils weigh a 5.0 g aliquot, place in autosampler, place 5.0 ml of DI water in a 5 ml gas-tight syringe, add 5.0 μl of the 30 μg/ml IS/SS internal standard and surrogate standard, add to soil position in autosampler, heat to 40 C and purge as before. When using the Dynatrap PTA-30 autosampler, fill the standard syringe with 150 μg/ml internal standard and surrogates. 1.0 μl is automatically added to each sample for a final concentration of 30 ppb each. The recovery of the internal standards and surrogate standards are calculated and compared to the limits specified above. If recovery is not within the specified range, the sample must be reanalyzed. If reanalysis of the sample does not correct the situation, the system should be examined and action taken to correct the situation. If the concentration of any analyte is above the working range of the instrument (i.e., 200 μg/L), an appropriate dilution of the sample must be analyzed. Use a second unopened VOA vial to repeat analysis or prepare a dilution. The operator's experience with both this method and with the instrument should weigh heavily on the dismissal or acceptance of the data generated. Check the pH of the sample with indicator paper. Note in logbook to nearest whole pH. Dilute water samples by injecting appropriate amount into 5 ml gas-tight syringe partially filled with DI water. For water-miscible liquids prepare a 50 X dilution by injecting 100 μl into a 5 ml DI water in a 5 ml syringe. For soils, dilutions may be made by reducing the amount purged i.e. min. of 1 g or extracting 5 g with 5.0 ml methanol and injecting 100 μl into 5 ml DI water in a 5 ml gas-tight syringe for a 50 X dilution. Do not inject more than 100 μl of methanol per 5 ml water.

C7.6 Determine dilution factor as if 1 g was purged instead of 5 g the enter a dilution factor of 5. Enter in dilution field of LIMS which will multiply the integrated result times that factor. For methanol extractions when using 5 g sample to 5 ml methanol. If needed, determine dilution factor for solids as follows: 5 / ml MeOH purged.

C7.7 All calculations must be performed by the analyst and indicated on the worklist prior to entry into the LIMS.

C8.0 QUALITY CONTROL

C8.1 MATRIX SPIKE / MATRIX SPIKE DUPLICATE/LCS - A matrix spike, matrix spike duplicate and LCS should be analyzed per batch, not to exceed 20 samples of a given matrix. Recovery ranges for matrix spikes shall be within statistically derived limits. After analysis of the original sample, 5.0 ml (water)

or 5.0 g (soil) of the sample is reanalyzed after spiking with 5 µl of working VOA standard (50 ppb) of the target compounds. Check % recovery and confirm that the following are within limits below: 1,1-dichloroethane, trichloroethene, benzene, toluene, and chlorobenzene. If the sample required dilution on the original run in order to bring all analyte concentrations into the calibration range of the instrument, the same dilution should be analyzed for the matrix spike and matrix spike duplicate. The percent recovery and RPD of the matrix spike and spike duplicate compounds is calculated and compared to the QC limits specified:

Compound	%Recovery Water	RPD	%Recovery Soil	RPD Soil
1,1 - DCE	61 - 145	0 - 14	59 - 172	0 - 22
TCE	71 - 120	0 - 14	62 - 137	0 - 24
Benzene	76 - 127	0 - 11	66 - 142	0 - 21
Toluene	76 - 125	0 - 13	59 - 139	0 - 21
Chlorobenzene	75 - 130	0 - 13	60 - 133	0 - 21

All relevant QC requirements as pertains to internal and surrogate standard recoveries is also evaluated. The amount of each of the matrix spike compounds present in the original sample should be subtracted from the values determined by the matrix spike and matrix spike duplicate analyses. The relative percent difference between the matrix spike and matrix spike duplicate is calculated as follows:

$$\frac{[\text{matrix spike}] - [\text{matrix spike duplicate}]}{[\text{matrix spike} + \text{matrix spike duplicate}/2]} * 100\%$$

For every batch, a 50 ppb LCS (laboratory control standard) using 5 µl of working VOA standard containing all target compounds in 5 ml DI water or 5 g synthetic soil must be analyzed. Determine % recovery for each analyte. Recovery must be 70 - 130 % or repeat all affected samples. If any IS/SS fails repeat all samples in the batch.

All QA/QC data pertaining to the calibration procedures (both the initial 5 point calibration curve and all daily standards), all method blanks, and all matrix spike/matrix spike duplicates should be filed in a separate QA/QC file for documentation and quick reference to any sample analyses to which they pertain. All QA/QC data should be approved by the GC/MS supervisor or senior analyst before sample analysis begins.

C8.2 MDL's must be determined yearly per 40 CFR 136 Appendix A. For waters use a 0.002 µg/ml concentration and for soils use 0.005 µg/g. Calculate using the standard deviation of seven consecutive replicates, multiply std. deviation by 3.14. The result must be less than the reporting level.

C8.3 Control charts will be used for trend analysis on the LCS, MS and MSD. These are generated monthly. Examples are attached.

C9.0 REFERENCES

C9.1 SW-846 Method 8260B, Rev.2, Jan 1995

C10.0 CORRECTIVE ACTION

C10.1 Each applicable section contains the required corrective action if specified criteria are outside limits.

C10.2 Most problems may be corrected by changing traps, remaking a standard, performing column maintenance, etc. All maintenance is to be recorded in the maintenance log.

C10.3 If routine maintenance does not correct the problem notify your supervisor immediately.

QUANTITATION REPORT

Data File : C:\HPCHEM\1\DATA\VS0709B.D
Acq Time : 10 Jul 97 9:04 am
Sample : CON CAL
Misc :
Quant Time: Jul 10 14:48 1997

Operator: HP-1
Inst : 5971 - In
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\8260S.M
Title: 8260 VOLATILES
Last Update : Thu Jul 10 09:25:12 1997
Response via : Multiple Level Calibration

Internal Standards		R.T.	QIon	Response	Conc	Units	Dev(Min)
1)	Pentafluorobenzene	13.62	168	216659	30.00	µg/L	0.00
26)	1,4-Difluorobenzene	14.84	114	366683	30.00	µg/L	0.00
42)	Chlorobenzene-d5	19.31	119	90940	30.00	µg/L	0.01
55)	1,4-Dichlorobenzene-d4	23.00	152	128657	30.00	µg/L	0.01
System Monitoring Compounds							% Recovery
21)	1,2-Dichloroethane-d4	13.71	65	109739	30.61	µg/L	102.04%
22)	Dibromofluoromethane	13.06	111	110063	30.19	µg/L	100.64%
38)	Toluene-d8	17.34	98	376667	30.06	µg/L	100.19%
57)	Bromofluorobenzene	20.98	95	127750	28.49	µg/L	94.95%
Target Compounds							
2)	Dichlorodifluoromethane	6.12	85	186330	59.23	µg/L	82
3)	Chloromethane	14.54	50	376323	59.97	µg/L	95
4)	Vinyl Chloride	6.94	62	253476	49.71	µg/L #	1
5)	Bromomethane	7.78	96	156688	51.68	µg/L	97
6)	Chloroethane	8.04	64	190451	48.63	µg/L #	81
7)	Trichlorofluoromethane	9.08	101	202234	40.88	µg/L	96
8)	**Acetone**	**9.24**	**43**	**31561**	**34.49**	**µg/L**	**91**
9)	1,1-Dichloroethene	10.01	96	187731	53.50	µg/L #	75
10)	Methylene Chloride	10.25	84	233754	56.48	µg/L #	67
11)	**Carbon Disulfide**	**10.64**	**76**	**460524**	**52.03**	**µg/L**	**100**
12)	trans-1,2-Dichloroethene	11.33	61	387291	57.15	µg/L #	80
13)	Methyl-t-butyl ether	11.50	73	498449	52.12	µg/L	95
14)	1,1-Dichloroethane	11.71	63	430885	57.19	µg/L #	98
15)	2-Butanone	12.38	43	426491	50.47	µg/L #	75
16)	Diisopropyl ether	12.38	45	854797	53.05	µg/L #	85
17)	cis-1,2-Dichloroethene	12.57	61	302936	56.80	µg/L #	80
18)	Bromochloromethane	12.82	130	125616	54.13	µg/L	95
19)	Chloroform	12.88	83	368126	57.28	µg/L	99
20)	2,2-Dichloropropane	13.00	77	296867	54.47	µg/L	93
23)	1,2-Dichloroethane	13.83	62	246605	52.87	µg/L #	95
24)	1, 1,1-Trichloroethane	13.97	97	289060	55.23	µg/L #	92
25)	1,1-Dichloropropene	14.22	75	318538	57.63	µg/L	97
27)	Carbon Tetrachloride	14.49	117	234181	52.39	µg/L	97
28)	**Benzene**	**14.55**	**78**	**870746**	**53.34**	**µg/L**	**100**
29)	Dibromomethane	15.33	174	106441	50.78	µg/L #	82
30)	1,2-Dichloropropane	15.37	63	233236	52.90	µg/L #	87
31)	Trichloroethene	15.43	130	226180	54.25	µg/L	96
32)	2-Chloro vinyl ether	15.37	63	233236	49.65	µg/L	89
33)	Bromodichloromethane	15.50	129	24602	50.11	µg/L	84
34)	cis-1,3-Dichloropropene	16.36	75	289025	48.93	µg/L	98
35)	4-Methyl-2-Pentanone	16.49	43	196686	49.46	µg/L #	83
36)	trans-1,3-Dichloropropene	16.94	75	226488	46.36	µg/L	97

(#) = qualifier out of range (m) = manual integration

QUANTITATION REPORT

Data File : C:\HPCHEM\1\DATA\VS0709B.D
Acq Time : 10 Jul 97 9:04 am
Sample : CON CAL
Misc :
Quant Time: Jul 10 14:48 1997

Operator: HP-1
Inst : 5971 - In
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\8260S.M
Title: 8260 VOLATILES
Last Update : Thu Jul 10 09:25:12 1997
Response via : Multiple Level Calibration

	Compound	R.T.	Qion	Response	Conc	Units	Dev(Min)
37)	1, 1,2-Trichloroethane	17.18	97	139522	50.70	µg/L	98
39)	**Toluene**	**17.44**	**91**	**834146**	**55.24**	**µg/L**	**100**
40)	1,3-Dichloropropane	17.49	76	267446	49.95	µg/L #	72
41)	2-Hexanone	17.67	43	116832	45.17	µg/L #	82
43)	Dibromochloromethane	17.89	129	152153	49.87	µg/L	97
44)	1,2-Dibromoethane	18.23	107	145042	50.82	µg/L	97
45)	**Tetrachloroethene**	**18.44**	**166**	**197234**	**55.13**	**µg/L**	**91**
46)	1, 1, 1,2-Tetrachloroethane	19.26	131	164922	53.47	µg/L	97
47)	Chlorobenzene	19.37	112	511402	54.28	µg/L	99
48)	**Ethylbenzene**	**19.61**	**91**	**870818**	**54.35**	**µg/L**	**98**
49)	**m,p-Xylene**	**19.86**	**91**	**1285446**	**110.39**	**µg/L**	**97**
50)	Bromoform	20.07	173	78002	45.02	µg/L	99
51)	Styrene	20.32	104	535099	51.77	µg/L	100
52)	**o-Xylene**	**20.42**	**91**	**663923**	**56.39**	**µg/L**	**96**
53)	1, 1, 2,2-Tetrachloroethane	19.25	133	155921	52.91	µg/L	1
54)	1,2,3-Trichloropropane	20.61	110	45211	48.93	µg/L	41
56)	**Isopropylbenzene**	**20.91**	**105**	**878370**	**53.58**	**µg/L**	**97**
58)	Bromobenzene	21.30	77	319968	52.14	µg/L #	82
59)	Propylbenzene	21.55	91	991631	52.99	µg/L #	97
60)	2-Chlorotoluene	21.72	91	562722	54.05	µg/L #	96
61)	4-Chlorotoluene	21.82	91	536284	51.16	µg/L	97
62)	**1, 3,5-Trimethylbenzene**	**21.96**	**105**	**652608**	**53.82**	**µg/L**	**98**
63)	**T-Butylbenzene**	**22.43**	**119**	**609721**	**55.11**	**µg/L**	**98**
64)	**1, 2,4-Trimethylbenzene**	**22.59**	**105**	**637973**	**51.86**	**µg/L**	**100**
65)	**Sec-Butylbenzene**	**22.78**	**105**	**968017**	**55.79**	**µg/L**	**94**
66)	1,3-Dichlorobenzene	22.94	146	343549	50.95	µg/L	99
67)	1,4-Dichlorobenzene	23.05	146	333969	49.49	µg/L	100
68)	1,2-Dichlorobenzene	23.69	146	311233	50.69	µg/L	100
69)	p-Isopropyltoluene	22.43	119	609721	55.03	µg/L #	60
70)	Butylbenzene	23.81	91	676473	51.85	µg/L	92
72)	1, 2,4-Trichlorobenzene	27.57	180	159775	43.19	µg/L	98
73)	Naphthalene	28.16	128	359466	44.32	µg/L	100
74)	Hexachlorobutadiene	28.27	225	125832	51.70	µg/L	96
75)	1, 2,3-Trichlorobenzene	28.63	180	139291	43.00	µg/L	96

(#) = qualifier out of range (m) = manual integration

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

D1 PROJECT DESCRIPTION AND QUALITY ASSURANCE OBJECTIVES

D1.1 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared by Parsons Engineering Science, Inc. (Parsons ES) for the confirmation soil sampling, soil gas sampling, and *in situ* respiration testing at Sites SS-06 and ST-40, Wurtsmith AFB, Oscoda, Michigan. The QAPP will serve as a controlling mechanism during soil and soil gas sampling to ensure that all data collected are valid and reliable, and meet project data quality objectives (DQOs). The primary DQO is to ensure that data are of sufficient quality and quantity to allow an assessment of whether or not MDEQ cleanup criteria are met.

An effective QA program addresses quality objectives for both sampling and analytical methodologies. Field QA efforts are aimed primarily at ensuring that samples are representative of the conditions in the various environmental media at the rime of sampling. Analytical QA efforts are aimed primarily at ensuring that analytical procedures provide sufficient accuracy and precision for quantification of contaminant levels in environmental samples.

D1.2 Project Description

See Sections 1 and 2 of the Confirmation Sampling and Analysis Plan for POL Yard, Site SS-06 and ST-40, Wurtsmith AFB, Michigan.

D1.3 Data Quality Objectives

The primary objective of the quality assurance/quality control (QA/QC) program is to ensure that the procedures followed and data obtained during the course of sampling and testing activities are adequate to determine the degree of cleanup achieved and determine if remaining soil contamination meet MDEQ generic residential cleanup criteria. Specific objectives of the QA/QC program include the following:

- Ensure the use of proper investigative procedures and equipment in the field and the analytical laboratory;
- Specify the responsibilities of contractor personnel under the QA/QC program and specify how the program will be implemented; and

- Maintain a high level of quality during the field testing, data analysis, and report writing phases of the project.

D2 LABORATORY TESTING QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

The QA objectives for all laboratory analyses include considerations of precision, accuracy, completeness, representativeness, and comparability.

D2.1 Precision

The precision of a measurement is an expression of mutual agreement of multiple measurement values of the same parameter conducted under prescribed similar conditions. Precision is evaluated most directly by recording and comparing multiple measurements of the same parameter on the same sample under the same conditions.

For laboratory analyses precision is expressed in terms of relative percent difference (RPD). The RPD is calculated as follows:

$$RPD = \frac{(x_1 - x_2)\ 100}{(x_1 + x_2)/2}$$

where:

x_1 = analyte concentration of primary sample; and
x_2 = analyte concentration of duplicate sample.

Acceptable levels of precision will vary according to the sample matrix, the specific analytical method, and the analytical concentration relative to the method detection limit. Replicate standards and/or spiked samples will be used to estimate the precision of 5 percent (1 in 20) of the analytical test procedures for a known matrix. Precision criteria for the laboratory QC samples are defined by limits listed in Table D.1. An RPD within the control limits indicates satisfactory precision in a measurement system.

D2.2 Accuracy

The term accuracy refers to the correctness of the value obtained from analysis of a sample, and is determined by analyzing a sample and its corresponding matrix spike sample. Accuracy is expressed as percent recovery (PR) and is calculated using the following formula:

$$PR = \frac{(A-B)}{C} \times 100$$

where:

A = spiked sample result (SSR);
B = sample result (SR); and
C = spike added (SA).

TABLE D.1
QUALITY ASSURANCE OBJECTIVES
PRECISION, ACCURACY AND QUANTITATION LIMITS FOR SOIL AND SOIL GAS ANALYSES
QUALITY ASSURANCE PROJECT PLAN
WURTSMITH AFB, MICHIGAN

Parameter/ Method	Analyte	Reporting Units	Maximum PRL	Accuracy (% R)	Precision (% RPD)
Soil					
VOCs	1,2,4-Trimethylbenzene	mg/kg	0.007	65–135	< 30
SW8260B	1,3,5-Trimethylbenzene	mg/kg	0.003	62–135	< 30
	Acetone	mg/kg	0.0088	65–135	< 30
	Benzene	mg/kg	0.002	65–135	< 30
	Carbon disulfide	mg/kg	0.0007	65–135	< 30
	Ethylbenzene	mg/kg	0.003	65–135	< 30
	Isopropylbenzene	mg/kg	0.008	65–135	< 30
	m-Xylene	mg/kg	0.003	65–135	< 30
	n-Butylbenzene	mg/kg	0.005	65–135	< 30
	n-Propylbenzene	mg/kg	0.002	65–135	< 30
	o-Xylene	mg/kg	0.005	65–135	< 30
	p-Xylene	mg/kg	0.007	65–135	< 30
	Sec-Butylbenzene	mg/kg	0.007	65–135	< 30
	Tert-Butylbenzene	mg/kg	0.007	65–135	< 30
	Tetrachloroethene	mg/kg	0.007	61–135	< 30
	Toluene	mg/kg	0.005	64–135	< 30
Soil Gas					
TO-3	Benzene	ppbv	0.50	75-125	< 30
	Toluene	ppbv	0.50	75-125	< 30
	Ethylbenzene	ppbv	0.50	75-125	< 30
	Total Xylenes	ppbv	0.50	75-125	< 30
	TVH	ppbv	10.0	75-125	< 30

The degree of accuracy and the recovery of analyte to be expected for the analysis of QA samples and spiked samples is dependent upon the matrix, method of analysis, and compound or element being determined. The concentration of the analyte relative to the detection limit is also a major factor in determining the accuracy of the measurement. The practical quantitation limit (PQL) for most analyses is generally stated in the analytical method. Certified standards and/or spiked samples will be used to estimate analyte recovery for each test procedure for a known matrix. The accuracy of gas chromatography (GC) analyses is compound- and matrix-dependent. Thus matrix spike recovery is used to determine the effect of the matrix, and a laboratory control sample is used to determine accuracy of the analyses. The recovery of analytes in a soil matrix is often lower than that obtainable for liquid matrices. As for precision, replicate standards and/or spiked samples will be used to estimate the accuracy of 5 percent (1 in 20) of analytical test procedures for a known matrix. Accuracy criteria for the laboratory QC samples are defined by control limits listed in Table D.1.

D2.3 Completeness

The completeness of the data is the amount of valid data obtained from the measurement system (field and laboratory) versus the amount of data expected from the system. At the end of each sampling event, an assessment of the completeness of data will be performed and, if any sample omissions are apparent, an attempt will be made to resample if feasible. Resampling for laboratory analyses is not feasible, therefore, it is critical that holding times are met and that the laboratory inform the deputy project manager if any containers were broken during shipping. In addition, data completeness will be assessed prior to the preparation of data reports.

D2.4 Representativeness

Samples taken must be representative of the population. A random sampling grid system will be employed for soil samples to ensure they represent site conditions. To assess the representativeness of the samples, some samples will be collected in replicate. Comparisons of the results from the original sample and its field replicate will allow for an evaluation of the representativeness of the samples.

D2.5 Comparability

Where appropriate, the results of the analyses obtained during this effort may be compared with the results obtained in previous studies. Consistency in the acquisition, handling, and analysis of samples by US Environmental Protection Agency (USEPA) recommended procedures is necessary in order that the results may be compared. To this end, standard solutions and materials used in calibrating field and laboratory analytical instruments must be traceable to National Bureau of Standards (NBS) or USEPA standards, and published analytical methods will be followed. Any deviations from the specified analytical protocol will be documented by the laboratory.

D3 SAMPLE HANDLING

D3.1 Sample Handling, Packaging, and Shipment

D3.1.1 Sample Containers

Laboratory samples will be submitted in either EnCore™ Samplers (soil) or SUMMA® canisters (soil gas) as listed on Table D.2. The samples will be carefully packed for shipment. The pre-cleaned SUMMA® canisters will be obtained from the analytical laboratory, and the EnCore™ Samplers will be obtained from either the analytical laboratory or manufacturer. The soil samples will be placed into insulated shipping coolers with a plastic bag of ice. To prevent condensation, soil gas sample containers will not be packed with ice. A chain-of-custody record describing the contents of the cooler will be placed in a sealed plastic bag and taped to the upper lid of the cooler. When coolers are delivered to the shipping company, they will be taped shut with security labels taped over opposite ends of the lid.

D3.1.2 Sample Sealing and Labeling

Laboratory sample containers will be labeled and sealed with a clear adhesive tape. The label will include the sample numbers assigned according to the sample numbering system.

D3.1.3 Sample Numbering System

Each laboratory sample will be assigned a unique sample identification number that describes where the sample was collected. Each number will consist of a group of letters and numbers, separated by hyphens.

D3.1.4 Preservatives and Holding Times

After samples have been taken, they will be delivered to the laboratory for analysis as soon as possible after collection in order to ensure that the most reliable and accurate answers will be obtained as a result of the analysis. Holding times and preservation methods are specified in Table D.2. The holding time begins at the date and time of collection in the field.

D3.2 Shipping Requirements

Shipping containers will be secured by using nylon strapping tape and custody seals to ensure that the samples are not disturbed during transport. The custody seals will be placed such that the containers cannot be opened without breaking the seal.

Soil samples which must be kept cool will be shipped in insulated containers with either freezer forms or ice. If ice is used, it will be placed in a container so that the water will

TABLE D.2
SAMPLE CONTAINERS, SAMPLE PRESERVATION METHODS, AND HOLDING TIMES FOR SOIL AND SOIL GAS SAMPLES
WURTSMITH AFB, MICHIGAN

Analytical Parameter	Analytical Method	Sample Containers		Preservation Method	Holding Time
		Quantity	Type		
Volatile Organic Compounds (VOCs)	SW5035/SW8260B	3	EnCore® Sampler	4°C/ methanol extraction	48 hours from collection to extraction 14 days from collection to analysis
Total Volatile Hydrocarbons and BTEX	TO-3	1	1-liter Summa® canister	None	14 days

not fill the cooler as the ice melts. The samples will be delivered as soon as possible after collection to allow the laboratory to meet holding times.

Copies of the signed chain-of-custody forms will be delivered to Parsons ES with the data packages. The originals will remain on file with the laboratory.

D3.3 Laboratories

All soil and soil vapor samples will be shipped to an approved laboratory. Soil samples will be analyzed by Specialized Assays, Inc. of Nashville, Tennessee, which is an AFCEE- and State of Michigan-approved laboratory. Soil gas samples will be analyzed by Air Toxics, Ltd. of Folsom, California; an AFCEE-approved laboratory.

D3.4 Sample Receipt

The laboratory will sign the chain-of-custody upon receipt, keep the original, and immediately send a signed copy, which describes sample conditions upon receipt, back to the Parsons ES site manager. The condition of the samples and temperature of the cooler will be documented in a signed, dated, and bound log book and on the chain-of-custody form with signature and date of person checking samples. If any breakage occurs or discrepancy arises between chain-of-custody, sample labels, and requested analysis, the sample custodian will notify the Parsons ES site manager immediately. Any breakage, discrepancy, or improper preservation will be noted by the laboratory on an out-of-control form with the corrective action taken. The out-of-control form will be signed and dated by the custodian and any other person responsible for corrective action.

D4 SAMPLE CUSTODY

All samples will be accompanied by a chain-of-custody record. A chain-of-custody record will accompany the sample during shipment to the laboratory and through the laboratory. The Parsons ES field sampler will deliver a copy of each chain-of-custody record to the study manager for tracking purposes.

The information provided on the chain-of-custody record will include:

- The project name and the site name;
- The signature of the samplers;
- The sampling station number or sample number;
- Date and time of collection;
- Grab or sample designation;
- A brief description of the type of sample and sampling location;
- Signature of individuals involved in the sample transfer;

- The time and date they received the sample;
- The type of matrix;
- The preservatives used; and
- The analytical methods required; and
- The number of containers of each sample.

Chain-of-custody records initiated in the field will be placed in a plastic cover and taped to the inside of the shipping containers used for sample transport from the field to the laboratory. This record will be used to document sample custody transfer from the field sampler to the laboratory or to a Parsons ES office.

D4.1 Sample Custody

A sample is under custody if:

- It is in an individual's actual possession; or
- It is in an individual's view, after being in your physical possession; or
- It was in physical possession and then locked up by the individual to prevent tampering; or
- It is in a designated and identified secure area.

D4.2 Transfer of Custody and Shipment

The following procedures will be used in transferring and shipping samples:

- Samples are accompanied by a chain-of-custody record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the field sampler to another person, or to the laboratory.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed chain-of-custody record enclosed in each sample box or cooler. The chain-of-custody records will be numbered 1 of N, 2 of N, ..., where N is equal to the number of coolers shipped that day.
- Whenever samples are split with a facility or government agency, a separate chain-of-custody record will be prepared for those samples and marked to indicate with whom the samples are being split.
- All packages will be accompanied by the chain-of-custody record showing identification of the contents. The original record will accompany the shipment and copies will be retained by the field sampler and in the Parsons ES Denver office.

D4.3 Laboratory Custody Procedures

The analytical laboratory will, as a minimum, record the temperature of the shipping container, check all incoming samples for integrity, and note any observations on the original chain-of-custody record. Each sample will be logged into the laboratory system by assigning it a unique sample number. This number and the field sample identification number will be recorded on the laboratory report. Samples will be stored and analyzed according to specific USEPA methods. After the project is completed, the original chain-of-custody record will be returned to the project manager for permanent storage.

The following procedure will be used by the laboratory sample custodian in maintaining the chain-of-custody once the samples have arrived at the laboratory:

- The samples received by the laboratory will be cross-checked to verify that the information on the sample labels matches that on the chain-of-custody record included with the shipment;
- If all data and samples are correct, and there has been no tampering with the custody seals, the "received by laboratory" box is signed and dated; and
- The samples will be distributed to the appropriate analysts, with names of individuals who receive samples to be recorded in internal laboratory records.

For data that are input by an analyst and processed using a computer, a copy of the input will be kept and identified with the project number and other information, as necessary.

If the data are directly acquired from instrumentation and processed, the analyst will verify that the following are correct:

- Project and sample numbers;
- Calibration constants and response factors;
- Output parameters such as units of measurement; and
- Numerical values used for detection limits if a value is reported as "less than".

D5 ANALYTICAL PROCEDURES

Specific chemical parameters for the sampling program were selected based on chemicals of potential concern (COPCs) at Sites SS-06 and ST-40. The analytical program was designed to qualify and quantify the effect of bioventing on soil contaminants and levels of any contaminants remaining in site soils.

D5.1 Analyses for Organic Compounds

All analyses will be performed within the holding times recommended for the specific test procedure and sample matrix. Samples will be collected and shipped in USEPA recommended sample containers and preserved as required for specific tests as specified on Table D.2.

D5.2 Detection Limits

The project reporting limits (PRLs) for the soil and soil vapor analyses are listed on Table D.1.

D6 DATA REDUCTION, VALIDATION AND REPORTING

D6.1 Field Measurement Data

Field measurements will be made by the technician or the test engineer. The following standard reporting units will be used during all phases of the project:

- Soil sampling depths will be reported to the nearest 0.5 foot.
- TVH concentrations will be reported to the nearest 1.0 ppmv.
- Oxygen and carbon dioxide will be reported to the nearest 0.1 percent.

Field data will be validated using three different procedures:

- Routine checks will be made during the processing of data. An example is looking for errors in identification codes.
- Internal consistency of a data set will be evaluated. This step may involve plotting the data and testing for outliers.
- Checks may be made for consistency with parallel data sets, that is, data sets obtained presumably from the same population (for example, from the same volume of soil).

The purpose of these validation checks and tests is to identify outliers (i.e., an observation that does not conform to the pattern established by other observations). Outliers may be the result of transcription errors or instrumental breakdowns. Outliers may also be manifestations of a greater degree of spatial or temporal variability than expected.

After an outlier has been identified, a decision concerning its fate must be rendered. Obvious mistakes in data will be corrected when possible, and the correct value will be inserted. If the correct value cannot be obtained, the data may be excluded. An attempt will be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may be excluded, but a note to that effect will be included in the report.

D6.2 Data Analysis and Reporting

During data analysis and report preparation, the accuracy of numbers, calculations, tables, and figures will be reviewed and confirmed. In addition, the technical content of the report will be reviewed by the study manager and technical director, and the report will be edited for syntax, grammar, composition, and printed quality.

Data will be reported in AFCEE level 1 format. Data analysis reports will be issued to Parsons ES Denver within 30 days of receipt of samples. All data packages will be submitted to the deputy project manager and will include soil and soil gas analysis results. A copy of the chain-of-custody record will be submitted with the analysis results.

D7 FIELD AND LABORATORY CONTROL CHECKS

D7.1 Field Quality Control Samples

During each sampling effort, a number of QC samples must be collected and submitted for laboratory analysis. The number and frequency of the QC sample collection will be 5 percent (or 1 for every 20 samples). A list of the types of QC samples that will be collected along with a brief description of each sample type are outlined in the following sections.

D7.1.1. Field Replicates

Ten percent of all soil samples will be collected in replicate and submitted for laboratory analysis. For example, if 23 samples are collected, then 3 field replicates will be collected. Field replicates will be labeled in such a manner so that persons performing laboratory analyses are not able to distinguish replicates from other collected samples.

D7.2 Laboratory Quality Control Data

Laboratory QC data are necessary to determine the precision and accuracy of the analyses, confirm matrix interferences, and demonstrate target compound contamination of sample results. QC samples will be analyzed routinely by the analytical laboratory as part of the laboratory QC procedures. Contract laboratories performing definitive data quality analyses require a more stringent QC program than those performing screening-level data quality analyses. Definitions for QC samples are presented below. Frequency and acceptance requirements are defined in Table D.3.

TABLE D.3
SUMMARY OF CALIBRATION AND QC PROCEDURES
QUALITY ASSURANCE PROJECT PLAN
WURTSMITH AFB, MICHIGAN

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a/]
SW8260B	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥ 0.30[b/] and %RSD for RFs for CCCs ≤ 30% and one option below	Correct problem then repeat initial calibration
				option 1 linear- mean RSD for all analytes ≤ 15% with no individual analyte RSD >30%	
				option 2 linear – least squares regression r > 0.995	
				option 3 non-linear – COD ≥ 0.990 (6 points shall be used for second order, 7 points shall be used for third order)	
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration
		Retention time window calculated for each analyte	Each sample	Relative retention time (RRT) of the analyte within ± 0.06 RRT units of the RRT	Correct problem then reanalyze all samples analyzed since the last retention time check
		Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF ≥ 0.30[c/]; and CCCs ≤ 20% difference (when using RFs)or drift (when using least squares regression or non-linear calibration)	Correct problem then repeat initial calibration
				All calibration analytes within ±20% of expected value	
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyte	QC acceptance criteria, Table B.1	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria
		ISs	Immediately after or during data acquisition for each sample	Retention time ±30 seconds from retention time of the mid-point std. in the ICAL. EICP area within -50% to +100% of ICAL mid-point std.	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning

TABLE D.3 (Continued)
SUMMARY OF CALIBRATION AND QC PROCEDURES
QUALITY ASSURANCE PROJECT PLAN
WURTSMITH AFB, MICHIGAN

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]
SW8260B (Cont.)	Volatile Organics	Method blank	One per analytical batch	No analytes detected ≥ PRL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table D.1	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table D.1	none
		Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description	Retune instrument and verify
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table D.1	Correct problem then reextract and analyze sample
		MDL study	Once per 12 month period	Detection limits established shall be ≤ ½ the PRLs in Table D.1	none
		Results reported between MDL and PRL	none	none	none
TO-3	BTEX, TVH	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	RSD[c] < 20% for CFs[d] or RFs[e] or >/= 0.995 correlation coefficient (RSD < 10% for E502.2)	Correct problem then repeat initial calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration
		Retention time window calculation for each analyte	Each initial calibration and calibration verifications	±3 times standard deviation for each analyte retention time from 72-hour study	Correct problem the reanalyze all samples analyzed since the last successful retention time check
		Calibration verification	Daily, before sample analysis, every 12 hours of analysis time	All analytes within ± 25% of expected value	Correct problem then repeat initial calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria, Table D.1	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria

TABLE D.3(Concluded)
SUMMARY OF CALIBRATION AND QC PROCEDURES FOR METHOD SW8260B
QUALITY ASSURANCE PROJECT PLAN
WURTSMITH AFB, MICHIGAN

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]
TO-3 (Cont.)		Check of mass spectral ion intensities using BFB[n/]	Prior to initial and calibration verification	Refer to criteria listed in the method description	Retune instrument and verify
	BTEX, TVH	IS[o/]	Every sample, spiked sample, standard, and method blank	Retention time ±30 seconds: IS area within -50% to +100% of last calibration verification (12 hours) for each	Inspect mass spectrometer or GC[p/] for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning
		Method blank	One per analytical batch	No analytes detected > reporting limit	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table D.1	Correct problem then reprep and analyze the LCS and all samples in the affected analytical batch
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table D.1	Correct problem then re-extract and analyze sample
		MDL study	Once per 12 months	Detection limits established shall meet reporting limit requirements	Re-establish MDL

a/ All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
b/ Except > 0.10 for bromoform, and > 0.10 for chloromethane and 1,1-dichloroethane

D7.2.1 Holding Time

Holding times for sample extraction and/or analysis as required by the methods will be met for all samples. The holding time is calculated from the date and time of sample collection to the time of sample preparation and/or analysis. All sample analyses, including extractions, dilutions, and second-column confirmation, will meet the required holding times.

D7.2.2 Method Blanks

Method blanks are designed to detect contamination of the field samples in the laboratory environment. Method blanks verify that interferences caused by contaminants in solvents, reagents, glassware, or in other sample processing hardware are known and minimized. The method blank will be ASTM Type II water (or equivalent) for water samples, and a purified solid matrix (Ottawa sand or equivalent) for soil samples. The concentration of target compounds in the blanks must be less than or equal to one half the PRL. Exceptions are not made for common laboratory contaminants. If the blank contaminant concentration is not less than the specified limit, then the source of contamination will be identified, and corrective action will be taken. Sample quantitation limits (SQLs) and detection limits will not be raised because of blank contamination. Analytical data will not be corrected for presence of analytes in blanks.

D7.2.3 Laboratory Control Samples

Laboratory control samples (LCSs) are blank spikes made from clean laboratory-simulated matrices (reference method blank matrices) spiked with known concentrations of all target analytes of interest at levels approximately 10 times the method detection limits (MDLs). The LCS is carried through the complete sample preparation and analysis procedures. LCSs are designed to check the instrument and method accuracy. An LCS will be analyzed with every analytical batch. Failure of the LCS to meet PR criteria requires corrective action before any further analyses can continue. All sample results associated with the out-of-control LCS must be reanalyzed after control has been reestablished.

D7.2.4 Surrogate Spike Analyses

Surrogate spike analyses are used to determine the efficiency of analyte recovery in sample preparation and analysis in relation to sample matrix. Calculated PR of the spike is used to measure the accuracy of the analytical method for an individual sample. A surrogate spike is prepared by adding to an environmental sample (before extraction) a known concentration of a compound similar in type to the target analytes (i.e., a surrogate compound) to be analyzed for organic target compounds. Surrogate compounds as specified in the methods will be added to all samples analyzed, including method blanks, MS/MSDs, LCSs, field samples, and replicate samples. Failure of the surrogate to meet PR criteria requires corrective action.

D7.2.5 Matrix Spike/Duplicate Spike Analyses

This technique is used to determine the effect of matrix interference on the results for the GC/MS methods. Aliquots of the same sample are prepared in the laboratory and each aliquot is treated exactly the same throughout the analytical method. Spikes are added at concentrations specified in the method. The percent difference between the values of the duplicates is taken as a measure of the precision of the analytical method.

Selected samples will be spiked to determine accuracy as a percentage recovery of the analyte from the sample matrix. These matrix spikes will be prepared using reagent grade salts, pure compounds, or certified stock solutions whenever possible. Concentrated solutions will be used to minimize differences in the sample matrix resulting from dilution. Samples will be randomly selected and split into identical duplicates, one of which will then be spiked with a known mass of the analyte to be determined. The final concentration after spiking should be within the same range as the samples being analyzed to avoid the need for dilution, attenuation of instrument outputs, or other required alterations in the procedure which might affect the instrument response and determination of accuracy. A matrix spike duplicate sample is prepared in the same manner as the matrix spike sample.

D7.2.6 Analytical Batches

Analytical batches will be designated in the laboratory at a minimum of one batch per sample delivery group (SDG). Each SDG will be comprised of a maximum of 20 project samples of similar matrix collected within a 7-day period. Included in each SDG of 20 (or fewer) samples per analytical method will be an analytical batch identification number. This identification number will clearly allow a reviewer to determine the association between field samples and QC samples. Analytical batches also will be inclusive of preparation lots and calibration periods.

D7.2.7 Retention Times

Retention time (RT) is the amount of time required for a target compound to elute from the chromatographic column, and the instrument detector to record a signal response. The RT window is the allowable deviation from the true expected RT for any one compound. A peak response within this RT window will constitute a positive detection for that compound. RT windows are QC criteria for all GC and high-performance liquid chromatography (HPLC) methods. RT windows are determined through replicate analyses of a standard over multiple days. The calculation of RT windows is described in USEPA (1996) Method SW8000B. Corrective action is required when the RT windows are out of control.

D7.2.8 Internal Standards

Internal standards (ISs) are compounds of known concentrations used to quantitate the concentrations of target detections in field and QC samples. ISs are added to all samples after sample extraction or preparation. Because of this, ISs provide for the accurate quantitation of target detections by allowing for the effects of sample loss

through extraction, purging, and/or matrix effects. ISs are used for any method requiring an IS calibration. Corrective action is required when ISs are out of control.

D7.2.9 Second-Column Confirmation

Quantitative confirmation of results at or above the MDL for samples analyzed by GC or HPLC will be required and will be completed within the method-required holding times. For GC methods, a second column is used for confirmation. For HPLC methods, a second column or a different detector is used. The result of the first column/detector will be the result reported.

D7.2.10 Calibration Requirements

Analytical instruments will be calibrated in accordance with the analytical methods. All analytes reported will be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in Table D.1. Records of standard preparation and instrument calibration will be maintained by the contract laboratory. Records will unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards will be traceable to standard materials.

Analyte concentrations are determined with either calibration curves or response factors (RFs). For GC and GC/mass spectroscopy MS methods, when using RFs to determine analyte concentrations, the average RF from the initial five-point calibration will be used. The continuing calibration will not be used to update the RFs from the initial five-point calibration.

D7.2.11 Standard Materials

Standard materials used in calibration and to prepare samples will be traceable to National Institute of Standards and Technology, USEPA, American Association of Laboratory Accreditation, or other equivalent approved source, if available. The standard materials will be current, in accordance with the following expiration policy: The expiration dates for ampulated solutions will not exceed the manufacturer's expiration date or 1 year from the date of receipt, whichever occurs first. Expiration dates for laboratory-prepared stock and diluted standards will be no later than the expiration date of the stock solution or material, or the date calculated from the holding time allowed by the applicable analytical method, whichever occurs first. The laboratory will label standard and QC materials with expiration dates.

D8 PREVENTIVE MAINTENANCE

All field equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations. Maintenance records will be documented and traceable to specific equipment.

All laboratory instruments will be maintained in accordance with the standard operating procedures for each instrument. All maintenance will be documented for each analytical instrument.

D9 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, including malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted at the project site, laboratory, or subcontractor locations, the cause of the condition will be determined, and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the study manager, QA manager, site investigation geologist, test engineer, and involved subcontractor management, as a minimum. Implementation of corrective action will be verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

Corrective actions may be initiated as a minimum:

- When predetermined acceptance standards are not attained (objectives for precision, accuracy, and completeness);
- When procedures or data compiled are determined to be faulty;
- When equipment or instrumentation is found faulty;
- When samples and test results cannot be traced with certainty;
- When QA requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment; or
- As a result of QA audits.

APPENDIX B

FIELD BOREHOLE LOGS

GEOLOGIC BORING LOG

BORING NO. SB1 CONTRACTOR: DATE SPUD: 10/13/98 1422
CLIENT: Wurtsmith RIG TYPE: Geoprobe DATE CMPL: 10/13/98
JOB NO.: 726876.69120 DRLG METHOD: ELEVATION:
LOCATION: ST 40 BORING DIA.: 2.5" TEMP.:
GEOLOGIST: JFH DRLG FLUID — WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	1		SP	Sand - md. gr, lt brn, moist		0-4			
									0.0/0.0
	5			SAA		4-8			
									0.0/0.0
				SAA					
	10					8-12			
									0.0/60
				SAA sl. odor					
						12-16			
	15								
									40/120
				SAA sl. odor		16-18			
									40/60
				SAA sl. odor, v. moist @ 19'		18-19			40/60
	20								
	25								
	30								

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery

Core lost

Water level drilled

Sheet 1 of 1

GEOLOGIC BORING LOG

BORING NO. SB2 | CONTRACTOR: | DATE SPUD: 10/13/94 1630
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/13
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: ST-40 | BORING DIA.: 2.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	Sand, md, lt brn, moist		0-4			
									40/40
				SAA		4-8			
									40/40
				SAA		8-12			
									40/40
				SAA		12-16			
									20/40
				SAA		18-20			
				grey @ 19' - fuel odor					20/40

sl – slight; tr – trace; sm – some; & – and; @ – at; w – with
v – very; lt – light; dk – dark; bf – buff; brn – brown; blk – black
f – fine; m – medium; c – coarse; BH – Bore Hole; SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost
Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB3 | CONTRACTOR: | DATE SPUD: 10/14/98 0845
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/14
JOB NO.: 726876.6920 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Profile	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	Sand, med-grained, lt brn					
				moist					
	5								
	10								
	15								
	20			SAA		18-20			
				SAA, fuel odor	lab	20-22			20/180
				wet @ 21.8' 22'					

sl – slight | v – very | f – fine
tr – trace | lt – light | m – medium
sm – some | dk – dark | c – coarse
& – and | bf – buff | BH – Bore Hole
@ – at | brn – brown | SAA – Same As Above
w – with | blk – black

SAMPLE TYPE
D – DRIVE C Core recovery
C – CORE
G – GRAB Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB4 | CONTRACTOR: | DATE SPUD: 10/14/98 0945
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/14
JOB NO.: 726876.64130 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 1 1/2" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20								
			SP	SAND, md., lt brn, v.mo.st grey stain, fuel odor		20-22			0/2,900

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery

Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB5 | CONTRACTOR: | DATE SPUD: 10/14/98
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/14
JOB NO.: 726876.64120 | DRLG METHOD: | ELEVATION:
LOCATION: SSO6 | BORING DIA.: 1 1/2 " | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
			SP	SAND, md. lt. brn, moist		10-12			0/~~40~~ 0/40
	15								
	20						X		
			SP	SAA, fuel odor wet @ 23' grey stain		21-23			0/1860

sl – slight; tr – trace; sm – some; & – and; @ – at; w – with
v – very; lt – light; dk – dark; bf – buff; brn – brown; blk – black
f – fine; m – medium; c – coarse; BH – Bore Hole; SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB
C Core recovery
Core lost
Water level drilled

Sheet 1 of 1

GEOLOGIC BORING LOG

BORING NO. SB6 | CONTRACTOR: | DATE SPUD: 10/15/98 0830
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSO6 | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20								
			SP	SAND, med. grained, lt. brn,		21-23			
				mo. st, fuel odor, wet @					0/1100 x 2
				22.5					

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost
Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB7 CONTRACTOR: DATE SPUD: 10/14/98 1650
CLIENT: Wurtsmith RIG TYPE: Geoprobe DATE CMPL: 10/14
JOB NO.: 726876.69120 DRLG METHOD: ELEVATION:
LOCATION: SSO6 BORING DIA.: 1.5" TEMP.:
GEOLOGIST: JFH DRLG FLUID — WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
			SP	SAA		18-20			
	20			Grey stain @ 19.9', v moist					0/640

sl – slight v – very f – fine
tr – trace lt – light m – medium
sm – some dk – dark c – coarse
& – and bf – buff BH – Bore Hole
@ – at brn – brown SAA – Same As Above
w – with blk – black

SAMPLE TYPE
D – DRIVE C Core recovery
C – CORE
G – GRAB Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB8 | CONTRACTOR: | DATE SPUD: 10/10/98 1710
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/14
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20		SP	SAND, md. lt. brn, moist -		19-21			
				v. mo.st, grey stain,					0/3540
				fuel odor					

sl – slight | v – very | f – fine
tr – trace | lt – light | m – medium
sm – some | dk – dark | c – coarse
& – and | bf – buff | BH – Bore Hole
@ – at | brn – brown | SAA – Same As Above
w – with | blk – black

SAMPLE TYPE
D – DRIVE C Core recovery
C – CORE
G – GRAB Core lost

Water level drilled

Sheet 1 of 1

GEOLOGIC BORING LOG

BORING NO. SB 9 | CONTRACTOR: | DATE SPUD: 10/5/98 0830
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/5
JOB NO.: 726876.64120 | DRLG METHOD: | ELEVATION:
LOCATION: SS06 | BORING DIA.: 2.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	SAND, md., lt. brn, moist		0-4			
									0/20 0/0
	5			SAA		4-8			
									0/0
				SAA		8-12			
	10								
									0/0
				SAA		12-14			
									0/20×2
	15								
	20								
				SAA gray @ ~21' wet at		20-22			
				~21.5					0/3200×2

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB10 | CONTRACTOR: | DATE SPUD: 10/15/88 1240
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSOC | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20								
			SP	SAND, md. grained, v. moist grey, fuel odor		21-23			0/960

sl – slight; tr – trace; sm – some; & – and; @ – at; w – with
v – very; lt – light; dk – dark; bf – buff; brn – brown; blk – black
f – fine; m – medium; c – coarse; BH – Bore Hole; SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost
Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB11 | CONTRACTOR: | DATE SPUD: 10/16/98
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/16/98
JOB NO.: 776876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JEH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20		SP	SAND, lt. brn, gray stain wet @ 21'		19-21			0/1180

sl – slight; tr – trace; sm – some; & – and; @ – at; w – with
v – very; lt – light; dk – dark; bf – buff; brn – brown; blk – black
f – fine; m – medium; c – coarse; BH – Bore Hole; SAA – Same As Above

SAMPLE TYPE
D – DRIVE; C – CORE; G – GRAB
C Core recovery
Core lost
Water level drilled

Sheet 1 of 1

GEOLOGIC BORING LOG

BORING NO. SB12 | CONTRACTOR: | DATE SPUD: 10/15/98 1410
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15
JOB NO.: 726876.64120 | DRLG METHOD: | ELEVATION:
LOCATION: SS06 | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20								
			SP	SAND, md grained, v. mo.st lt brn,		20-22			0/320

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery

Core lost

Water level drilled

GEOLOGIC BORING LOG

JFH

BORING NO. SB143 | CONTRACTOR: | DATE SPUD: 10/16/98
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/16/98
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SJOG | BORING DIA.: 2.5 | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	SAND, lt. brn, mc. JT		0-4			0/20
	5			SAA		4-8			0/40
	10			SAA		8-12			0/40
	15			SAA		12-16			0/40
	20			SAA, gray stain, fuel oder wet @ 21'		19-21			0/6,200

sl – slight | v – very | f – fine
tr – trace | lt – light | m – medium
sm – some | dk – dark | c – coarse
& – and | bf – buff | BH – Bore Hole
@ – at | brn – brown | SAA – Same As Above
w – with | blk – black

SAMPLE TYPE
D – DRIVE C Core recovery
C – CORE
G – GRAB Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB184 (SB184 JFH) | CONTRACTOR: | DATE SPUD: 10/15/98
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15/98
JOB NO.: 726876.64120 | DRLG METHOD: | ELEVATION:
LOCATION: SS06 | BORING DIA.: 2.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID —— | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	SAND, lt brn, moist		0-4			
									0/40
	5			SAA sl fuel odor		4-8			
									0/320
				SAA sl fuel odor		8-12			
	10								0/540
				SAA sl. fuel odor		12-14.5			0/380
	15								
	20			SAA, gray stain, fuel odor		19-21			0/5,100

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost
Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB15 | CONTRACTOR: | DATE SPUD: 10/15/98
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 2.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	SAND, md., lt brn, moist		0-4			
									0/40
	5			SAA		4-8			
									0/80
				SAA		8-12			
	10								
									0/100
				SAA		12-15			
	15								0/80
	20								
				SAND, md. grained lt brn		20-22			
				sl. grey stain, sl. fuel odor					0/480

sl – slight | v – very | f – fine
tr – trace | lt – light | m – medium
sm – some | dk – dark | c – coarse
& – and | bf – buff | BH – Bore Hole
@ – at | brn – brown | SAA – Same As Above
w – with | blk – black

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. SB16 | CONTRACTOR: | DATE SPUD: 10/15/98
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 2.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID | WEATHER:
COMMENTS:

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
			SP	SAND		0-4			
									0/140
	05		SP	SAA		4-8			
			ML	SILT, v. moist-wet	Lab				0/520
				fine odor					
	10					8-12			
									0/180
			SP	SAND, med. grained, lt. brn		12-15			
				moist					
	15								0/220
	20		SP	SAA	lab	19-21			
									0/580

sl – slight | v – very | f – fine
tr – trace | lt – light | m – medium
sm – some | dk – dark | c – coarse
& – and | bf – buff | BH – Bore Hole
@ – at | brn – brown | SAA – Same As Above
w – with | blk – black

SAMPLE TYPE
D – DRIVE C Core recovery
C – CORE
G – GRAB Core lost

Water level drilled

Sheet 1 of 1

GEOLOGIC BORING LOG

BORING NO. SB17 | CONTRACTOR: | DATE SPUD: 10/15/98 1330
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/15
JOB NO.: 726876.69170 | DRLG METHOD: | ELEVATION:
LOCATION: SSOC | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: JFH | DRLG FLUID — | WEATHER:
COMMENTS: S. of berm

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10								
	15								
	20								
	25		SP	SAND, md., lt brn., moist		24-26			0/140

sl – slight
tr – trace
sm – some
& – and
@ – at
w – with

v – very
lt – light
dk – dark
bf – buff
brn – brown
blk – black

f – fine
m – medium
c – coarse
BH – Bore Hole
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery

Core lost

Water level drilled

GEOLOGIC BORING LOG

BORING NO. (SB-18) SB18A | CONTRACTOR: | DATE SPUD: 10/14/98 1602
CLIENT: Wurtsmith | RIG TYPE: Geoprobe | DATE CMPL: 10/14
JOB NO.: 726876.69120 | DRLG METHOD: | ELEVATION:
LOCATION: SSOG | BORING DIA.: 1.5" | TEMP.:
GEOLOGIST: | DRLG FLUID | WEATHER:
COMMENTS: W. of Bldg 361 - former UST loc. - hit concrete @ ~10' @ SB18

Elev. (ft.)	Depth (ft.)	Pro-file	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Bkgrnd/Reading (ppm)
	5								
	10		SP	SAND, md. grain, lt. brn, mst		10-12			0/120
	15								
	20		SP	SAA, Blk stain @ 21.9, wet		20-22			0/340
				SB					
				SB18 refusal @ 9'					

sl – slight; tr – trace; sm – some; & – and; @ – at; w – with
v – very; lt – light; dk – dark; bf – buff; brn – brown; blk – black
f – fine; m – medium; c – coarse; BH – Bore Hole; SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

C Core recovery
Core lost
Water level drilled

APPENDIX C

LABORATORY ANALYTICAL RESULTS AND COC FORMS

SPECIALIZED ASSAYS INC. • 2960 Foster Creighton Dr. • P.O. Box 40566 • Nashville, Tennessee 37204-0566
615-726-0177 • 1-800-765-0980 • Fax 615-726-3404

CASE NARRATIVE

Client: Parsons Engineering Science
Attn: Lynnea Peterson
1700 Broadway, Suite 900
Denver, CO 80290

Client Project: WURTSMITH BIOVENTING

Matrix: SOIL

Laboratory Project: 117018

Number samples: 6

Date Received: 10/15/98

Date Collected: 10/13/98

Sample Receipt Notes: All samples were received in good condition, properly preserved. All analyses were performed within method specified holding times.

QA/QC Summary:

Volatile Organic Method 8260B – Soil:

1. All surrogate, matrix spikes, matrix spike duplicate, and laboratory control sample recoveries were within acceptable quality control limits. The relative percent difference for Chlorobenzene on the MS/MSD pair was above QC limits at 16 % (upper limit = 14 %). The sample used for MS/MSD analysis for this analytical batch was not part of this sample delivery group. Samples SB1-19, SB2-20, and SB4-22 required dilution in order to bring all analytes into the calibration range of the instrument. Quantitation on unknown concentrations were determined from the initial calibration curve using the average response factor when the % RSD was less than or equal to 15%. All other analytes were calculated using linear regression.

Johnny A. Mitchell

Johnny A. Mitchell
Director of Technical Services
Specialized Assays, Inc.

Enclosures

SPECIALIZED ASSAYS
ENVIRONMENTAL

7A-059006

2960 Foster Creighton Drive
Nashville, TN 37204
615-726-0177, 800-765-0980
FAX 615/726-3404

REFERRING CLIENT

Parsons Co

8071
8156
~~8185~~
~~8154~~
463

CONTROL NUMBER (FOR LAB USE ONLY) 117018

PROJECT # 726876.69120

P.O. #

S (Signature-Please Print) John Hall

PROJECT NAME Wurtsmith Bioventing

LAB USE ONLY ACC#	SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	# OF CONT	ANALYSIS REQUESTED
136223	SB1-16	10/13/98	1610		X	3	8260 + Acetone Carbon Disulfide
136224	SB1-19	"	1505		X	3	"
136225	SB2-16	"	1700		X	3	"
136226	SB2-20	"	1730		X	3	"
136227	SB3-22	10/14/98	0930		X	3	8260
136228	SB4-22	10/14/98	1130		X	3	"

	Date / Time		
ished by: (Signature)	10/14/98 1300	Received by: (Signature)	Received for Laboratory by: Date / Time 10/15/98 911
ished by: (Signature)	Date / Time	Received by: (Signature)	Remarks
shed by: (Signature)	Date / Time	Received by: (Signature)	
shed by: (Signature)	Date / Time	Received by: (Signature)	SAI Project #: 000001

or further assistance in completing the chain of custody form please refer to the instructions found on the opposite

Cooler Receipt Form

Client: Parsons

Cooler Received On: 10/15/98 And Opened On: 10/15/98 By: Paul R Buckingham II

PRB
(Signature)

1. Temperature of Cooler when opened 4°C

2. Were custody seals on outside of cooler and intact? (Yes) No

   a. If yes, what kind and where: 2 front/back

   b. Were the signature and date correct? (Yes) No

3. Were custody papers inside cooler? (Yes) No

4. Were custody papers properly filled out (ink, signed, etc)? (Yes) No

5. Did you sign the custody papers in the appropriate place? (Yes) No

6. What kind of packing material was used? bubble wrap

7. Was sufficient ice used (if appropriate)? (Yes) No

8. Did all bottles arrive in good condition (unbroken)? (Yes) No

9. Were all bottle labels complete (#, date, signed, pres, etc)? (Yes) No

10. Did all bottle labels and tags agree with custody papers? (Yes) No

11. Were correct bottles used for the analysis requested? (Yes) No

12. If present, were VOA vials checked for absence of air bubbles and noted if found? (Yes) No

13. Was sufficient amount of sample sent in each bottle? (Yes) No

14. Were correct preservatives used? (Yes) No

15. Corrective action taken, if necessary:

   a. Name of person contacted: _____

   b. Date _____

000002

TE: 10.15.98

E:

TCH NO.: 117018

SPECIALIZED ASSAYS, INC.

BTX SOIL PREP LOG

PAGE NO:

MATRIX: SOIL

ANALYST: JANE H.

	SAMPLE ID	SAMPLE WEIGHT (g)	DILUTION	METHOD	WORKLIST	REMARKS
o Blank #						
	126223	4.84		5035	3846	
	126224	4.85				
	126225	5.14				
	126226	~~4.78~~ 5.80				
	126227	4.78				
	126228	~~5.80~~ 5.15				
	127015	4.43		5035	4444	Project # 117194
	127016	4.80				
	127017	5.23				
	127018	5.09				
	127019	5.60				
	127020	4.98				
	127021	5.15				
	127022	5.48				
E						
KE Dupl.						

KING SOLUTIONS:

REAGENTS:

000003

SNA12

FedEx USA Airbill

FedEx Tracking Number 808219104049

Form ID No 0210

From 10/14/98

Sender's Name Parsons Engineering/AFCEE Phone ( )

Company 1700 Broadway Ste 900

Address Denver CO 80290 Dept/Floor/Suite/Room 3105

City State ZIP

Your Internal Billing Reference Information

4a Express Package Service *Packages under 150 lbs.*

Delivery commitment may be later in some areas.

- [X] FedEx Priority Overnight (Next business morning)
- [ ] FedEx Standard Overnight (Next business afternoon)
- [ ] FedEx First Overnight (Earliest next business morning delivery to select locations) (Higher rates apply)
- [ ] FedEx 2Day (Second business day)
- [ ] FedEx Express Saver (Third business day)

FedEx Letter Rate not available. Minimum charge: One pound rate.

4b Express Freight Service *Packages over 150 lbs.*

Delivery commitment may be later in some areas.

- [ ] FedEx Overnight Freight (Next business day)
- [ ] FedEx 2Day Freight (Second business day)
- [ ] FedEx Express Saver Freight (Up to 3 business days)

(Call for delivery schedule. See back for detailed descriptions of freight services.)

5 Packaging

- [ ] FedEx Letter
- [ ] FedEx Pak
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other Pkg.

Declared value limit $500

6 Special Handling

(One box must be checked)

Does this shipment contain dangerous goods?*

- [ ] No
- [ ] Yes (As per attached Shipper's Declaration)
- [ ] Yes (Shipper's Declaration not required)

- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
- [ ] Cargo Aircraft Only

*Dangerous Goods cannot be shipped in FedEx packaging.

7 Payment

FedEx Account No.

Bill to:

- [ ] Sender (Account No in Section 1 will be billed)
- [X] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

(Enter FedEx Account No. or Credit Card No. below)

To

Recipient's Name SAMPLE RECEIVING Phone (615) 726-0177

Company SPECIALIZED ASSAYS ENVIRON

Address 2960 FOSTER CREIGHTON DR Dept/Floor/Suite/Room

(HOLD at FedEx location, print FedEx address here)

City NASHVILLE State TN ZIP 37204-3719

- [ ] Check here if residence (Extra charge applies for FedEx Express Saver)

For HOLD at FedEx Location check here

- [ ] Hold Weekday (Not available with FedEx First Overnight)
- [ ] Hold Saturday (Not available at all locations) (Available for FedEx Priority Overnight and FedEx 2Day only)

For WEEKEND Delivery check here (Extra Charge. Not available at all locations)

- [ ] Saturday Delivery (Available for FedEx Priority Overnight and FedEx 2Day only)
- [ ] NEW Sunday Delivery (Available for FedEx Priority Overnight only)

Total Packages	Total Weight	Total Declared Value*	Total Charges
1	2	$ .00	$

Credit Card Auth.

*When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE, AND LIMIT OF LIABILITY section for further information.

8 Release Signature

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

321

Questions?
Call 1-800-Go-FedEx® (800)463-3339

WCSL 0/98
Rev Date 3/98
Part #15307
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006676224 7

A 0 8 2 1 9 1 0 4 0 4 9

SUMMARY DATA
VOC

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB1-16

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126223
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/22/98
Analysis Time: 18:35
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.6	U
67-64-1	Acetone	9.2	U
71-43-2	Benzene	2.1	U
108-86-1	Bromobenzene	2.1	U
124-48-1	Bromochloromethane	2.1	U
75-25-2	Bromoform	6.2	U
74-83-9	Bromomethane	5.2	U
104-51-8	n-Butylbenzene	5.2	U
135-98-8	sec-Butylbenzene	7.3	U
98-06-6	t-Butylbenzene	7.3	U
75-15-0	Carbon disulfide	1.5	U
56-23-5	Carbon tetrachloride	10.4	U
108-90-7	Chlorobenzene	2.1	U
75-00-3	Chloroethane	5.2	U
67-66-3	Chloroform	2.1	U
74-87-3	Chloromethane	7.3	U
95-49-8	2-Chlorotoluene	2.1	U
106-43-4	4-Chlorotoluene	3.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U
124-48-1	Dibromochloromethane	3.1	U
74-95-3	1,2-Dibromoethane	3.1	U
74-95-3	Dibromomethane	10.4	U
95-50-1	1,2-Dichlorobenzene	2.1	U
541-73-1	1,3-Dichlorobenzene	6.2	U
106-46-7	1,4-Dichlorobenzene	2.1	U
75-71-8	Dichlorodifluoromethane	5.2	U
75-34-3	1,1-Dichloroethane	2.1	U
107-06-2	1,2-Dichloroethane	3.1	U
75-35-4	1,1-Dichloroethene	6.2	U
156-59-2	cis-1,2-Dichloroethene	6.2	U
156-60-5	trans-1,2-Dichloroethene	3.1	U
78-87-5	1,2-Dichloropropane	2.1	U
142-28-9	1,3-Dichloropropane	2.1	U
594-20-7	2,2-Dichloropropane	20.8	U
563-58-6	1,1-Dichloropropene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
10061-02-6	trans-1,3-Dichloropropene	5.2	U
100-41-4	Ethylbenzene	3.1	U
87-68-3	Hexachlorobutadiene	5.2	U

000005

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB1-16

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A126223
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	8.3	U
99-87-6	4-Isopropyltoluene	6.2	U
75-09-2	Methylene chloride	2.1	U
91-20-3	Naphthalene	2.1	U
103-65-1	n-Propylbenzene	2.1	U
100-42-5	Styrene	2.1	U
630-20-6	1,1,1,2-Tetrachloroethane	3.1	U
79-34-5	1,1,2,2-Tetrachloroethane	2.1	U
127-18-4	Tetrachloroethene	7.3	U
108-88-3	Toluene	5.2	U
87-61-6	1,2,3-Trichlorobenzene	2.1	U
120-82-1	1,2,4-Trichlorobenzene	2.1	U
71-55-6	1,1,1-Trichloroethane	4.2	U
79-00-5	1,1,2-Trichloroethane	5.2	U
79-01-6	Trichloroethene	10.4	U
96-18-4	1,2,3-Trichloropropane	20.8	U
95-63-6	1,2,4-Trimethylbenzene	7.3	U
108-67-8	1,3,5-Trimethylbenzene	3.1	U
75-01-4	Vinyl chloride	9.4	U
75-27-4	Bromodichloromethane	4.2	U
6615	o-Xylene	5.2	U
6616	m,p-Xylene	3.1	U
75-69-4	Trichlorofluoromethane	4.2	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB1-19

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126224
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/22/98
Analysis Time: 19:12
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.6	U
67-64-1	Acetone	9.2	U
71-43-2	Benzene	2.1	U
108-86-1	Bromobenzene	2.1	U
124-48-1	Bromochloromethane	2.1	U
75-25-2	Bromoform	6.2	U
74-83-9	Bromomethane	5.2	U
104-51-8	n-Butylbenzene	5.2	U
135-98-8	sec-Butylbenzene	7.3	U
98-06-6	t-Butylbenzene	7.3	U
75-15-0	Carbon disulfide	1.5	U
56-23-5	Carbon tetrachloride	10.4	U
108-90-7	Chlorobenzene	2.1	U
75-00-3	Chloroethane	5.2	U
67-66-3	Chloroform	2.1	U
74-87-3	Chloromethane	7.3	U
95-49-8	2-Chlorotoluene	2.1	U
106-43-4	4-Chlorotoluene	3.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U
124-48-1	Dibromochloromethane	3.1	U
74-95-3	1,2-Dibromoethane	3.1	U
74-95-3	Dibromomethane	10.4	U
95-50-1	1,2-Dichlorobenzene	2.1	U
541-73-1	1,3-Dichlorobenzene	6.2	U
106-46-7	1,4-Dichlorobenzene	2.1	U
75-71-8	Dichlorodifluoromethane	5.2	U
75-34-3	1,1-Dichloroethane	2.1	U
107-06-2	1,2-Dichloroethane	3.1	U
75-35-4	1,1-Dichloroethene	6.2	U
156-59-2	cis-1,2-Dichloroethene	6.2	U
156-60-5	trans-1,2-Dichloroethene	3.1	U
78-87-5	1,2-Dichloropropane	2.1	U
142-28-9	1,3-Dichloropropane	2.1	U
594-20-7	2,2-Dichloropropane	20.8	U
563-58-6	1,1-Dichloropropene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
10061-02-6	trans-1,3-Dichloropropene	5.2	U
100-41-4	Ethylbenzene	3.1	U
87-68-3	Hexachlorobutadiene	5.2	U

000007

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB1-19

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A126224
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	8.3	U
99-87-6	4-Isopropyltoluene	26.0	
75-09-2	Methylene chloride	2.1	U
91-20-3	Naphthalene	2.1	U
103-65-1	n-Propylbenzene	2.1	U
100-42-5	Styrene	2.1	U
630-20-6	1,1,1,2-Tetrachloroethane	3.1	U
79-34-5	1,1,2,2-Tetrachloroethane	2.1	U
127-18-4	Tetrachloroethene	7.3	U
108-88-3	Toluene	5.2	U
87-61-6	1,2,3-Trichlorobenzene	2.1	U
120-82-1	1,2,4-Trichlorobenzene	2.1	U
71-55-6	1,1,1-Trichloroethane	4.2	U
79-00-5	1,1,2-Trichloroethane	5.2	U
79-01-6	Trichloroethene	10.4	U
96-18-4	1,2,3-Trichloropropane	20.8	U
95-63-6	1,2,4-Trimethylbenzene	7.3	U
108-67-8	1,3,5-Trimethylbenzene	270.	E
75-01-4	Vinyl chloride	9.4	U
75-27-4	Bromodichloromethane	4.2	U
6615	o-Xylene	5.2	U
6616	m,p-Xylene	3.1	U
75-69-4	Trichlorofluoromethane	4.2	U

000008

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB1-19

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 50.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126224
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/21/98
Analysis Time: 14:55
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	130.	....	U
67-64-1	Acetone	458.	....	U
71-43-2	Benzene	104.	....	U
108-86-1	Bromobenzene	104.	....	U
124-48-1	Bromochloromethane	104.	....	U
75-25-2	Bromoform	312.	....	U
74-83-9	Bromomethane	260.	....	U
104-51-8	n-Butylbenzene	260.	....	U
135-98-8	sec-Butylbenzene	365.	....	U
98-06-6	t-Butylbenzene	365.	....	U
75-15-0	Carbon disulfide	72.9	....	U
56-23-5	Carbon tetrachloride	521.	....	U
108-90-7	Chlorobenzene	104.	....	U
75-00-3	Chloroethane	260.	....	U
67-66-3	Chloroform	104.	....	U
74-87-3	Chloromethane	365.	....	U
95-49-8	2-Chlorotoluene	104.	....	U
106-43-4	4-Chlorotoluene	156.	....	U
96-12-8	1,2-Dibromo-3-chloropropane	52.1	....	U
124-48-1	Dibromochloromethane	156.	....	U
74-95-3	1,2-Dibromoethane	156.	....	U
74-95-3	Dibromomethane	521.	....	U
95-50-1	1,2-Dichlorobenzene	104.	....	U
541-73-1	1,3-Dichlorobenzene	312.	....	U
106-46-7	1,4-Dichlorobenzene	104.	....	U
75-71-8	Dichlorodifluoromethane	260.	....	U
75-34-3	1,1-Dichloroethane	104.	....	U
107-06-2	1,2-Dichloroethane	156.	....	U
75-35-4	1,1-Dichloroethene	312.	....	U
156-59-2	cis-1,2-Dichloroethene	312.	....	U
156-60-5	trans-1,2-Dichloroethene	156.	....	U
78-87-5	1,2-Dichloropropane	104.	....	U
142-28-9	1,3-Dichloropropane	104.	....	U
594-20-7	2,2-Dichloropropane	1040	....	U
563-58-6	1,1-Dichloropropene	260.	....	U
10061-01-5	cis-1,3-Dichloropropene	260.	....	U
10061-02-6	trans-1,3-Dichloropropene	260.	....	U
100-41-4	Ethylbenzene	156.	....	U
87-68-3	Hexachlorobutadiene	260.	....	U

000009

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB1-19

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A126224
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	417.	U
99-87-6	4-Isopropyltoluene	260.	J
75-09-2	Methylene chloride	104.	U
91-20-3	Naphthalene	104.	U
103-65-1	n-Propylbenzene	104.	U
100-42-5	Styrene	104.	U
630-20-6	1,1,1,2-Tetrachloroethane	156.	U
79-34-5	1,1,2,2-Tetrachloroethane	104.	U
127-18-4	Tetrachloroethene	365.	U
108-88-3	Toluene	260.	U
87-61-6	1,2,3-Trichlorobenzene	104.	U
120-82-1	1,2,4-Trichlorobenzene	104.	U
71-55-6	1,1,1-Trichloroethane	208.	U
79-00-5	1,1,2-Trichloroethane	260.	U
79-01-6	Trichloroethene	521.	U
96-18-4	1,2,3-Trichloropropane	1040	U
95-63-6	1,2,4-Trimethylbenzene	365.	U
108-67-8	1,3,5-Trimethylbenzene	2450	
75-01-4	Vinyl chloride	469.	U
75-27-4	Bromodichloromethane	208.	U
6615	o-Xylene	260.	U
6616	m,p-Xylene	125.	J
75-69-4	Trichlorofluoromethane	208.	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB2-16

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126225
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/22/98
Analysis Time: 19:48
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.6	U
67-64-1	Acetone	9.2	U
71-43-2	Benzene	2.1	U
108-86-1	Bromobenzene	2.1	U
124-48-1	Bromochloromethane	2.1	U
75-25-2	Bromoform	6.2	U
74-83-9	Bromomethane	5.2	U
104-51-8	n-Butylbenzene	5.2	U
135-98-8	sec-Butylbenzene	7.3	U
98-06-6	t-Butylbenzene	7.3	U
75-15-0	Carbon disulfide	1.5	U
56-23-5	Carbon tetrachloride	10.4	U
108-90-7	Chlorobenzene	2.1	U
75-00-3	Chloroethane	5.2	U
67-66-3	Chloroform	2.1	U
74-87-3	Chloromethane	7.3	U
95-49-8	2-Chlorotoluene	2.1	U
106-43-4	4-Chlorotoluene	3.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U
124-48-1	Dibromochloromethane	3.1	U
74-95-3	1,2-Dibromoethane	3.1	U
74-95-3	Dibromomethane	10.4	U
95-50-1	1,2-Dichlorobenzene	2.1	U
541-73-1	1,3-Dichlorobenzene	6.2	U
106-46-7	1,4-Dichlorobenzene	2.1	U
75-71-8	Dichlorodifluoromethane	5.2	U
75-34-3	1,1-Dichloroethane	2.1	U
107-06-2	1,2-Dichloroethane	3.1	U
75-35-4	1,1-Dichloroethene	6.2	U
156-59-2	cis-1,2-Dichloroethene	6.2	U
156-60-5	trans-1,2-Dichloroethene	3.1	U
78-87-5	1,2-Dichloropropane	2.1	U
142-28-9	1,3-Dichloropropane	2.1	U
594-20-7	2,2-Dichloropropane	20.8	U
563-58-6	1,1-Dichloropropene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
10061-02-6	trans-1,3-Dichloropropene	5.2	U
100-41-4	Ethylbenzene	3.1	U
87-68-3	Hexachlorobutadiene	5.2	U

00001

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB2-16

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A126225
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	8.3	U
99-87-6	4-Isopropyltoluene	6.2	U
75-09-2	Methylene chloride	2.1	U
91-20-3	Naphthalene	2.1	U
103-65-1	n-Propylbenzene	2.1	U
100-42-5	Styrene	2.1	U
630-20-6	1,1,1,2-Tetrachloroethane	3.1	U
79-34-5	1,1,2,2-Tetrachloroethane	2.1	U
127-18-4	Tetrachloroethene	7.3	U
108-88-3	Toluene	5.2	U
87-61-6	1,2,3-Trichlorobenzene	2.1	U
120-82-1	1,2,4-Trichlorobenzene	2.1	U
71-55-6	1,1,1-Trichloroethane	4.2	U
79-00-5	1,1,2-Trichloroethane	5.2	U
79-01-6	Trichloroethene	10.4	U
96-18-4	1,2,3-Trichloropropane	20.8	U
95-63-6	1,2,4-Trimethylbenzene	7.3	U
108-67-8	1,3,5-Trimethylbenzene	3.1	U
75-01-4	Vinyl chloride	9.4	U
75-27-4	Bromodichloromethane	4.2	U
6615	o-Xylene	5.2	U
6616	m,p-Xylene	3.1	U
75-69-4	Trichlorofluoromethane	4.2	U

000012

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB2-20

Matrix: Soil
% Dry Weight: 92.
Units: ug/kg dry weight
Dilution Factor: 500.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126226
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/21/98
Analysis Time: 16:08
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	1360	U
67-64-1	Acetone	4780	U
71-43-2	Benzene	1090	U
108-86-1	Bromobenzene	1090	U
124-48-1	Bromochloromethane	1090	U
75-25-2	Bromoform	3260	U
74-83-9	Bromomethane	2720	U
104-51-8	n-Butylbenzene	2720	U
135-98-8	sec-Butylbenzene	3800	U
98-06-6	t-Butylbenzene	3800	U
75-15-0	Carbon disulfide	761.	U
56-23-5	Carbon tetrachloride	5430	U
108-90-7	Chlorobenzene	1090	U
75-00-3	Chloroethane	2720	U
67-66-3	Chloroform	1090	U
74-87-3	Chloromethane	3800	U
95-49-8	2-Chlorotoluene	1090	U
106-43-4	4-Chlorotoluene	1630	U
96-12-8	1,2-Dibromo-3-chloropropane	543.	U
124-48-1	Dibromochloromethane	1630	U
74-95-3	1,2-Dibromoethane	1630	U
74-95-3	Dibromomethane	5430	U
95-50-1	1,2-Dichlorobenzene	1090	U
541-73-1	1,3-Dichlorobenzene	3260	U
106-46-7	1,4-Dichlorobenzene	1090	U
75-71-8	Dichlorodifluoromethane	2720	U
75-34-3	1,1-Dichloroethane	1090	U
107-06-2	1,2-Dichloroethane	1630	U
75-35-4	1,1-Dichloroethene	3260	U
156-59-2	cis-1,2-Dichloroethene	3260	U
156-60-5	trans-1,2-Dichloroethene	1630	U
78-87-5	1,2-Dichloropropane	1090	U
142-28-9	1,3-Dichloropropane	1090	U
594-20-7	2,2-Dichloropropane	10900	U
563-58-6	1,1-Dichloropropene	2720	U
10061-01-5	cis-1,3-Dichloropropene	2720	U
10061-02-6	trans-1,3-Dichloropropene	2720	U
100-41-4	Ethylbenzene	12000	
87-68-3	Hexachlorobutadiene	2720	U

000013

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB2-20

Matrix: Soil
% Dry Weight: 92.
Units: ug/kg dry weight

Lab Sample ID: 98-A126226
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
98-82-8	Isopropylbenzene	4350	....	
99-87-6	4-Isopropyltoluene	7610	....	
75-09-2	Methylene chloride	1090	....	U
91-20-3	Naphthalene	7070	....	
103-65-1	n-Propylbenzene	4890	....	
100-42-5	Styrene	1090	....	U
630-20-6	1,1,1,2-Tetrachloroethane	1630	....	U
79-34-5	1,1,2,2-Tetrachloroethane	1090	....	U
127-18-4	Tetrachloroethene	3800	....	U
108-88-3	Toluene	2720	....	U
87-61-6	1,2,3-Trichlorobenzene	1090	....	U
120-82-1	1,2,4-Trichlorobenzene	1090	....	U
71-55-6	1,1,1-Trichloroethane	2170	....	U
79-00-5	1,1,2-Trichloroethane	2720	....	U
79-01-6	Trichloroethene	5430	....	U
96-18-4	1,2,3-Trichloropropane	10900	....	U
95-63-6	1,2,4-Trimethylbenzene	120000	....	E
108-67-8	1,3,5-Trimethylbenzene	43500	....	
75-01-4	Vinyl chloride	4890	....	U
75-27-4	Bromodichloromethane	2170	....	U
6615	o-Xylene	62000	....	
6616	m,p-Xylene	222000	....	E
75-69-4	Trichlorofluoromethane	2170	....	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB2-20

Matrix: Soil
% Dry Weight: 92.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126226
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/22/98
Analysis Time: 21:01
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2720	U
67-64-1	Acetone	9570	U
71-43-2	Benzene	2170	U
108-86-1	Bromobenzene	2170	U
124-48-1	Bromochloromethane	2170	U
75-25-2	Bromoform	6520	U
74-83-9	Bromomethane	5430	U
104-51-8	n-Butylbenzene	5430	U
135-98-8	sec-Butylbenzene	7610	U
98-06-6	t-Butylbenzene	7610	U
75-15-0	Carbon disulfide	1520	U
56-23-5	Carbon tetrachloride	10900	U
108-90-7	Chlorobenzene	2170	U
75-00-3	Chloroethane	5430	U
67-66-3	Chloroform	2170	U
74-87-3	Chloromethane	7610	U
95-49-8	2-Chlorotoluene	2170	U
106-43-4	4-Chlorotoluene	3260	U
96-12-8	1,2-Dibromo-3-chloropropane	1090	U
124-48-1	Dibromochloromethane	3260	U
74-95-3	1,2-Dibromoethane	3260	U
74-95-3	Dibromomethane	10900	U
95-50-1	1,2-Dichlorobenzene	2170	U
541-73-1	1,3-Dichlorobenzene	6520	U
106-46-7	1,4-Dichlorobenzene	2170	U
75-71-8	Dichlorodifluoromethane	5430	U
75-34-3	1,1-Dichloroethane	2170	U
107-06-2	1,2-Dichloroethane	3260	U
75-35-4	1,1-Dichloroethene	6520	U
156-59-2	cis-1,2-Dichloroethene	6520	U
156-60-5	trans-1,2-Dichloroethene	3260	U
78-87-5	1,2-Dichloropropane	2170	U
142-28-9	1,3-Dichloropropane	2170	U
594-20-7	2,2-Dichloropropane	21700	U
563-58-6	1,1-Dichloropropene	5430	U
10061-01-5	cis-1,3-Dichloropropene	5430	U
10061-02-6	trans-1,3-Dichloropropene	5430	U
100-41-4	Ethylbenzene	8700	
87-68-3	Hexachlorobutadiene	5430	U

000015

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB2-20

Matrix: Soil
% Dry Weight: 92.
Units: ug/kg dry weight

Lab Sample ID: 98-A126226
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	3260	J
99-87-6	4-Isopropyltoluene	7610	
75-09-2	Methylene chloride	2170	U
91-20-3	Naphthalene	8700	
103-65-1	n-Propylbenzene	3260	
100-42-5	Styrene	2170	U
630-20-6	1,1,1,2-Tetrachloroethane	3260	U
79-34-5	1,1,2,2-Tetrachloroethane	2170	U
127-18-4	Tetrachloroethene	7610	U
108-88-3	Toluene	5430	U
87-61-6	1,2,3-Trichlorobenzene	2170	U
120-82-1	1,2,4-Trichlorobenzene	2170	U
71-55-6	1,1,1-Trichloroethane	4350	U
79-00-5	1,1,2-Trichloroethane	5430	U
79-01-6	Trichloroethene	10900	U
96-18-4	1,2,3-Trichloropropane	21700	U
95-63-6	1,2,4-Trimethylbenzene	117000	
108-67-8	1,3,5-Trimethylbenzene	42400	
75-01-4	Vinyl chloride	9780	U
75-27-4	Bromodichloromethane	4350	U
6615	o-Xylene	47800	
6616	m,p-Xylene	175000	
75-69-4	Trichlorofluoromethane	4350	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB3-22

Matrix: Soil
% Dry Weight: 97.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126227
Date Sampled: 10/14/98
Date Received: 10/15/98
Analysis Date: 10/22/98
Analysis Time: 20:24
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.6	U
67-64-1	Acetone	9.1	U
71-43-2	Benzene	2.1	U
108-86-1	Bromobenzene	2.1	U
124-48-1	Bromochloromethane	2.1	U
75-25-2	Bromoform	6.2	U
74-83-9	Bromomethane	5.2	U
104-51-8	n-Butylbenzene	5.2	U
135-98-8	sec-Butylbenzene	7.2	U
98-06-6	t-Butylbenzene	7.2	U
75-15-0	Carbon disulfide	1.4	U
56-23-5	Carbon tetrachloride	10.3	U
108-90-7	Chlorobenzene	2.1	U
75-00-3	Chloroethane	5.2	U
67-66-3	Chloroform	2.1	U
74-87-3	Chloromethane	7.2	U
95-49-8	2-Chlorotoluene	2.1	U
106-43-4	4-Chlorotoluene	3.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U
124-48-1	Dibromochloromethane	3.1	U
74-95-3	1,2-Dibromoethane	3.1	U
74-95-3	Dibromomethane	10.3	U
95-50-1	1,2-Dichlorobenzene	2.1	U
541-73-1	1,3-Dichlorobenzene	6.2	U
106-46-7	1,4-Dichlorobenzene	2.1	U
75-71-8	Dichlorodifluoromethane	5.2	U
75-34-3	1,1-Dichloroethane	2.1	U
107-06-2	1,2-Dichloroethane	3.1	U
75-35-4	1,1-Dichloroethene	6.2	U
156-59-2	cis-1,2-Dichloroethene	6.2	U
156-60-5	trans-1,2-Dichloroethene	3.1	U
78-87-5	1,2-Dichloropropane	2.1	U
142-28-9	1,3-Dichloropropane	2.1	U
594-20-7	2,2-Dichloropropane	20.6	U
563-58-6	1,1-Dichloropropene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
10061-02-6	trans-1,3-Dichloropropene	5.2	U
100-41-4	Ethylbenzene	3.1	U
87-68-3	Hexachlorobutadiene	5.2	U

000017

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB3-22

Matrix: Soil
% Dry Weight: 97.
Units: ug/kg dry weight

Lab Sample ID: 98-A126227
Date Sampled: 10/14/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	8.2	U
99-87-6	4-Isopropyltoluene	6.2	U
75-09-2	Methylene chloride	2.1	U
91-20-3	Naphthalene	2.1	U
103-65-1	n-Propylbenzene	2.1	U
100-42-5	Styrene	2.1	U
630-20-6	1,1,1,2-Tetrachloroethane	3.1	U
79-34-5	1,1,2,2-Tetrachloroethane	2.1	U
127-18-4	Tetrachloroethene	7.2	U
108-88-3	Toluene	5.2	U
87-61-6	1,2,3-Trichlorobenzene	2.1	U
120-82-1	1,2,4-Trichlorobenzene	2.1	U
71-55-6	1,1,1-Trichloroethane	4.1	U
79-00-5	1,1,2-Trichloroethane	5.2	U
79-01-6	Trichloroethene	10.3	U
96-18-4	1,2,3-Trichloropropane	20.6	U
95-63-6	1,2,4-Trimethylbenzene	7.2	U
108-67-8	1,3,5-Trimethylbenzene	3.1	U
75-01-4	Vinyl chloride	9.3	U
75-27-4	Bromodichloromethane	4.1	U
6615	o-Xylene	5.2	U
6616	m,p-Xylene	3.1	U
75-69-4	Trichlorofluoromethane	4.1	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB4-22

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight
Dilution Factor: 100.
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126228
Date Sampled: 10/14/98
Date Received: 10/15/98
Analysis Date: 10/22/98
Analysis Time: 21:37
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	278.	U
67-64-1	Acetone	978.	U
71-43-2	Benzene	222.	U
108-86-1	Bromobenzene	222.	U
124-48-1	Bromochloromethane	222.	U
75-25-2	Bromoform	667.	U
74-83-9	Bromomethane	556.	U
104-51-8	n-Butylbenzene	556.	U
135-98-8	sec-Butylbenzene	778.	U
98-06-6	t-Butylbenzene	778.	U
75-15-0	Carbon disulfide	156.	U
56-23-5	Carbon tetrachloride	1110	U
108-90-7	Chlorobenzene	222.	U
75-00-3	Chloroethane	556.	U
67-66-3	Chloroform	222.	U
74-87-3	Chloromethane	778.	U
95-49-8	2-Chlorotoluene	222.	U
106-43-4	4-Chlorotoluene	333.	U
96-12-8	1,2-Dibromo-3-chloropropane	111.	U
124-48-1	Dibromochloromethane	333.	U
74-95-3	1,2-Dibromoethane	333.	U
74-95-3	Dibromomethane	1110	U
95-50-1	1,2-Dichlorobenzene	222.	U
541-73-1	1,3-Dichlorobenzene	667.	U
106-46-7	1,4-Dichlorobenzene	222.	U
75-71-8	Dichlorodifluoromethane	556.	U
75-34-3	1,1-Dichloroethane	222.	U
107-06-2	1,2-Dichloroethane	333.	U
75-35-4	1,1-Dichloroethene	667.	U
156-59-2	cis-1,2-Dichloroethene	667.	U
156-60-5	trans-1,2-Dichloroethene	333.	U
78-87-5	1,2-Dichloropropane	222.	U
142-28-9	1,3-Dichloropropane	222.	U
594-20-7	2,2-Dichloropropane	2220	U
563-58-6	1,1-Dichloropropene	556.	U
10061-01-5	cis-1,3-Dichloropropene	556.	U
10061-02-6	trans-1,3-Dichloropropene	556.	U
100-41-4	Ethylbenzene	21000	
87-68-3	Hexachlorobutadiene	556.	U

000019

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB4-22

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight

Lab Sample ID: 98-A126228
Date Sampled: 10/14/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	6110	
99-87-6	4-Isopropyltoluene	8780	
75-09-2	Methylene chloride	222.	U
91-20-3	Naphthalene	5560	
103-65-1	n-Propylbenzene	6110	
100-42-5	Styrene	222.	U
630-20-6	1,1,1,2-Tetrachloroethane	333.	U
79-34-5	1,1,2,2-Tetrachloroethane	222.	U
127-18-4	Tetrachloroethene	778.	U
108-88-3	Toluene	222.	J
87-61-6	1,2,3-Trichlorobenzene	222.	U
120-82-1	1,2,4-Trichlorobenzene	222.	U
71-55-6	1,1,1-Trichloroethane	444.	U
79-00-5	1,1,2-Trichloroethane	556.	U
79-01-6	Trichloroethene	1110	U
96-18-4	1,2,3-Trichloropropane	2220	U
95-63-6	1,2,4-Trimethylbenzene	7890	
108-67-8	1,3,5-Trimethylbenzene	36700	E
75-01-4	Vinyl chloride	1000	U
75-27-4	Bromodichloromethane	444.	U
6615	o-Xylene	10400	
6616	m,p-Xylene	95100	E
75-69-4	Trichlorofluoromethane	444.	U

000020

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB4-22

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: 98-A126228
Date Sampled: 10/14/98
Date Received: 10/15/98
Analysis Date: 10/25/98
Analysis Time: 5:01
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	2780	....	U
67-64-1	Acetone	9780	....	U
71-43-2	Benzene	2220	....	U
108-86-1	Bromobenzene	2220	....	U
124-48-1	Bromochloromethane	2220	....	U
75-25-2	Bromoform	6670	....	U
74-83-9	Bromomethane	5560	....	U
104-51-8	n-Butylbenzene	5560	....	U
135-98-8	sec-Butylbenzene	7780	....	U
98-06-6	t-Butylbenzene	7780	....	U
75-15-0	Carbon disulfide	1560	....	U
56-23-5	Carbon tetrachloride	11100	....	U
108-90-7	Chlorobenzene	2220	....	U
75-00-3	Chloroethane	5560	....	U
67-66-3	Chloroform	2220	....	U
74-87-3	Chloromethane	7780	....	U
95-49-8	2-Chlorotoluene	2220	....	U
106-43-4	4-Chlorotoluene	3330	....	U
96-12-8	1,2-Dibromo-3-chloropropane	1110	....	U
124-48-1	Dibromochloromethane	3330	....	U
74-95-3	1,2-Dibromoethane	3330	....	U
74-95-3	Dibromomethane	11100	....	U
95-50-1	1,2-Dichlorobenzene	2220	....	U
541-73-1	1,3-Dichlorobenzene	6670	....	U
106-46-7	1,4-Dichlorobenzene	2220	....	U
75-71-8	Dichlorodifluoromethane	5560	....	U
75-34-3	1,1-Dichloroethane	2220	....	U
107-06-2	1,2-Dichloroethane	3330	....	U
75-35-4	1,1-Dichloroethene	6670	....	U
156-59-2	cis-1,2-Dichloroethene	6670	....	U
156-60-5	trans-1,2-Dichloroethene	3330	....	U
78-87-5	1,2-Dichloropropane	2220	....	U
142-28-9	1,3-Dichloropropane	2220	....	U
594-20-7	2,2-Dichloropropane	22200	....	U
563-58-6	1,1-Dichloropropene	5560	....	U
10061-01-5	cis-1,3-Dichloropropene	5560	....	U
10061-02-6	trans-1,3-Dichloropropene	5560	....	U
100-41-4	Ethylbenzene	20000	....	
87-68-3	Hexachlorobutadiene	5560	....	U

000021

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB4-22

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight

Lab Sample ID: 98-A126228
Date Sampled: 10/14/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
98-82-8	Isopropylbenzene	5560	J
99-87-6	4-Isopropyltoluene	7780	
75-09-2	Methylene chloride	2220	U
91-20-3	Naphthalene	7780	
103-65-1	n-Propylbenzene	5560	
100-42-5	Styrene	2220	U
630-20-6	1,1,1,2-Tetrachloroethane	3330	U
79-34-5	1,1,2,2-Tetrachloroethane	2220	U
127-18-4	Tetrachloroethene	7780	U
108-88-3	Toluene	5560	U
87-61-6	1,2,3-Trichlorobenzene	2220	U
120-82-1	1,2,4-Trichlorobenzene	2220	U
71-55-6	1,1,1-Trichloroethane	4440	U
79-00-5	1,1,2-Trichloroethane	5560	U
79-01-6	Trichloroethene	11100	U
96-18-4	1,2,3-Trichloropropane	22200	U
95-63-6	1,2,4-Trimethylbenzene	82200	
108-67-8	1,3,5-Trimethylbenzene	34400	
75-01-4	Vinyl chloride	10000	U
75-27-4	Bromodichloromethane	4440	U
6615	o-Xylene	10000	
6616	m,p-Xylene	109000	
75-69-4	Trichlorofluoromethane	4440	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Soil
% Dry Weight: 100
Units: UG/KG
Dilution Factor: 1
Analysis Method: SW8260B
Delivery Group: 117018
Instrument: HP-2

Lab Sample ID: BLANK
Date Sampled: 10/13/98
Date Received: 10/15/98
Analysis Date: 10/21/98
Analysis Time: 6:26
Sample QC Group: 3395

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
71-43-2	Benzene	2.0	....	U
67-64-1	Acetone	8.8	....	U
108-86-1	Bromobenzene	2.0	....	U
124-48-1	Bromochloromethane	2.0	....	U
75-25-2	Bromoform	6.0	....	U
74-83-9	Bromomethane	5.0	....	U
104-51-8	n-Butylbenzene	5.0	....	U
135-98-8	sec-Butylbenzene	7.0	....	U
98-06-6	t-Butylbenzene	7.0	....	U
75-15-0	Carbon disulfide	1.4	....	U
56-23-5	Carbon tetrachloride	10.0	....	U
108-90-7	Chlorobenzene	2.0	....	U
75-00-3	Chloroethane	5.0	....	U
67-66-3	Chloroform	2.0	....	U
74-87-3	Chloromethane	7.0	....	U
95-49-8	2-Chlorotoluene	2.0	....	U
106-43-4	4-Chlorotoluene	3.0	....	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	....	U
124-48-1	Dibromochloromethane	3.0	....	U
74-95-3	1,2-Dibromoethane	3.0	....	U
74-95-3	Dibromomethane	10.0	....	U
95-50-1	1,2-Dichlorobenzene	2.0	....	U
541-73-1	1,3-Dichlorobenzene	6.0	....	U
106-46-7	1,4-Dichlorobenzene	2.0	....	U
75-71-8	Dichlorodifluoromethane	5.0	....	U
75-34-3	1,1-Dichloroethane	2.0	....	U
107-06-2	1,2-Dichloroethane	3.0	....	U
75-35-4	1,1-Dichloroethene	6.0	....	U
156-59-2	cis-1,2-Dichloroethene	6.0	....	U
156-60-5	trans-1,2-Dichloroethene	3.0	....	U
78-87-5	1,2-Dichloropropane	2.0	....	U
142-28-9	1,3-Dichloropropane	2.0	....	U
594-20-7	2,2-Dichloropropane	20.0	....	U
563-58-6	1,1-Dichloropropene	5.0	....	U
10061-01-5	cis-1,3-Dichloropropene	5.0	....	U
10061-02-6	trans-1,3-Dichloropropene	5.0	....	U
100-41-4	Ethylbenzene	3.0	....	U
87-68-3	Hexachlorobutadiene	5.0	....	U
98-82-8	Isopropylbenzene	8.0	....	U

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SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Soil
% Dry Weight: 100
Units: UG/KG

Lab Sample ID: BLANK
Date Sampled: 10/13/98
Date Received: 10/15/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
99-87-6	4-Isopropyltoluene	6.0	U
75-09-2	Methylene chloride	20.0	
91-20-3	Naphthalene	2.0	U
103-65-1	n-Propylbenzene	2.0	U
100-42-5	Styrene	2.0	U
630-20-6	1,1,1,2-Tetrachloroethane	3.0	U
79-34-5	1,1,2,2-Tetrachloroethane	2.0	U
127-18-4	Tetrachloroethene	7.0	U
108-88-3	Toluene	5.0	U
87-61-6	1,2,3-Trichlorobenzene	2.0	U
120-82-1	1,2,4-Trichlorobenzene	2.0	U
71-55-6	1,1,1-Trichloroethane	4.0	U
79-00-5	1,1,2-Trichloroethane	5.0	U
79-01-6	Trichloroethene	10.0	U
96-18-4	1,2,3-Trichloropropane	20.0	U
95-63-6	1,2,4-Trimethylbenzene	7.0	U
108-67-8	1,3,5-Trimethylbenzene	3.0	U
75-01-4	Vinyl chloride	9.0	U
75-27-4	Bromodichloromethane	4.0	U
6615	o-Xylene	5.0	U
6616	m,p-Xylene	3.0	U
75-69-4	Trichlorofluoromethane	4.0	U

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2B

SOIL VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: SPECIALIZED ASSAYS Contract: _____

Lab Code: SASSAYS Case No.: _____ SAS No.: _____ SDG No.: 117018

Level: (low/med) LOW

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01	VBLK04	112	98	105	0
02	127173	102	102	100	0
03	VBLK02	105	101	106	0
04	127173MS	82	97	91	0
05	127173MSD	83	96	90	0
06	CONTROL	82	98	92	0
07	SB1-19	83	97	89	0
08	SB2-20	83	95	79	0
09	SB4-22	83	96	85	0
10	VBLK03	113	100	102	0
11	SB1-16	101	104	101	0
12	SB1-19	93	99	90	0
13	SB2-16	101	92	103	0
14	SB3-22	95	101	105	0
15	SB2-20DL	87	104	96	0
16	SB4-22DL	85	97	100	0
17	SB4-22DLB	98	106	101	0

			QC LIMITS
SMC1	=	1,2-Dichloroethane-d4	(62-147)
SMC2	=	Toluene-d8	(84-117)
SMC3	=	Bromofluorobenzene	(64-126)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D System Monitoring Compound diluted out

FORM 3B

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Matrix Spike Sample: SDG: 117018

QC Group: 3395

Compound	Spike Added	Sample Conc	Spike Conc	% Rec	QC Limits
Benzene	50.0	0.0	58.0	116	58 - 135
Chlorobenzene	50.0	0.0	58.0	116	54 - 136
1,1-Dichloroethene	50.0	0.0	63.0	126	58 - 138
Toluene	50.0	0.0	55.0	110	56 - 135
Trichloroethene	50.0	0.0	54.0	108	52 - 143

Compound	Spike Added	MSD Conc	% Rec	RPD	RPD Limit	Recovery Limits
Benzene	0.0	0.0	134	14	17	58 - 135
Chlorobenzene	0.0	0.0	136	16#	14	54 - 136
1,1-Dichloroethene	0.0	0.0	136	8	19	58 - 138
Toluene	0.0	0.0	126	14	18	56 - 135
Trichloroethene	0.0	0.0	126	15	18	52 - 143

Concentration Units: ug/kg

RPD: 1 out of 5 outside QC limits.
Spike Recoveries: 0 out of 10 outside QC limits.

FORM 8Sa

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

SDG: 117018 QC Group: 3395

Compound	Known Value	Conc	% Rec	QC Limits
Acetone	50	55	110	47-150
Benzene	50	61	122	39-151
Bromobenzene	50	54	108	74-122
Bromochloromethane	50	47	94	68-134
Bromoform	50	54	108	31-144
Bromomethane	50	42	84	51-135
n-Butylbenzene	50	47	94	65-127
sec-Butylbenzene	50	58	116	68-129
t-Butylbenzene	50	55	110	68-128
Carbon disulfide	50	61	122	61-128
Carbon tetrachloride	50	56	112	53-144
Chlorobenzene	50	64	128	62-130
Chloroethane	50	55	110	56-138
Chloroform	50	65	130	71-132
Chloromethane	50	54	108	65-134
2-Chlorotoluene	50	55	110	72-123
4-Chlorotoluene	50	52	104	70-123
1,2-Dibromo-3-chloropropane	50	39	78	70-130
Dibromochloromethane	50	59	118	41-133
1,2-Dibromoethane	50	54	108	47-136
Dibromomethane	50	49	98	60-141
1,2-Dichlorobenzene	50	47	94	66-123
1,3-Dichlorobenzene	50	46	92	65-128
1,4-Dichlorobenzene	50	45	90	66-129
Dichlorodifluoromethane	50	64	128	50-140
1,1-Dichloroethane	50	64	128	70-132
1,2-Dichloroethane	50	55	110	58-135
1,1-Dichloroethene	50	64	128	69-130
cis-1,2-Dichloroethene	50	64	128	59-140
trans-1,2-Dichloroethene	50	56	112	72-126
1,2-Dichloropropane	50	63	126	45-149
1,3-Dichloropropane	50	52	104	58-138
2,2-Dichloropropane	50	46	92	43-146
1,1-Dichloropropene	50	58	116	56-132
cis-1,3-Dichloropropene	50	54	108	69-130
trans-1,3-Dichloropropene	50	51	102	56-126
Ethylbenzene	50	64	128	61-129
Hexachlorobutadiene	50	60	120	59-136
Isopropylbenzene	50	51	102	70-127
4-Isopropyltoluene	50	39	78	70-127
Methylene chloride	50	50	100	68-142

FORM 3Ba

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Naphthalene	50	45	90	54-146
n-Propylbenzene	50	58	116	67-126
Styrene	50	60	120	65-128
1,1,1,2-Tetrachloroethane	50	58	116	53-130
1,1,2,2-Tetrachloroethane	50	54	108	37-149
Tetrachloroethene	50	62	124	55-126
Toluene	50	63	126	65-131
1,2,3-Trichlorobenzene	50	35	70	55-137
1,2,4-Trichlorobenzene	50	52	104	48-141
1,1,1-Trichloroethane	50	46	92	60-136
1,1,2-Trichloroethane	50	53	106	56-137
Trichloroethene	50	62	124	61-141
1,2,3-Trichloropropane	50	50	100	39-146
1,2,4-Trimethylbenzene	50	55	110	72-126
1,3,5-Trimethylbenzene	50	58	116	22-125
Vinyl chloride	50	58	116	57-138
Bromodichloromethane	50	63	126	60-133
o-Xylene	50	59	118	64-126
m,p-Xylene	100	129	129	59-131
Trichlorofluoromethane	50	53	106	56-142

Concentration Units: ug/kg

Recoveries: 0 out of 61 outside QC limits.

SPECIALIZED ASSAYS INC. • 2960 Foster Creighton Dr. • P.O. Box 40566 • Nashville, Tennessee 37204-0566
615-726-0177 • 1-800-765-0980 • Fax 615-726-3404

CASE NARRATIVE

Client: Parsons Engineering Science
Attn: Lynnea Peterson
1700 Broadway, Suite 900
Denver, CO 80290

Client Project: WURTSMITH BIOVENTING

Matrix: SOIL/WATER

Laboratory Project: 117229

Number samples: 10/3

Date Received: 10/16/98

Date Collected: 10/15/98 – 10/15/98

Sample Receipt Notes: All samples were received in good condition, properly preserved. All analyses were performed within method specified holding times.

QA/QC Summary:

Volatile Organic Method 8260B – Water:

1. All surrogate, matrix spikes, matrix spike duplicate, and laboratory control sample recoveries for this analytical batch (#4751) were within acceptable quality control limits. The sample used for MS/MSD analysis for this analytical batch was not part of this sample delivery group. All water samples in this delivery group are reported as not detected for all analytes. Quantitation on unknown concentrations were determined from the initial calibration curve using the average response factor when the % RSD was less than or equal to 15%. All other analytes were calculated using linear regression.

Volatile Organic Method 8260B – Soil:

All surrogate and laboratory control sample recoveries were within acceptable quality control limits. The relative percent difference for Benzene and Chlorobenzene on the MS/MSD pair was above QC limits, as was the recovery for benzene on the MSD sample. The sample used for MS/MSD analysis for this analytical batch was SB9-14. Due to sample matrix issues, all soil samples in this batch (#4754) required dilution for analysis.. Quantitation on unknown concentrations were determined from the initial calibration curve using the average response factor when the % RSD was less than or equal to 15%. All other analytes were calculated using linear regression.

Johnny A. Mitchell

Johnny A. Mitchell
Director of Technical Services
Specialized Assays, Inc.

SPECIALIZED ASSAYS
ENVIRONMENTAL

Page 1 of 2

7A-059007

2960 Foster Creighton Drive
Nashville, TN 37204
615-726-0177, 800-765-0980
FAX 615/726-3404

Specialized Assays: (800) 765-098

REFERRING CLIENT

Account: 8185
Parsons Engineering/AFCEE Exte
Doug Scott
1700 Broadway Ste 900
Denver, CO 80290
Ph: 303-831-8100 Fax: 303-831-8208

CONTROL NUMBER (FOR LAB USE ONLY) 117229

PROJECT # 726876.69120

P.O. #

S (Signature-Please Print)

PROJECT NAME Wurtsmith Bioventing

LAB USE ONLY ACC#	SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	# OF CONT	ANALYSIS REQUESTED
A127165	SB25-23	10/14/98	1430		X	3	8260
A127166	SB5-23	"	1500		X	3	"
A127167	SB5-12	"	1520		X	3	"
A127168	SB18A-20	"	1620		X	3	"
A127169	SB7-20	"	1700		X	3	"
A127170	SB28-21	"	1720		X	3	"
A127171	SB8-21	"	1745		X	3	"
A127172	SB6-22	10/15/98	0900		X	3	"
A127173	SB9-14	"	1015		X	3	"
	SB9-14 MS	"	"		X	3	"

ished by: (Signature)	Date / Time	Received by: (Signature)	Received for Laboratory by:	Date / Time
	10/15/98 1300			10/16/98 9:10
shed by: (Signature)	Date / Time	Received by: (Signature)	Remarks	
shed by: (Signature)	Date / Time	Received by: (Signature)		
ished by: (Signature)	Date / Time	Received by: (Signature)	SAI Project #: 009001	

or further assistance in completing the chain of custody form please refer to the instructions found on the opposite s

SPECIALIZED ASSAYS
ENVIRONMENTAL

Page 2 of 2

7A-059008

2960 Foster Creighton Drive
Nashville, TN 37204
615-726-0177, 800-765-0980
FAX 615/726-3404

Specialized Assays: (800) 765-098

REFERRING CLIENT

Account: 8185
Parsons Engineering/AFCEE Exte
Doug Scott
1700 Broadway Ste 900
Denver, CO 80290
Ph: 303-831-8100 Fax: 303-831-8208

CONTROL NUMBER (FOR LAB USE ONLY) 117229

PROJECT # 726876.69120

P.O. #

S (Signature-Please Print)

PROJECT NAME Wurtsmith Bioventing

LAB USE ONLY ACC#	SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	# OF CONT	ANALYSIS REQUESTED
7173	SB9-14 MSD	10/14/98	1015		x	3	8260
127174	SB9-22	"	1020		x	3	"
127175	EB-1	"	1050		x	2	8260
127176	EB-2	"	1100		x	2	"
127177	TB-1	—	—			1	8260

ished by: (Signature)	Date / Time 10/15/98 1300	Received by: (Signature)	Received for Laboratory by: Date / Time 10/16/98 9:
uished by: (Signature)	Date / Time	Received by: (Signature)	Remarks
ished by: (Signature)	Date / Time	Received by: (Signature)	
ished by: (Signature)	Date / Time	Received by: (Signature)	SAI Project #: 000005

or further assistance in completing the chain of custody form please refer to the instructions found on the opposite

Cooler Receipt Form

Client: Parsons

Cooler Received On: 10/16/98 And Opened On: 10/16/98 By: Ann R Buckingham

P.L Rapp
(Signature)

1. Temperature of Cooler when opened 4°C
2. Were custody seals on outside of cooler and intact? (Yes) No
   a. If yes, what kind and where: 2 front / back
   b. Were the signature and date correct? (Yes) No
3. Were custody papers inside cooler? (Yes) No
4. Were custody papers properly filled out (ink, signed, etc)? (Yes) No
5. Did you sign the custody papers in the appropriate place? (Yes) No
6. What kind of packing material was used? bubble wrap
7. Was sufficient ice used (if appropriate)? (Yes) No
8. Did all bottles arrive in good condition (unbroken)? (Yes) No
9. Were all bottle labels complete (#, date, signed, pres, etc)? (Yes) No
10. Did all bottle labels and tags agree with custody papers? (Yes) No
11. Were correct bottles used for the analysis requested? (Yes) No
12. If present, were VOA vials checked for absence of air bubbles and noted if found? (Yes) No
13. Was sufficient amount of sample sent in each bottle? (Yes) No
14. Were correct preservatives used? (Yes) No
15. Corrective action taken, if necessary:
    a. Name of person contacted: _____
    b. Date _____

SPECIALIZED ASSAYS, INC.

BTX SOIL PREP LOG

DATE: 10/16/98

NAME:

BATCH NO.: 117229

PAGE NO:

MATRIX: Soil

ANALYST: Chl

	SAMPLE ID	SAMPLE WEIGHT (g)	DILUTION	METHOD	WORKLIST	REMARKS
Prep Blank #						Project #
	127165	4.32		5035	4564	117229
	127166	4.97				
	127167	5.02				
	127168	5.42				
	127169	5.15				
	127170	5.25				
	127171	4.85				
	127172	4.72				
	127173	5.35				
0	127174	5.61				
	[redacted]	[redacted]		5035	4510	117221
2	127148	4.95				
	127149	4.92				
	127150	4.89				
5	127151	5.33				
	127152	5.41				
7	127028	5.26		5035	4446	117197
	127029	5.09				
9	127030	5.37				
LCS						
SPIKE						
SPIKE Dupl.						

KING SOLUTIONS:

REAGENTS:

000004

SNA12

FedEx. USA Airbill

FedEx Tracking Number 808219104027

Form I.D. No. 0210

Recipient's Copy

From

10/15/98

Parsons Engineering/ARCH Lyle

Sender's Name _____ Phone ( )

1700 Broadway Ste 900

Company Denver CO 80290

Address 8135 Dept/Floor/Suite/Room

City _____ State _____ ZIP _____

Your Internal Billing Reference Information _____

To

Recipient's Name SAMPLE RECEIVING Phone (615) 726-0177

Company SPECIALIZED ASSAYS ENVIRON

☐ Check here if residence (Extra charge applies for FedEx Express Saver)

Address 2960 FOSTER CREIGHTON DR Dept/Floor/Suite/Room

("HOLD" at FedEx location, print FedEx address here)

City NASHVILLE State TN ZIP 37204-3719

For HOLD at FedEx Location check here

☐ Hold Weekday (Not available with FedEx First Overnight)

☐ Hold Saturday (Not available at all locations) (Available for FedEx Priority Overnight and FedEx 2Day only)

For WEEKEND Delivery check here (Extra Charge. Not available at all locations)

☐ Saturday Delivery (Available for FedEx Priority Overnight and FedEx 2Day only)

☐ NEW Sunday Delivery (Available for FedEx Priority Overnight only)

4a Express Package Service *Packages under 150 lbs.* Delivery commitment may be later in some areas.

☒ FedEx Priority Overnight (Next business morning)

☐ FedEx Standard Overnight (Next business afternoon)

☐ FedEx First Overnight (Earliest next business morning delivery to select locations) (Higher rates apply)

☐ FedEx 2Day (Second business day)

☐ FedEx Express Saver (Third business day)

FedEx Letter Rate not available. Minimum charge: One pound rate.

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.

☐ FedEx Overnight Freight (Next business day)

☐ FedEx 2Day Freight (Second business day)

☐ FedEx Express Saver Freight (Up to 3 business days)

(Call for delivery schedule. See back for detailed descriptions of freight services.)

5 Packaging

☐ FedEx Letter ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☒ Other Pkg.

Declared value limit $500

6 Special Handling (One box must be checked)

Does this shipment contain dangerous goods?* ☐ No ☐ Yes (As per attached Shipper's Declaration) ☐ Yes (Shipper's Declaration not required)

☐ Dry Ice Dry Ice, 9, UN 1845 _____ x _____ kg

☐ Cargo Aircraft Only

*Dangerous Goods cannot be shipped in FedEx packaging

7 Payment Obtain Recipient FedEx Account No.

Bill to: ☐ Sender (Account No in Section 1 will be billed) ☒ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

(Enter FedEx Account No. or Credit Card No. below)

Total Packages	Total Weight	Total Declared Value*	Total Charges
		$ .00	$

*When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE, AND LIMIT OF LIABILITY section for further information

Credit Card Auth. #

8 Release Signature

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

321

For Questions? Call 1-800-Go-FedEx® (800)463-3339

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VOLATILE ORGANICS - WATER

SUMMARY

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

EB-1

Matrix: Water
pH:
Units: ug/l
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-8

Lab Sample ID: 98-A127175
Date Sampled:: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/20/98
Analysis Time: 22:33
Sample QC Group: 4751

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.5	U
71-43-2	Benzene	0.4	U
108-86-1	Bromobenzene	0.3	U
74-97-5	Bromochloromethane	0.4	U
75-25-2	Bromoform	1.2	U
74-83-9	Bromomethane	1.1	U
104-51-8	n-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.3	U
98-06-6	t-Butylbenzene	1.4	U
56-23-5	Carbon tetrachloride	2.1	U
108-90-7	Chlorobenzene	0.4	U
75-00-3	Chloroethane	1.0	U
67-66-3	Chloroform	0.3	U
74-87-3	Chloromethane	1.3	U
95-49-8	2-Chlorotoluene	0.4	U
106-43-4	4-Chlorotoluene	0.6	U
96-12-8	1,2-Dibromo-3-chloropropane	2.6	U
124-48-1	Dibromochloromethane	0.5	U
74-95-3	1,2-Dibromoethane	0.6	U
74-95-3	Dibromomethane	2.4	U
95-50-1	1,2-Dichlorobenzene	0.3	U
541-73-1	1,3-Dichlorobenzene	1.2	U
106-46-7	1,4-Dichlorobenzene	0.3	U
75-71-8	Dichlorodifluoromethane	1.0	U
75-34-3	1,1-Dichloroethane	0.4	U
107-06-2	1,2-Dichloroethane	0.6	U
75-35-4	1,1-Dichloroethene	1.2	U
156-59-2	cis-1,2-Dichloroethene	1.2	U
156-60-5	trans-1,2-Dichloroethene	0.6	U
78-87-5	1,2-Dichloropropane	0.4	U
142-28-9	1,3-Dichloropropane	0.4	U
594-20-7	2,2-Dichloropropane	3.5	U
563-58-6	1,1-Dichloropropene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
100-41-4	Ethylbenzene	0.6	U
87-68-3	Hexachlorobutadiene	1.1	U
98-82-8	Isopropylbenzene	0.5	U
99-87-6	4-Isopropyltoluene	1.2	U

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

EB-1

Matrix: Water
pH:
Units: ug/l

Lab Sample ID: 98-A127175
Date Sampled:: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	0.3	U
91-20-3	Naphthalene	0.4	U
103-65-1	n-Propylbenzene	0.4	U
100-42-5	Styrene	0.4	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.4	U
127-18-4	Tetrachloroethene	1.4	U
108-88-3	Toluene	1.1	U
87-61-6	1,2,3-Trichlorobenzene	0.3	U
120-82-1	1,2,4-Trichlorobenzene	0.4	U
71-55-6	1,1,1-Trichloroethane	0.8	U
79-00-5	1,1,2-Trichloroethane	1.0	U
79-01-6	Trichloroethene	1.0	U
96-18-4	1,2,3-Trichloropropane	3.2	U
95-63-6	1,2,4-Trimethylbenzene	1.3	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
75-01-4	Vinyl chloride	1.1	U
75-27-4	Bromodichloromethane	0.8	U
95-47-6	o-Xylene	0.5	U
108-38-3	m,p-Xylene	0.5	U
75-69-4	Trichlorofluoromethane	0.8	U

000007

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

EB-2

Matrix: Water
pH:
Units: ug/l
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-8

Lab Sample ID: 98-A127176
Date Sampled:: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/20/98
Analysis Time: 23:10
Sample QC Group: 4751

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	2.5	....	U
71-43-2	Benzene	0.4	....	U
108-86-1	Bromobenzene	0.3	....	U
74-97-5	Bromochloromethane	0.4	....	U
75-25-2	Bromoform	1.2	....	U
74-83-9	Bromomethane	1.1	....	U
104-51-8	n-Butylbenzene	1.1	....	U
135-98-8	sec-Butylbenzene	1.3	....	U
98-06-6	t-Butylbenzene	1.4	....	U
56-23-5	Carbon tetrachloride	2.1	....	U
108-90-7	Chlorobenzene	0.4	....	U
75-00-3	Chloroethane	1.0	....	U
67-66-3	Chloroform	0.3	....	U
74-87-3	Chloromethane	1.3	....	U
95-49-8	2-Chlorotoluene	0.4	....	U
106-43-4	4-Chlorotoluene	0.6	....	U
96-12-8	1,2-Dibromo-3-chloropropane	2.6	....	U
124-48-1	Dibromochloromethane	0.5	....	U
74-95-3	1,2-Dibromoethane	0.6	....	U
74-95-3	Dibromomethane	2.4	....	U
95-50-1	1,2-Dichlorobenzene	0.3	....	U
541-73-1	1,3-Dichlorobenzene	1.2	....	U
106-46-7	1,4-Dichlorobenzene	0.3	....	U
75-71-8	Dichlorodifluoromethane	1.0	....	U
75-34-3	1,1-Dichloroethane	0.4	....	U
107-06-2	1,2-Dichloroethane	0.6	....	U
75-35-4	1,1-Dichloroethene	1.2	....	U
156-59-2	cis-1,2-Dichloroethene	1.2	....	U
156-60-5	trans-1,2-Dichloroethene	0.6	....	U
78-87-5	1,2-Dichloropropane	0.4	....	U
142-28-9	1,3-Dichloropropane	0.4	....	U
594-20-7	2,2-Dichloropropane	3.5	....	U
563-58-6	1,1-Dichloropropene	1.0	....	U
10061-01-5	cis-1,3-Dichloropropene	1.0	....	U
10061-02-6	trans-1,3-Dichloropropene	1.0	....	U
100-41-4	Ethylbenzene	0.6	....	U
87-68-3	Hexachlorobutadiene	1.1	....	U
98-82-8	Isopropylbenzene	0.5	....	U
99-87-6	4-Isopropyltoluene	1.2	....	U

000008

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

EB-2

Matrix: Water
pH:
Units: ug/l

Lab Sample ID: 98-A127176
Date Sampled:: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	0.3	U
91-20-3	Naphthalene	0.4	U
103-65-1	n-Propylbenzene	0.4	U
100-42-5	Styrene	0.4	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.4	U
127-18-4	Tetrachloroethene	1.4	U
108-88-3	Toluene	1.1	U
87-61-6	1,2,3-Trichlorobenzene	0.3	U
120-82-1	1,2,4-Trichlorobenzene	0.4	U
71-55-6	1,1,1-Trichloroethane	0.8	U
79-00-5	1,1,2-Trichloroethane	1.0	U
79-01-6	Trichloroethene	1.0	U
96-18-4	1,2,3-Trichloropropane	3.2	U
95-63-6	1,2,4-Trimethylbenzene	1.3	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
75-01-4	Vinyl chloride	1.1	U
75-27-4	Bromodichloromethane	0.8	U
95-47-6	o-Xylene	0.5	U
108-38-3	m,p-Xylene	0.5	U
75-69-4	Trichlorofluoromethane	0.8	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

TB-1

Matrix: Water
pH:
Units: ug/l
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-8

Lab Sample ID: 98-A127177
Date Sampled::
Date Received: 10/16/98
Analysis Date: 10/20/98
Analysis Time: 23:47
Sample QC Group: 4751

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.5	U
71-43-2	Benzene	0.4	U
108-86-1	Bromobenzene	0.3	U
74-97-5	Bromochloromethane	0.4	U
75-25-2	Bromoform	1.2	U
74-83-9	Bromomethane	1.1	U
104-51-8	n-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.3	U
98-06-6	t-Butylbenzene	1.4	U
56-23-5	Carbon tetrachloride	2.1	U
108-90-7	Chlorobenzene	0.4	U
75-00-3	Chloroethane	1.0	U
67-66-3	Chloroform	0.3	U
74-87-3	Chloromethane	1.3	U
95-49-8	2-Chlorotoluene	0.4	U
106-43-4	4-Chlorotoluene	0.6	U
96-12-8	1,2-Dibromo-3-chloropropane	2.6	U
124-48-1	Dibromochloromethane	0.5	U
74-95-3	1,2-Dibromoethane	0.6	U
74-95-3	Dibromomethane	2.4	U
95-50-1	1,2-Dichlorobenzene	0.3	U
541-73-1	1,3-Dichlorobenzene	1.2	U
106-46-7	1,4-Dichlorobenzene	0.3	U
75-71-8	Dichlorodifluoromethane	1.0	U
75-34-3	1,1-Dichloroethane	0.4	U
107-06-2	1,2-Dichloroethane	0.6	U
75-35-4	1,1-Dichloroethene	1.2	U
156-59-2	cis-1,2-Dichloroethene	1.2	U
156-60-5	trans-1,2-Dichloroethene	0.6	U
78-87-5	1,2-Dichloropropane	0.4	U
142-28-9	1,3-Dichloropropane	0.4	U
594-20-7	2,2-Dichloropropane	3.5	U
563-58-6	1,1-Dichloropropene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
100-41-4	Ethylbenzene	0.6	U
87-68-3	Hexachlorobutadiene	1.1	U
98-82-8	Isopropylbenzene	0.5	U
99-87-6	4-Isopropyltoluene	1.2	U

000010

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

TB-1

Matrix: Water
pH:
Units: ug/l

Lab Sample ID: 98-A127177
Date Sampled::
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	0.3	U
91-20-3	Naphthalene	0.4	U
103-65-1	n-Propylbenzene	0.4	U
100-42-5	Styrene	0.4	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.4	U
127-18-4	Tetrachloroethene	1.4	U
108-88-3	Toluene	1.1	U
87-61-6	1,2,3-Trichlorobenzene	0.3	U
120-82-1	1,2,4-Trichlorobenzene	0.4	U
71-55-6	1,1,1-Trichloroethane	0.8	U
79-00-5	1,1,2-Trichloroethane	1.0	U
79-01-6	Trichloroethene	1.0	U
96-18-4	1,2,3-Trichloropropane	3.2	U
95-63-6	1,2,4-Trimethylbenzene	1.3	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
75-01-4	Vinyl chloride	1.1	U
75-27-4	Bromodichloromethane	0.8	U
95-47-6	o-Xylene	0.5	U
108-38-3	m,p-Xylene	0.5	U
75-69-4	Trichlorofluoromethane	0.8	U

000011

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Water
% Dry Weight:
Units: UG/L
Dilution Factor: 1
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-8

Lab Sample ID: BLANK
Date Sampled:
Date Received: 10/16/98
Analysis Date: 10/20/98
Analysis Time: 15:36
Sample QC Group: 4751

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
71-43-2	Benzene	0.4	....	U
108-86-1	Bromobenzene	0.3	....	U
74-97-5	Bromochloromethane	0.4	....	U
75-25-2	Bromoform	1.2	....	U
74-83-9	Bromomethane	1.1	....	U
104-51-8	n-Butylbenzene	1.1	....	U
135-98-8	sec-Butylbenzene	1.3	....	U
98-06-6	t-Butylbenzene	1.4	....	U
56-23-5	Carbon tetrachloride	2.1	....	U
108-90-7	Chlorobenzene	0.4	....	U
75-00-3	Chloroethane	1.0	....	U
67-66-3	Chloroform	0.3	....	U
74-87-3	Chloromethane	1.3	....	U
95-49-8	2-Chlorotoluene	0.4	....	U
106-43-4	4-Chlorotoluene	0.6	....	U
96-12-8	1,2-Dibromo-3-chloropropane	2.6	....	U
124-48-1	Dibromochloromethane	0.5	....	U
74-95-3	1,2-Dibromoethane	0.6	....	U
74-95-3	Dibromomethane	2.4	....	U
95-50-1	1,2-Dichlorobenzene	0.3	....	U
541-73-1	1,3-Dichlorobenzene	1.2	....	U
106-46-7	1,4-Dichlorobenzene	0.3	....	U
75-71-8	Dichlorodifluoromethane	1.0	....	U
75-34-3	1,1-Dichloroethane	0.4	....	U
107-06-2	1,2-Dichloroethane	0.6	....	U
75-35-4	1,1-Dichloroethene	1.2	....	U
156-59-2	cis-1,2-Dichloroethene	1.2	....	U
156-60-5	trans-1,2-Dichloroethene	0.6	....	U
78-87-5	1,2-Dichloropropane	0.4	....	U
142-28-9	1,3-Dichloropropane	0.4	....	U
594-20-7	2,2-Dichloropropane	3.5	....	U
563-58-6	1,1-Dichloropropene	1.0	....	U
10061-01-5	cis-1,3-Dichloropropene	1.0	....	U
10061-02-6	trans-1,3-Dichloropropene	1.0	....	U
100-41-4	Ethylbenzene	0.6	....	U
87-68-3	Hexachlorobutadiene	1.1	....	U
98-82-8	Isopropylbenzene	0.5	....	U
99-87-6	4-Isopropyltoluene	1.2	....	U
75-09-2	Methylene chloride	0.3	....	U

000012

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Water
% Dry Weight:
Units: UG/L

Lab Sample ID: BLANK
Date Sampled:
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
91-20-3	Naphthalene	0.4	U
103-65-1	n-Propylbenzene	0.4	U
100-42-5	Styrene	0.4	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.4	U
127-18-4	Tetrachloroethene	1.4	U
108-88-3	Toluene	1.1	U
87-61-6	1,2,3-Trichlorobenzene	0.3	U
120-82-1	1,2,4-Trichlorobenzene	0.4	U
71-55-6	1,1,1-Trichloroethane	0.8	U
79-00-5	1,1,2-Trichloroethane	1.0	U
79-01-6	Trichloroethene	1.0	U
96-18-4	1,2,3-Trichloropropane	3.2	U
95-63-6	1,2,4-Trimethylbenzene	1.3	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
75-01-4	Vinyl chloride	1.1	U
75-27-4	Bromodichloromethane	0.8	U
95-47-6	o-Xylene	1.1	U
108-38-3	m,p-Xylene	0.5	U
75-69-4	Trichlorofluoromethane	0.8	U

000013

2A

WATER VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: SPECIALIZED ASSAYS Contract: _____

Lab Code: SASSAYS Case No.: _____ SAS No.: _____ SDG No.: 117229W

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01	VBLK02	109	97	95	0
02	EB-1	114	97	96	0
03	EB-2	117	97	97	0
04	TB-1	119	98	97	0
05	127137MS	125	100	100	0
06	127137MSD	114	98	97	0
07	CONTROL	115	98	97	0

			QC LIMITS
SMC1	=	1,2-Dichloroethane-d4	(70-131)
SMC2	=	Toluene-d8	(83-115)
SMC3	=	Bromofluorobenzene	(73-119)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D System Monitoring Compound diluted out

FORM 3A

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Matrix Spike Sample: SDG: 117229

QC Group: 4751

Compound	Spike Added	Sample Conc	Spike Conc	% Rec	QC Limits
Benzene	50.0	0.0	50.0	100	58 - 135
Chlorobenzene	50.0	0.0	46.0	92	56 - 126
1,1-Dichloroethene	50.0	0.0	48.0	96	58 - 138
Toluene	50.0	0.0	54.0	108	56 - 135
Trichloroethene	50.0	0.0	47.0	94	52 - 143

Compound	Spike Added	MSD Conc	% Rec	RPD	RPD Limit	Recovery Limits
Benzene	50.0	53.0	106	6	15	58 - 135
Chlorobenzene	50.0	52.0	104	12	19	56 - 126
1,1-Dichloroethene	50.0	51.0	102	6	16	58 - 138
Toluene	50.0	59.0	118	9	20	56 - 135
Trichloroethene	50.0	54.0	108	14	22	52 - 143

Concentration Units: ug/l

RPD: 0 out of 5 outside QC limits.
Spike Recoveries: 0 out of 10 outside QC limits.

FORM 3Aa

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

SDG: 117229 QC Group: 4751

Compound	Known Value	Conc	% Rec	QC Limits
Benzene	50	56	112	73-136
Bromobenzene	50	61	122	76-138
Bromochloromethane	50	57	114	65-145
Bromoform	50	62	124	50-146
Bromomethane	50	46	92	47-145
n-Butylbenzene	50	56	112	72-142
sec-Butylbenzene	50	53	106	65-148
t-Butylbenzene	50	51	102	74-132
Carbon tetrachloride	50	52	104	65-134
Chlorobenzene	50	52	104	72-133
Chloroethane	50	43	86	60-152
Chloroform	50	62	124	75-138
Chloromethane	50	42	84	58-152
2-Chlorotoluene	50	58	116	75-137
4-Chlorotoluene	50	57	114	73-137
1,2-Dibromo-3-chloropropane	50	56	112	70-130
Dibromochloromethane	50	57	114	60-141
1,2-Dibromoethane	50	58	116	66-142
Dibromomethane	50	60	120	70-139
1,2-Dichlorobenzene	50	53	106	72-139
1,3-Dichlorobenzene	50	53	106	72-134
1,4-Dichlorobenzene	50	51	102	74-128
Dichlorodifluoromethane	50	52	104	52-150
1,1-Dichloroethane	50	56	112	70-142
1,2-Dichloroethane	50	61	122	73-144
1,1-Dichloroethene	50	50	100	68-141
cis-1,2-Dichloroethene	50	58	116	70-144
trans-1,2-Dichloroethene	50	56	112	68-131
1,2-Dichloropropane	50	57	114	74-140
1,3-Dichloropropane	50	62	124	75-137
2,2-Dichloropropane	50	53	106	58-133
1,1-Dichloropropene	50	56	112	70-140
cis-1,3-Dichloropropene	50	58	116	69-130
trans-1,3-Dichloropropene	50	59	118	64-133
Ethylbenzene	50	56	112	71-141
Hexachlorobutadiene	50	48	96	58-140
Isopropylbenzene	50	54	108	70-147
4-Isopropyltoluene	50	50	100	68-138
Methylene chloride	50	60	120	64-154

FORM 3Aa

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Naphthalene	50	61	122	42-158
n-Propylbenzene	50	57	114	52-168
Styrene	50	54	108	68-137
1,1,1,2-Tetrachloroethane	50	54	108	67-135
1,1,2,2-Tetrachloroethane	50	63	126	64-155
Tetrachloroethene	50	50	100	69-132
Toluene	50	57	114	75-136
1,2,3-Trichlorobenzene	50	55	110	48-152
1,2,4-Trichlorobenzene	50	52	104	55-142
1,1,1-Trichloroethane	50	55	110	73-136
1,1,2-Trichloroethane	50	60	120	72-138
Trichloroethene	50	50	100	73-136
1,2,3-Trichloropropane	50	64	128	53-147
1,2,4-Trimethylbenzene	50	53	106	73-138
1,3,5-Trimethylbenzene	50	54	108	74-137
Vinyl chloride	50	44	88	54-154
Bromodichloromethane	50	62	124	69-136
o-Xylene	50	56	112	70-145
m,p-Xylene	50	55	110	63-156
Trichlorofluoromethane	50	48	96	66-142

Concentration Units: ug/l

Recoveries: 0 out of 59 outside QC limits.

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB25-23

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight
Dilution Factor: 125.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127165
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/19/98
Analysis Time: 11:14
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	347.	U
71-43-2	Benzene	278.	U
108-86-1	Bromobenzene	278.	U
124-48-1	Bromochloromethane	278.	U
75-25-2	Bromoform	833.	U
74-83-9	Bromomethane	694.	U
104-51-8	n-Butylbenzene	694.	U
135-98-8	sec-Butylbenzene	972.	U
98-06-6	t-Butylbenzene	972.	U
56-23-5	Carbon tetrachloride	1390	U
108-90-7	Chlorobenzene	278.	U
75-00-3	Chloroethane	694.	U
67-66-3	Chloroform	278.	U
74-87-3	Chloromethane	972.	U
95-49-8	2-Chlorotoluene	278.	U
106-43-4	4-Chlorotoluene	417.	U
96-12-8	1,2-Dibromo-3-chloropropane	139.	U
124-48-1	Dibromochloromethane	417.	U
74-95-3	1,2-Dibromoethane	417.	U
74-95-3	Dibromomethane	1390	U
95-50-1	1,2-Dichlorobenzene	278.	U
541-73-1	1,3-Dichlorobenzene	833.	U
106-46-7	1,4-Dichlorobenzene	278.	U
75-71-8	Dichlorodifluoromethane	694.	U
75-34-3	1,1-Dichloroethane	278.	U
107-06-2	1,2-Dichloroethane	417.	U
75-35-4	1,1-Dichloroethene	833.	U
156-59-2	cis-1,2-Dichloroethene	833.	U
156-60-5	trans-1,2-Dichloroethene	417.	U
78-87-5	1,2-Dichloropropane	278.	U
142-28-9	1,3-Dichloropropane	278.	U
594-20-7	2,2-Dichloropropane	2780	U
563-58-6	1,1-Dichloropropene	694.	U
10061-01-5	cis-1,3-Dichloropropene	694.	U
10061-02-6	trans-1,3-Dichloropropene	694.	U
100-41-4	Ethylbenzene	3470	
87-68-3	Hexachlorobutadiene	694.	U
98-82-8	Isopropylbenzene	1110	U
99-87-6	4-Isopropyltoluene	833.	U

080129

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB25-23

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight

Lab Sample ID: 98-A127165
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	278.	U
91-20-3	Naphthalene	1250	
103-65-1	n-Propylbenzene	278.	U
100-42-5	Styrene	278.	U
630-20-6	1,1,1,2-Tetrachloroethane	417.	U
79-34-5	1,1,2,2-Tetrachloroethane	278.	U
127-18-4	Tetrachloroethene	972.	U
108-88-3	Toluene	694.	U
87-61-6	1,2,3-Trichlorobenzene	278.	U
120-82-1	1,2,4-Trichlorobenzene	278.	U
71-55-6	1,1,1-Trichloroethane	556.	U
79-00-5	1,1,2-Trichloroethane	694.	U
79-01-6	Trichloroethene	1390	U
96-18-4	1,2,3-Trichloropropane	2780	U
95-63-6	1,2,4-Trimethylbenzene	7220	
108-67-8	1,3,5-Trimethylbenzene	2500	
75-01-4	Vinyl chloride	1250	U
75-27-4	Bromodichloromethane	556.	U
6615	o-Xylene	694.	U
6616	m,p-Xylene	14000	
75-69-4	Trichlorofluoromethane	556.	U

000130

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB5-23

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight
Dilution Factor: 125.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127166
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/19/98
Analysis Time: 11:50
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	347.	U
71-43-2	Benzene	278.	U
108-86-1	Bromobenzene	278.	U
124-48-1	Bromochloromethane	278.	U
75-25-2	Bromoform	833.	U
74-83-9	Bromomethane	694.	U
104-51-8	n-Butylbenzene	694.	U
135-98-8	sec-Butylbenzene	556.	J
98-06-6	t-Butylbenzene	972.	U
56-23-5	Carbon tetrachloride	1390	U
108-90-7	Chlorobenzene	278.	U
75-00-3	Chloroethane	694.	U
67-66-3	Chloroform	278.	U
74-87-3	Chloromethane	972.	U
95-49-8	2-Chlorotoluene	278.	U
106-43-4	4-Chlorotoluene	417.	U
96-12-8	1,2-Dibromo-3-chloropropane	139.	U
124-48-1	Dibromochloromethane	417.	U
74-95-3	1,2-Dibromoethane	417.	U
74-95-3	Dibromomethane	1390	U
95-50-1	1,2-Dichlorobenzene	278.	U
541-73-1	1,3-Dichlorobenzene	833.	U
106-46-7	1,4-Dichlorobenzene	278.	U
75-71-8	Dichlorodifluoromethane	694.	U
75-34-3	1,1-Dichloroethane	278.	U
107-06-2	1,2-Dichloroethane	417.	U
75-35-4	1,1-Dichloroethene	833.	U
156-59-2	cis-1,2-Dichloroethene	833.	U
156-60-5	trans-1,2-Dichloroethene	417.	U
78-87-5	1,2-Dichloropropane	278.	U
142-28-9	1,3-Dichloropropane	278.	U
594-20-7	2,2-Dichloropropane	2780	U
563-58-6	1,1-Dichloropropene	694.	U
10061-01-5	cis-1,3-Dichloropropene	694.	U
10061-02-6	trans-1,3-Dichloropropene	694.	U
100-41-4	Ethylbenzene	2360	
87-68-3	Hexachlorobutadiene	694.	U
98-82-8	Isopropylbenzene	1110	U
99-87-6	4-Isopropyltoluene	833.	U

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB5-23

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight

Lab Sample ID: 98-A127166
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	278.	U
91-20-3	Naphthalene	972.	
103-65-1	n-Propylbenzene	278.	U
100-42-5	Styrene	278.	U
630-20-6	1,1,1,2-Tetrachloroethane	417.	U
79-34-5	1,1,2,2-Tetrachloroethane	278.	U
127-18-4	Tetrachloroethene	972.	U
108-88-3	Toluene	694.	U
87-61-6	1,2,3-Trichlorobenzene	278.	U
120-82-1	1,2,4-Trichlorobenzene	278.	U
71-55-6	1,1,1-Trichloroethane	556.	U
79-00-5	1,1,2-Trichloroethane	694.	U
79-01-6	Trichloroethene	1390	U
96-18-4	1,2,3-Trichloropropane	2780	U
95-63-6	1,2,4-Trimethylbenzene	972.	U
108-67-8	1,3,5-Trimethylbenzene	2220	
75-01-4	Vinyl chloride	1250	U
75-27-4	Bromodichloromethane	556.	U
6615	o-Xylene	694.	U
6616	m,p-Xylene	10800	
75-69-4	Trichlorofluoromethane	556.	U

000132

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB5-12

Matrix: Soil
% Dry Weight: 95.
Units: ug/kg dry weight
Dilution Factor: 5.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127167
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/23/98
Analysis Time: 0:39
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	13.2	....	U
71-43-2	Benzene	10.5	....	U
108-86-1	Bromobenzene	10.5	....	U
124-48-1	Bromochloromethane	10.5	....	U
75-25-2	Bromoform	31.6	....	U
74-83-9	Bromomethane	26.3	....	U
104-51-8	n-Butylbenzene	26.3	....	U
135-98-8	sec-Butylbenzene	36.8	....	U
98-06-6	t-Butylbenzene	36.8	....	U
56-23-5	Carbon tetrachloride	52.6	....	U
108-90-7	Chlorobenzene	10.5	....	U
75-00-3	Chloroethane	26.3	....	U
67-66-3	Chloroform	10.5	....	U
74-87-3	Chloromethane	36.8	....	U
95-49-8	2-Chlorotoluene	10.5	....	U
106-43-4	4-Chlorotoluene	15.8	....	U
96-12-8	1,2-Dibromo-3-chloropropane	5.3	....	U
124-48-1	Dibromochloromethane	15.8	....	U
74-95-3	1,2-Dibromoethane	15.8	....	U
74-95-3	Dibromomethane	52.6	....	U
95-50-1	1,2-Dichlorobenzene	10.5	....	U
541-73-1	1,3-Dichlorobenzene	31.6	....	U
106-46-7	1,4-Dichlorobenzene	10.5	....	U
75-71-8	Dichlorodifluoromethane	26.3	....	U
75-34-3	1,1-Dichloroethane	10.5	....	U
107-06-2	1,2-Dichloroethane	15.8	....	U
75-35-4	1,1-Dichloroethene	31.6	....	U
156-59-2	cis-1,2-Dichloroethene	31.6	....	U
156-60-5	trans-1,2-Dichloroethene	15.8	....	U
78-87-5	1,2-Dichloropropane	10.5	....	U
142-28-9	1,3-Dichloropropane	10.5	....	U
594-20-7	2,2-Dichloropropane	105.	....	U
563-58-6	1,1-Dichloropropene	26.3	....	U
10061-01-5	cis-1,3-Dichloropropene	26.3	....	U
10061-02-6	trans-1,3-Dichloropropene	26.3	....	U
100-41-4	Ethylbenzene	15.8	....	U
87-68-3	Hexachlorobutadiene	26.3	....	U
98-82-8	Isopropylbenzene	42.1	....	U
99-87-6	4-Isopropyltoluene	31.6	....	U

000133

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB5-12

Matrix: Soil
% Dry Weight: 95.
Units: ug/kg dry weight

Lab Sample ID: 98-A127167
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	10.5	U
91-20-3	Naphthalene	10.5	U
103-65-1	n-Propylbenzene	10.5	U
100-42-5	Styrene	10.5	U
630-20-6	1,1,1,2-Tetrachloroethane	15.8	U
79-34-5	1,1,2,2-Tetrachloroethane	10.5	U
127-18-4	Tetrachloroethene	36.8	U
108-88-3	Toluene	26.3	U
87-61-6	1,2,3-Trichlorobenzene	10.5	U
120-82-1	1,2,4-Trichlorobenzene	10.5	U
71-55-6	1,1,1-Trichloroethane	21.1	U
79-00-5	1,1,2-Trichloroethane	26.3	U
79-01-6	Trichloroethene	52.6	U
96-18-4	1,2,3-Trichloropropane	105.	U
95-63-6	1,2,4-Trimethylbenzene	36.8	U
108-67-8	1,3,5-Trimethylbenzene	15.8	U
75-01-4	Vinyl chloride	47.4	U
75-27-4	Bromodichloromethane	21.1	U
6615	o-Xylene	26.3	U
6616	m,p-Xylene	15.8	U
75-69-4	Trichlorofluoromethane	21.1	U

000134

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB18A-20

Matrix: Soil
% Dry Weight: 92.
Units: ug/kg dry weight
Dilution Factor: 125.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127168
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/19/98
Analysis Time: 13:03
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	340.	U
71-43-2	Benzene	272.	U
108-86-1	Bromobenzene	272.	U
124-48-1	Bromochloromethane	272.	U
75-25-2	Bromoform	815.	U
74-83-9	Bromomethane	679.	U
104-51-8	n-Butylbenzene	679.	U
135-98-8	sec-Butylbenzene	951.	U
98-06-6	t-Butylbenzene	951.	U
56-23-5	Carbon tetrachloride	1360	U
108-90-7	Chlorobenzene	272.	U
75-00-3	Chloroethane	679.	U
67-66-3	Chloroform	272.	U
74-87-3	Chloromethane	951.	U
95-49-8	2-Chlorotoluene	272.	U
106-43-4	4-Chlorotoluene	408.	U
96-12-8	1,2-Dibromo-3-chloropropane	136.	U
124-48-1	Dibromochloromethane	408.	U
74-95-3	1,2-Dibromoethane	408.	U
74-95-3	Dibromomethane	1360	U
95-50-1	1,2-Dichlorobenzene	272.	U
541-73-1	1,3-Dichlorobenzene	815.	U
106-46-7	1,4-Dichlorobenzene	272.	U
75-71-8	Dichlorodifluoromethane	679.	U
75-34-3	1,1-Dichloroethane	272.	U
107-06-2	1,2-Dichloroethane	408.	U
75-35-4	1,1-Dichloroethene	815.	U
156-59-2	cis-1,2-Dichloroethene	815.	U
156-60-5	trans-1,2-Dichloroethene	408.	U
78-87-5	1,2-Dichloropropane	272.	U
142-28-9	1,3-Dichloropropane	272.	U
594-20-7	2,2-Dichloropropane	2720	U
563-58-6	1,1-Dichloropropene	679.	U
10061-01-5	cis-1,3-Dichloropropene	679.	U
10061-02-6	trans-1,3-Dichloropropene	679.	U
100-41-4	Ethylbenzene	815.	
87-68-3	Hexachlorobutadiene	679.	U
98-82-8	Isopropylbenzene	1090	U
99-87-6	4-Isopropyltoluene	815.	U

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB18A-20

Matrix: Soil
% Dry Weight: 92.
Units: ug/kg dry weight

Lab Sample ID: 98-A127168
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	272.	U
91-20-3	Naphthalene	543.	
103-65-1	n-Propylbenzene	272.	U
100-42-5	Styrene	272.	U
630-20-6	1,1,1,2-Tetrachloroethane	408.	U
79-34-5	1,1,2,2-Tetrachloroethane	272.	U
127-18-4	Tetrachloroethene	951.	U
108-88-3	Toluene	679.	U
87-61-6	1,2,3-Trichlorobenzene	272.	U
120-82-1	1,2,4-Trichlorobenzene	272.	U
71-55-6	1,1,1-Trichloroethane	543.	U
79-00-5	1,1,2-Trichloroethane	679.	U
79-01-6	Trichloroethene	1360	U
96-18-4	1,2,3-Trichloropropane	2720	U
95-63-6	1,2,4-Trimethylbenzene	9380	
108-67-8	1,3,5-Trimethylbenzene	5840	
75-01-4	Vinyl chloride	1220	U
75-27-4	Bromodichloromethane	543.	U
6615	o-Xylene	679.	U
6616	m,p-Xylene	6520	
75-69-4	Trichlorofluoromethane	543.	U

000136

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB7-20

Matrix: Soil
% Dry Weight: 95.
Units: ug/kg dry weight
Dilution Factor: 125.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127169
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/19/98
Analysis Time: 13:39
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	329.	....	U
71-43-2	Benzene	263.	....	U
108-86-1	Bromobenzene	263.	....	U
124-48-1	Bromochloromethane	263.	....	U
75-25-2	Bromoform	789.	....	U
74-83-9	Bromomethane	658.	....	U
104-51-8	n-Butylbenzene	658.	....	U
135-98-8	sec-Butylbenzene	921.	....	U
98-06-6	t-Butylbenzene	921.	....	U
56-23-5	Carbon tetrachloride	1320	....	U
108-90-7	Chlorobenzene	263.	....	U
75-00-3	Chloroethane	658.	....	U
67-66-3	Chloroform	263.	....	U
74-87-3	Chloromethane	921.	....	U
95-49-8	2-Chlorotoluene	263.	....	U
106-43-4	4-Chlorotoluene	395.	....	U
96-12-8	1,2-Dibromo-3-chloropropane	132.	....	U
124-48-1	Dibromochloromethane	395.	....	U
74-95-3	1,2-Dibromoethane	395.	....	U
74-95-3	Dibromomethane	1320	....	U
95-50-1	1,2-Dichlorobenzene	263.	....	U
541-73-1	1,3-Dichlorobenzene	789.	....	U
106-46-7	1,4-Dichlorobenzene	263.	....	U
75-71-8	Dichlorodifluoromethane	658.	....	U
75-34-3	1,1-Dichloroethane	263.	....	U
107-06-2	1,2-Dichloroethane	395.	....	U
75-35-4	1,1-Dichloroethene	789.	....	U
156-59-2	cis-1,2-Dichloroethene	789.	....	U
156-60-5	trans-1,2-Dichloroethene	395.	....	U
78-87-5	1,2-Dichloropropane	263.	....	U
142-28-9	1,3-Dichloropropane	263.	....	U
594-20-7	2,2-Dichloropropane	2630	....	U
563-58-6	1,1-Dichloropropene	658.	....	U
10061-01-5	cis-1,3-Dichloropropene	658.	....	U
10061-02-6	trans-1,3-Dichloropropene	658.	....	U
100-41-4	Ethylbenzene	395.	....	U
87-68-3	Hexachlorobutadiene	658.	....	U
98-82-8	Isopropylbenzene	1050	....	U
99-87-6	4-Isopropyltoluene	1970	....	

000137

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB7-20

Matrix: Soil
% Dry Weight: 95.
Units: ug/kg dry weight

Lab Sample ID: 98-A127169
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	263.	U
91-20-3	Naphthalene	3030	
103-65-1	n-Propylbenzene	263.	U
100-42-5	Styrene	263.	U
630-20-6	1,1,1,2-Tetrachloroethane	395.	U
79-34-5	1,1,2,2-Tetrachloroethane	263.	U
127-18-4	Tetrachloroethene	921.	U
108-88-3	Toluene	658.	U
87-61-6	1,2,3-Trichlorobenzene	263.	U
120-82-1	1,2,4-Trichlorobenzene	263.	U
71-55-6	1,1,1-Trichloroethane	526.	U
79-00-5	1,1,2-Trichloroethane	658.	U
79-01-6	Trichloroethene	1320	U
96-18-4	1,2,3-Trichloropropane	2630	U
95-63-6	1,2,4-Trimethylbenzene	27100	
108-67-8	1,3,5-Trimethylbenzene	10900	
75-01-4	Vinyl chloride	1180	U
75-27-4	Bromodichloromethane	526.	U
6615	o-Xylene	8950	
6616	m,p-Xylene	26200	
75-69-4	Trichlorofluoromethane	526.	U

000133

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB28-21

Matrix: Soil
% Dry Weight: 88.
Units: ug/kg dry weight
Dilution Factor: 5.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127170
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/23/98
Analysis Time: 1:15
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	14.2	....	U
71-43-2	Benzene	11.4	....	U
108-86-1	Bromobenzene	11.4	....	U
124-48-1	Bromochloromethane	11.4	....	U
75-25-2	Bromoform	34.1	....	U
74-83-9	Bromomethane	28.4	....	U
104-51-8	n-Butylbenzene	28.4	....	U
135-98-8	sec-Butylbenzene	39.8	....	U
98-06-6	t-Butylbenzene	39.8	....	U
56-23-5	Carbon tetrachloride	56.8	....	U
108-90-7	Chlorobenzene	11.4	....	U
75-00-3	Chloroethane	28.4	....	U
67-66-3	Chloroform	11.4	....	U
74-87-3	Chloromethane	39.8	....	U
95-49-8	2-Chlorotoluene	11.4	....	U
106-43-4	4-Chlorotoluene	17.0	....	U
96-12-8	1,2-Dibromo-3-chloropropane	5.7	....	U
124-48-1	Dibromochloromethane	17.0	....	U
74-95-3	1,2-Dibromoethane	17.0	....	U
74-95-3	Dibromomethane	56.8	....	U
95-50-1	1,2-Dichlorobenzene	11.4	....	U
541-73-1	1,3-Dichlorobenzene	34.1	....	U
106-46-7	1,4-Dichlorobenzene	11.4	....	U
75-71-8	Dichlorodifluoromethane	28.4	....	U
75-34-3	1,1-Dichloroethane	11.4	....	U
107-06-2	1,2-Dichloroethane	17.0	....	U
75-35-4	1,1-Dichloroethene	34.1	....	U
156-59-2	cis-1,2-Dichloroethene	34.1	....	U
156-60-5	trans-1,2-Dichloroethene	17.0	....	U
78-87-5	1,2-Dichloropropane	11.4	....	U
142-28-9	1,3-Dichloropropane	11.4	....	U
594-20-7	2,2-Dichloropropane	114.	....	U
563-58-6	1,1-Dichloropropene	28.4	....	U
10061-01-5	cis-1,3-Dichloropropene	28.4	....	U
10061-02-6	trans-1,3-Dichloropropene	28.4	....	U
100-41-4	Ethylbenzene	17.0	....	U
87-68-3	Hexachlorobutadiene	28.4	....	U
98-82-8	Isopropylbenzene	45.5	....	U
99-87-6	4-Isopropyltoluene	34.1	....	U

000130

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB28-21

Matrix: Soil
% Dry Weight: 88.
Units: ug/kg dry weight

Lab Sample ID: 98-A127170
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
75-09-2	Methylene chloride	11.4	....	U
91-20-3	Naphthalene	11.4	....	U
103-65-1	n-Propylbenzene	11.4	....	U
100-42-5	Styrene	11.4	....	U
630-20-6	1,1,1,2-Tetrachloroethane	17.0	....	U
79-34-5	1,1,2,2-Tetrachloroethane	11.4	....	U
127-18-4	Tetrachloroethene	39.8	....	U
108-88-3	Toluene	28.4	....	U
87-61-6	1,2,3-Trichlorobenzene	11.4	....	U
120-82-1	1,2,4-Trichlorobenzene	11.4	....	U
71-55-6	1,1,1-Trichloroethane	22.7	....	U
79-00-5	1,1,2-Trichloroethane	28.4	....	U
79-01-6	Trichloroethene	56.8	....	U
96-18-4	1,2,3-Trichloropropane	114.	....	U
95-63-6	1,2,4-Trimethylbenzene	39.8	....	U
108-67-8	1,3,5-Trimethylbenzene	17.0	....	U
75-01-4	Vinyl chloride	51.1	....	U
75-27-4	Bromodichloromethane	22.7	....	U
6615	o-Xylene	28.4	....	U
6616	m,p-Xylene	17.0	....	U
75-69-4	Trichlorofluoromethane	22.7	....	U

000140

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB8-21

Matrix: Soil
% Dry Weight: 85.
Units: ug/kg dry weight
Dilution Factor: 125.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127171
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/19/98
Analysis Time: 14:52
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	368.	U
71-43-2	Benzene	294.	U
108-86-1	Bromobenzene	294.	U
124-48-1	Bromochloromethane	294.	U
75-25-2	Bromoform	882.	U
74-83-9	Bromomethane	735.	U
104-51-8	n-Butylbenzene	735.	U
135-98-8	sec-Butylbenzene	1030	U
98-06-6	t-Butylbenzene	1030	U
56-23-5	Carbon tetrachloride	1470	U
108-90-7	Chlorobenzene	294.	U
75-00-3	Chloroethane	735.	U
67-66-3	Chloroform	294.	U
74-87-3	Chloromethane	1030	U
95-49-8	2-Chlorotoluene	294.	U
106-43-4	4-Chlorotoluene	441.	U
96-12-8	1,2-Dibromo-3-chloropropane	147.	U
124-48-1	Dibromochloromethane	441.	U
74-95-3	1,2-Dibromoethane	441.	U
74-95-3	Dibromomethane	1470	U
95-50-1	1,2-Dichlorobenzene	294.	U
541-73-1	1,3-Dichlorobenzene	882.	U
106-46-7	1,4-Dichlorobenzene	294.	U
75-71-8	Dichlorodifluoromethane	735.	U
75-34-3	1,1-Dichloroethane	294.	U
107-06-2	1,2-Dichloroethane	441.	U
75-35-4	1,1-Dichloroethene	882.	U
156-59-2	cis-1,2-Dichloroethene	882.	U
156-60-5	trans-1,2-Dichloroethene	441.	U
78-87-5	1,2-Dichloropropane	294.	U
142-28-9	1,3-Dichloropropane	294.	U
594-20-7	2,2-Dichloropropane	2940	U
563-58-6	1,1-Dichloropropene	735.	U
10061-01-5	cis-1,3-Dichloropropene	735.	U
10061-02-6	trans-1,3-Dichloropropene	735.	U
100-41-4	Ethylbenzene	588.	
87-68-3	Hexachlorobutadiene	735.	U
98-82-8	Isopropylbenzene	1180	U
99-87-6	4-Isopropyltoluene	882.	U

000141

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB8-21

Matrix: Soil
% Dry Weight: 85.
Units: ug/kg dry weight

Lab Sample ID: 98-A127171
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	294.	U
91-20-3	Naphthalene	294.	
103-65-1	n-Propylbenzene	294.	U
100-42-5	Styrene	294.	U
630-20-6	1,1,1,2-Tetrachloroethane	441.	U
79-34-5	1,1,2,2-Tetrachloroethane	294.	U
127-18-4	Tetrachloroethene	1030	U
108-88-3	Toluene	735.	U
87-61-6	1,2,3-Trichlorobenzene	294.	U
120-82-1	1,2,4-Trichlorobenzene	294.	U
71-55-6	1,1,1-Trichloroethane	588.	U
79-00-5	1,1,2-Trichloroethane	735.	U
79-01-6	Trichloroethene	1470	U
96-18-4	1,2,3-Trichloropropane	2940	U
95-63-6	1,2,4-Trimethylbenzene	1030	
108-67-8	1,3,5-Trimethylbenzene	441.	
75-01-4	Vinyl chloride	1320	U
75-27-4	Bromodichloromethane	588.	U
6615	o-Xylene	735.	U
6616	m,p-Xylene	1760	
75-69-4	Trichlorofluoromethane	588.	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB6-22

Matrix: Soil
% Dry Weight: 89.
Units: ug/kg dry weight
Dilution Factor: 125.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127172
Date Sampled: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/20/98
Analysis Time: 20:08
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	351.	U
71-43-2	Benzene	281.	U
108-86-1	Bromobenzene	281.	U
124-48-1	Bromochloromethane	281.	U
75-25-2	Bromoform	843.	U
74-83-9	Bromomethane	702.	U
104-51-8	n-Butylbenzene	702.	U
135-98-8	sec-Butylbenzene	983.	U
98-06-6	t-Butylbenzene	983.	U
56-23-5	Carbon tetrachloride	1400	U
108-90-7	Chlorobenzene	281.	U
75-00-3	Chloroethane	702.	U
67-66-3	Chloroform	281.	U
74-87-3	Chloromethane	983.	U
95-49-8	2-Chlorotoluene	281.	U
106-43-4	4-Chlorotoluene	421.	U
96-12-8	1,2-Dibromo-3-chloropropane	140.	U
124-48-1	Dibromochloromethane	421.	U
74-95-3	1,2-Dibromoethane	421.	U
74-95-3	Dibromomethane	1400	U
95-50-1	1,2-Dichlorobenzene	281.	U
541-73-1	1,3-Dichlorobenzene	843.	U
106-46-7	1,4-Dichlorobenzene	281.	U
75-71-8	Dichlorodifluoromethane	702.	U
75-34-3	1,1-Dichloroethane	281.	U
107-06-2	1,2-Dichloroethane	421.	U
75-35-4	1,1-Dichloroethene	843.	U
156-59-2	cis-1,2-Dichloroethene	843.	U
156-60-5	trans-1,2-Dichloroethene	421.	U
78-87-5	1,2-Dichloropropane	281.	U
142-28-9	1,3-Dichloropropane	281.	U
594-20-7	2,2-Dichloropropane	2810	U
563-58-6	1,1-Dichloropropene	702.	U
10061-01-5	cis-1,3-Dichloropropene	702.	U
10061-02-6	trans-1,3-Dichloropropene	702.	U
100-41-4	Ethylbenzene	16300	
87-68-3	Hexachlorobutadiene	702.	U
98-82-8	Isopropylbenzene	1120	U
99-87-6	4-Isopropyltoluene	1830	

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB6-22

Matrix: Soil
% Dry Weight: 89.
Units: ug/kg dry weight

Lab Sample ID: 98-A127172
Date Sampled: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	281.	U
91-20-3	Naphthalene	3370	
103-65-1	n-Propylbenzene	281.	U
100-42-5	Styrene	281.	U
630-20-6	1,1,1,2-Tetrachloroethane	421.	U
79-34-5	1,1,2,2-Tetrachloroethane	281.	U
127-18-4	Tetrachloroethene	983.	U
108-88-3	Toluene	702.	U
87-61-6	1,2,3-Trichlorobenzene	281.	U
120-82-1	1,2,4-Trichlorobenzene	281.	U
71-55-6	1,1,1-Trichloroethane	562.	U
79-00-5	1,1,2-Trichloroethane	702.	U
79-01-6	Trichloroethene	1400	U
96-18-4	1,2,3-Trichloropropane	2810	U
95-63-6	1,2,4-Trimethylbenzene	26800	
108-67-8	1,3,5-Trimethylbenzene	9410	
75-01-4	Vinyl chloride	1260	U
75-27-4	Bromodichloromethane	562.	U
6615	o-Xylene	702.	U
6616	m,p-Xylene	51100	
75-69-4	Trichlorofluoromethane	562.	U

000144

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-14

Matrix: Soil
% Dry Weight: 97.
Units: ug/kg dry weight
Dilution Factor: 5.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127173
Date Sampled: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/23/98
Analysis Time: 0:03
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	12.9	....	U
71-43-2	Benzene	10.3	....	U
108-86-1	Bromobenzene	10.3	....	U
124-48-1	Bromochloromethane	10.3	....	U
75-25-2	Bromoform	30.9	....	U
74-83-9	Bromomethane	25.8	....	U
104-51-8	n-Butylbenzene	25.8	....	U
135-98-8	sec-Butylbenzene	36.1	....	U
98-06-6	t-Butylbenzene	36.1	....	U
56-23-5	Carbon tetrachloride	51.5	....	U
108-90-7	Chlorobenzene	10.3	....	U
75-00-3	Chloroethane	25.8	....	U
67-66-3	Chloroform	10.3	....	U
74-87-3	Chloromethane	36.1	....	U
95-49-8	2-Chlorotoluene	10.3	....	U
106-43-4	4-Chlorotoluene	15.5	....	U
96-12-8	1,2-Dibromo-3-chloropropane	5.2	....	U
124-48-1	Dibromochloromethane	15.5	....	U
74-95-3	1,2-Dibromoethane	15.5	....	U
74-95-3	Dibromomethane	51.5	....	U
95-50-1	1,2-Dichlorobenzene	10.3	....	U
541-73-1	1,3-Dichlorobenzene	30.9	....	U
106-46-7	1,4-Dichlorobenzene	10.3	....	U
75-71-8	Dichlorodifluoromethane	25.8	....	U
75-34-3	1,1-Dichloroethane	10.3	....	U
107-06-2	1,2-Dichloroethane	15.5	....	U
75-35-4	1,1-Dichloroethene	30.9	....	U
156-59-2	cis-1,2-Dichloroethene	30.9	....	U
156-60-5	trans-1,2-Dichloroethene	15.5	....	U
78-87-5	1,2-Dichloropropane	10.3	....	U
142-28-9	1,3-Dichloropropane	10.3	....	U
594-20-7	2,2-Dichloropropane	103.	....	U
563-58-6	1,1-Dichloropropene	25.8	....	U
10061-01-5	cis-1,3-Dichloropropene	25.8	....	U
10061-02-6	trans-1,3-Dichloropropene	25.8	....	U
100-41-4	Ethylbenzene	15.5	....	U
87-68-3	Hexachlorobutadiene	25.8	....	U
98-82-8	Isopropylbenzene	41.2	....	U
99-87-6	4-Isopropyltoluene	30.9	....	U

000145

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-14

Matrix: Soil
% Dry Weight: 97.
Units: ug/kg dry weight

Lab Sample ID: 98-A127173
Date Sampled: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	10.3	U
91-20-3	Naphthalene	10.3	U
103-65-1	n-Propylbenzene	10.3	U
100-42-5	Styrene	10.3	U
630-20-6	1,1,1,2-Tetrachloroethane	15.5	U
79-34-5	1,1,2,2-Tetrachloroethane	10.3	U
127-18-4	Tetrachloroethene	36.1	U
108-88-3	Toluene	25.8	U
87-61-6	1,2,3-Trichlorobenzene	10.3	U
120-82-1	1,2,4-Trichlorobenzene	10.3	U
71-55-6	1,1,1-Trichloroethane	20.6	U
79-00-5	1,1,2-Trichloroethane	25.8	U
79-01-6	Trichloroethene	51.5	U
96-18-4	1,2,3-Trichloropropane	103.	U
95-63-6	1,2,4-Trimethylbenzene	36.1	U
108-67-8	1,3,5-Trimethylbenzene	15.5	U
75-01-4	Vinyl chloride	46.4	U
75-27-4	Bromodichloromethane	20.6	U
6615	o-Xylene	25.8	U
6616	m,p-Xylene	15.5	U
75-69-4	Trichlorofluoromethane	20.6	U

000146

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight
Dilution Factor: 100.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127174
Date Sampled: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/20/98
Analysis Time: 21:20
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	291.	U
71-43-2	Benzene	5700	
108-86-1	Bromobenzene	233.	U
124-48-1	Bromochloromethane	233.	U
75-25-2	Bromoform	698.	U
74-83-9	Bromomethane	581.	U
104-51-8	n-Butylbenzene	581.	U
135-98-8	sec-Butylbenzene	814.	U
98-06-6	t-Butylbenzene	814.	U
56-23-5	Carbon tetrachloride	1160	U
108-90-7	Chlorobenzene	233.	U
75-00-3	Chloroethane	581.	U
67-66-3	Chloroform	233.	U
74-87-3	Chloromethane	814.	U
95-49-8	2-Chlorotoluene	233.	U
106-43-4	4-Chlorotoluene	349.	U
96-12-8	1,2-Dibromo-3-chloropropane	116.	U
124-48-1	Dibromochloromethane	349.	U
74-95-3	1,2-Dibromoethane	349.	U
74-95-3	Dibromomethane	1160	U
95-50-1	1,2-Dichlorobenzene	233.	U
541-73-1	1,3-Dichlorobenzene	698.	U
106-46-7	1,4-Dichlorobenzene	233.	U
75-71-8	Dichlorodifluoromethane	581.	U
75-34-3	1,1-Dichloroethane	233.	U
107-06-2	1,2-Dichloroethane	349.	U
75-35-4	1,1-Dichloroethene	698.	U
156-59-2	cis-1,2-Dichloroethene	698.	U
156-60-5	trans-1,2-Dichloroethene	349.	U
78-87-5	1,2-Dichloropropane	233.	U
142-28-9	1,3-Dichloropropane	233.	U
594-20-7	2,2-Dichloropropane	2330	U
563-58-6	1,1-Dichloropropene	581.	U
10061-01-5	cis-1,3-Dichloropropene	581.	U
10061-02-6	trans-1,3-Dichloropropene	581.	U
100-41-4	Ethylbenzene	56400	E
87-68-3	Hexachlorobutadiene	581.	U
98-82-8	Isopropylbenzene	930.	U
99-87-6	4-Isopropyltoluene	11500	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight

Lab Sample ID: 98-A127174
Date Sampled: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	233.	U
91-20-3	Naphthalene	28100	E
103-65-1	n-Propylbenzene	233.	U
100-42-5	Styrene	233.	U
630-20-6	1,1,1,2-Tetrachloroethane	349.	U
79-34-5	1,1,2,2-Tetrachloroethane	233.	U
127-18-4	Tetrachloroethene	814.	U
108-88-3	Toluene	581.	U
87-61-6	1,2,3-Trichlorobenzene	233.	U
120-82-1	1,2,4-Trichlorobenzene	233.	U
71-55-6	1,1,1-Trichloroethane	465.	U
79-00-5	1,1,2-Trichloroethane	581.	U
79-01-6	Trichloroethene	1160	U
96-18-4	1,2,3-Trichloropropane	2330	U
95-63-6	1,2,4-Trimethylbenzene	84300	E
108-67-8	1,3,5-Trimethylbenzene	55600	E
75-01-4	Vinyl chloride	1050	U
75-27-4	Bromodichloromethane	465.	U
6615	o-Xylene	1050	
6616	m,p-Xylene	120000	E
75-69-4	Trichlorofluoromethane	465.	U

000148

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight
Dilution Factor: 500.
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127174
Date Sampled: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/23/98
Analysis Time: 22:50
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	1450	....	U
71-43-2	Benzene	5230	....	
108-86-1	Bromobenzene	1160	....	U
124-48-1	Bromochloromethane	1160	....	U
75-25-2	Bromoform	3490	....	U
74-83-9	Bromomethane	2910	....	U
104-51-8	n-Butylbenzene	2910	....	U
135-98-8	sec-Butylbenzene	4070	....	U
98-06-6	t-Butylbenzene	4070	....	U
56-23-5	Carbon tetrachloride	5810	....	U
108-90-7	Chlorobenzene	1160	....	U
75-00-3	Chloroethane	2910	....	U
67-66-3	Chloroform	1160	....	U
74-87-3	Chloromethane	4070	....	U
95-49-8	2-Chlorotoluene	1160	....	U
106-43-4	4-Chlorotoluene	1740	....	U
96-12-8	1,2-Dibromo-3-chloropropane	581.	....	U
124-48-1	Dibromochloromethane	1740	....	U
74-95-3	1,2-Dibromoethane	1740	....	U
74-95-3	Dibromomethane	5810	....	U
95-50-1	1,2-Dichlorobenzene	1160	....	U
541-73-1	1,3-Dichlorobenzene	3490	....	U
106-46-7	1,4-Dichlorobenzene	1160	....	U
75-71-8	Dichlorodifluoromethane	2910	....	U
75-34-3	1,1-Dichloroethane	1160	....	U
107-06-2	1,2-Dichloroethane	1740	....	U
75-35-4	1,1-Dichloroethene	3490	....	U
156-59-2	cis-1,2-Dichloroethene	3490	....	U
156-60-5	trans-1,2-Dichloroethene	1740	....	U
78-87-5	1,2-Dichloropropane	1160	....	U
142-28-9	1,3-Dichloropropane	1160	....	U
594-20-7	2,2-Dichloropropane	11600	....	U
563-58-6	1,1-Dichloropropene	2910	....	U
10061-01-5	cis-1,3-Dichloropropene	2910	....	U
10061-02-6	trans-1,3-Dichloropropene	2910	....	U
100-41-4	Ethylbenzene	68000	....	
87-68-3	Hexachlorobutadiene	2910	....	U
98-82-8	Isopropylbenzene	4650	....	U
99-87-6	4-Isopropyltoluene	11000	....	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight

Lab Sample ID: 98-A127174
Date Sampled: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	1160	U
91-20-3	Naphthalene	23300	
103-65-1	n-Propylbenzene	1160	U
100-42-5	Styrene	1160	U
630-20-6	1,1,1,2-Tetrachloroethane	1740	U
79-34-5	1,1,2,2-Tetrachloroethane	1160	U
127-18-4	Tetrachloroethene	4070	U
108-88-3	Toluene	2910	U
87-61-6	1,2,3-Trichlorobenzene	1160	U
120-82-1	1,2,4-Trichlorobenzene	1160	U
71-55-6	1,1,1-Trichloroethane	2330	U
79-00-5	1,1,2-Trichloroethane	2910	U
79-01-6	Trichloroethene	5810	U
96-18-4	1,2,3-Trichloropropane	11600	U
95-63-6	1,2,4-Trimethylbenzene	160000	E
108-67-8	1,3,5-Trimethylbenzene	61600	
75-01-4	Vinyl chloride	5230	U
75-27-4	Bromodichloromethane	2330	U
6615	o-Xylene	2910	U
6616	m,p-Xylene	262000	E
75-69-4	Trichlorofluoromethane	2330	U

000150

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: 98-A127174
Date Sampled: 10/15/98
Date Received: 10/16/98
Analysis Date: 10/22/98
Analysis Time: 23:26
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2910	U
71-43-2	Benzene	5810	
108-86-1	Bromobenzene	2330	U
124-48-1	Bromochloromethane	2330	U
75-25-2	Bromoform	6980	U
74-83-9	Bromomethane	5810	U
104-51-8	n-Butylbenzene	5810	U
135-98-8	sec-Butylbenzene	8140	U
98-06-6	t-Butylbenzene	8140	U
56-23-5	Carbon tetrachloride	11600	U
108-90-7	Chlorobenzene	2330	U
75-00-3	Chloroethane	5810	U
67-66-3	Chloroform	2330	U
74-87-3	Chloromethane	8140	U
95-49-8	2-Chlorotoluene	2330	U
106-43-4	4-Chlorotoluene	3490	U
96-12-8	1,2-Dibromo-3-chloropropane	1160	U
124-48-1	Dibromochloromethane	3490	U
74-95-3	1,2-Dibromoethane	3490	U
74-95-3	Dibromomethane	11600	U
95-50-1	1,2-Dichlorobenzene	2330	U
541-73-1	1,3-Dichlorobenzene	6980	U
106-46-7	1,4-Dichlorobenzene	2330	U
75-71-8	Dichlorodifluoromethane	5810	U
75-34-3	1,1-Dichloroethane	2330	U
107-06-2	1,2-Dichloroethane	3490	U
75-35-4	1,1-Dichloroethene	6980	U
156-59-2	cis-1,2-Dichloroethene	6980	U
156-60-5	trans-1,2-Dichloroethene	3490	U
78-87-5	1,2-Dichloropropane	2330	U
142-28-9	1,3-Dichloropropane	2330	U
594-20-7	2,2-Dichloropropane	23300	U
563-58-6	1,1-Dichloropropene	5810	U
10061-01-5	cis-1,3-Dichloropropene	5810	U
10061-02-6	trans-1,3-Dichloropropene	5810	U
100-41-4	Ethylbenzene	75600	
87-68-3	Hexachlorobutadiene	5810	U
98-82-8	Isopropylbenzene	9300	U
99-87-6	4-Isopropyltoluene	14000	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB9-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight

Lab Sample ID: 98-A127174
Date Sampled: 10/15/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2330	U
91-20-3	Naphthalene	27900	
103-65-1	n-Propylbenzene	2330	U
100-42-5	Styrene	2330	U
630-20-6	1,1,1,2-Tetrachloroethane	3490	U
79-34-5	1,1,2,2-Tetrachloroethane	2330	U
127-18-4	Tetrachloroethene	8140	U
108-88-3	Toluene	5810	U
87-61-6	1,2,3-Trichlorobenzene	2330	U
120-82-1	1,2,4-Trichlorobenzene	2330	U
71-55-6	1,1,1-Trichloroethane	4650	U
79-00-5	1,1,2-Trichloroethane	5810	U
79-01-6	Trichloroethene	11600	U
96-18-4	1,2,3-Trichloropropane	23300	U
95-63-6	1,2,4-Trimethylbenzene	193000	
108-67-8	1,3,5-Trimethylbenzene	74400	
75-01-4	Vinyl chloride	10500	U
75-27-4	Bromodichloromethane	4650	U
6615	o-Xylene	5810	U
6616	m,p-Xylene	306000	
75-69-4	Trichlorofluoromethane	4650	U

000152

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Soil
% Dry Weight: 100
Units: UG/KG
Dilution Factor: 1
Analysis Method: SW8260B
Delivery Group: 117229
Instrument: HP-2

Lab Sample ID: BLANK
Date Sampled: 10/14/98
Date Received: 10/16/98
Analysis Date: 10/19/98
Analysis Time: 9:24
Sample QC Group: 4754

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
71-43-2	Benzene	2.0	....	U
108-86-1	Bromobenzene	2.0	....	U
124-48-1	Bromochloromethane	2.0	....	U
75-25-2	Bromoform	6.0	....	U
74-83-9	Bromomethane	5.0	....	U
104-51-8	n-Butylbenzene	5.0	....	U
135-98-8	sec-Butylbenzene	7.0	....	U
98-06-6	t-Butylbenzene	7.0	....	U
56-23-5	Carbon tetrachloride	10.0	....	U
108-90-7	Chlorobenzene	2.0	....	U
75-00-3	Chloroethane	5.0	....	U
67-66-3	Chloroform	2.0	....	U
74-87-3	Chloromethane	7.0	....	U
95-49-8	2-Chlorotoluene	2.0	....	U
106-43-4	4-Chlorotoluene	3.0	....	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	....	U
124-48-1	Dibromochloromethane	3.0	....	U
74-95-3	1,2-Dibromoethane	3.0	....	U
74-95-3	Dibromomethane	10.0	....	U
95-50-1	1,2-Dichlorobenzene	2.0	....	U
541-73-1	1,3-Dichlorobenzene	6.0	....	U
106-46-7	1,4-Dichlorobenzene	2.0	....	U
75-71-8	Dichlorodifluoromethane	5.0	....	U
75-34-3	1,1-Dichloroethane	2.0	....	U
107-06-2	1,2-Dichloroethane	3.0	....	U
75-35-4	1,1-Dichloroethene	6.0	....	U
156-59-2	cis-1,2-Dichloroethene	6.0	....	U
156-60-5	trans-1,2-Dichloroethene	3.0	....	U
78-87-5	1,2-Dichloropropane	2.0	....	U
142-28-9	1,3-Dichloropropane	2.0	....	U
594-20-7	2,2-Dichloropropane	20.0	....	U
563-58-6	1,1-Dichloropropene	5.0	....	U
10061-01-5	cis-1,3-Dichloropropene	5.0	....	U
10061-02-6	trans-1,3-Dichloropropene	5.0	....	U
100-41-4	Ethylbenzene	3.0	....	U
87-68-3	Hexachlorobutadiene	5.0	....	U
98-82-8	Isopropylbenzene	8.0	....	U
99-87-6	4-Isopropyltoluene	6.0	....	U
75-09-2	Methylene chloride	21.0	....	

000153

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Soil
% Dry Weight: 100
Units: UG/KG

Lab Sample ID: BLANK
Date Sampled: 10/14/98
Date Received: 10/16/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
91-20-3	Naphthalene	2.0	....	U
103-65-1	n-Propylbenzene	2.0	....	U
100-42-5	Styrene	2.0	....	U
630-20-6	1,1,1,2-Tetrachloroethane	3.0	....	U
79-34-5	1,1,2,2-Tetrachloroethane	2.0	....	U
127-18-4	Tetrachloroethene	7.0	....	U
108-88-3	Toluene	5.0	....	U
87-61-6	1,2,3-Trichlorobenzene	2.0	....	U
120-82-1	1,2,4-Trichlorobenzene	2.0	....	U
71-55-6	1,1,1-Trichloroethane	4.0	....	U
79-00-5	1,1,2-Trichloroethane	5.0	....	U
79-01-6	Trichloroethene	10.0	....	U
96-18-4	1,2,3-Trichloropropane	20.0	....	U
95-63-6	1,2,4-Trimethylbenzene	7.0	....	U
108-67-8	1,3,5-Trimethylbenzene	3.0	....	U
75-01-4	Vinyl chloride	9.0	....	U
75-27-4	Bromodichloromethane	4.0	....	U
6615	o-Xylene	5.0	....	U
6616	m,p-Xylene	3.0	....	U
75-69-4	Trichlorofluoromethane	4.0	....	U

2B

SOIL VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: SPECIALIZED ASSAYS Contract: _____

Lab Code: SASSAYS Case No.: _____ SAS No.: _____ SDG No.: 117229

Level: (low/med) LOW

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01	VBLK02	112	107	104	0
02	SB25-23	98	101	69	0
03	SB5-23	96	100	69	0
04	SB18A-20	96	102	92	0
05	SB7-20	97	99	77	0
06	SB8-21	98	103	96	0
07	VBLK03	112	98	105	0
08	SB6-22	107	104	86	0
09	SB9-14	102	102	100	0
10	SB9-22	96	99	111	0
11	VBLK04	105	101	106	0
12	SB9-14MS	82	97	91	0
13	SB9-14MSD	83	96	90	0
14	CONTROL	82	98	92	0
15	VBLK05	113	100	102	0
16	SB9-22DL	98	101	97	0
17	SB9-22DLB	100	102	98	0
18	SB9-14B	105	104	105	0
19	SB5-12B	103	101	104	0
20	SB28-21B	107	102	105	0

			QC LIMITS
SMC1	=	1,2-Dichloroethane-d4	(62-147)
SMC2	=	Toluene-d8	(84-117)
SMC3	=	Bromofluorobenzene	(64-126)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D System Monitoring Compound diluted out

FORM 3B

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Matrix Spike Sample: SB9-14 SDG: 117229

QC Group: 4754

Compound	Spike Added	Sample Conc	Spike Conc	% Rec	QC Limits
Benzene	2580	0.0	2940	114	58 - 135
Chlorobenzene	2580	0.0	2940	114	54 - 136
1,1-Dichloroethene	2580	0.0	3200	124	58 - 138
Toluene	2580	0.0	2780	108	56 - 135
Trichloroethene	2580	0.0	2780	108	52 - 143

Compound	Spike Added	MSD Conc	% Rec	RPD	RPD Limit	Recovery Limits
Benzene	2580	3510	136#	18#	17	58 - 135
Chlorobenzene	2580	3400	132	15#	14	54 - 136
1,1-Dichloroethene	2580	3510	136	9	19	58 - 138
Toluene	2580	3200	124	14	18	56 - 135
Trichloroethene	2580	3200	124	14	18	52 - 143

Concentration Units: ug/kg

RPD: 2 out of 5 outside QC limits.
Spike Recoveries: 1 out of 10 outside QC limits.

FORM 3Ba

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

SDG: 117229 QC Group: 4754

Compound	Known Value	Conc	% Rec	QC Limits
Benzene	50	61	122	39-151
Bromobenzene	50	54	108	74-122
Bromochloromethane	50	47	94	68-134
Bromoform	50	54	108	31-144
Bromomethane	50	42	84	51-135
n-Butylbenzene	50	47	94	65-127
sec-Butylbenzene	50	58	116	68-129
t-Butylbenzene	50	55	110	68-128
Carbon tetrachloride	50	59	118	53-144
Chlorobenzene	50	64	126	62-130
Chloroethane	50	55	110	56-138
Chloroform	50	64	128	71-132
Chloromethane	50	39	78	65-134
2-Chlorotoluene	50	55	110	72-123
4-Chlorotoluene	50	52	104	70-123
1,2-Dibromo-3-chloropropane	50	39	78	70-130
Dibromochloromethane	50	58	116	41-133
1,2-Dibromoethane	50	54	108	47-136
Dibromomethane	50	49	98	60-141
1,2-Dichlorobenzene	50	46	92	66-128
1,3-Dichlorobenzene	50	45	90	65-128
1,4-Dichlorobenzene	50	45	90	66-129
Dichlorodifluoromethane	50	64	128	50-140
1,1-Dichloroethane	50	64	128	70-132
1,2-Dichloroethane	50	55	110	58-135
1,1-Dichloroethene	50	64	128	69-130
cis-1,2-Dichloroethene	50	64	128	59-140
trans-1,2-Dichloroethene	50	57	114	72-128
1,2-Dichloropropane	50	63	126	45-149
1,3-Dichloropropane	50	52	104	58-138
2,2-Dichloropropane	50	46	92	43-146
1,1-Dichloropropene	50	53	106	56-132
cis-1,3-Dichloropropene	50	54	108	69-130
trans-1,3-Dichloropropene	50	51	102	56-126
Ethylbenzene	50	64	128	61-129
Hexachlorobutadiene	50	60	120	59-138
Isopropylbenzene	50	51	102	70-127
4-Isopropyltoluene	50	39	78	70-127
Methylene chloride	50	50	100	68-142
Naphthalene	50	45	90	54-146
n-Propylbenzene	50	58	116	67-128

FORM 3Ba

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Styrene	50	60	120	65-128
1,1,1,2-Tetrachloroethane	50	53	106	53-130
1,1,2,2-Tetrachloroethane	50	54	108	37-149
Tetrachloroethene	50	62	124	55-128
Toluene	50	63	126	65-131
1,2,3-Trichlorobenzene	50	35	70	55-137
1,2,4-Trichlorobenzene	50	52	104	48-141
1,1,1-Trichloroethane	50	56	112	60-136
1,1,2-Trichloroethane	50	53	106	56-137
Trichloroethene	50	62	124	61-141
1,2,3-Trichloropropane	50	50	100	39-146
1,2,4-Trimethylbenzene	50	55	110	72-126
1,3,5-Trimethylbenzene	50	58	116	22-125
Vinyl chloride	50	58	116	57-138
Bromodichloromethane	50	63	126	60-133
o-Xylene	50	59	118	64-126
m,p-Xylene	100	129	129	59-131
Trichlorofluoromethane	50	53	106	56-142

Concentration Units: ug/kg

Recoveries: 0 out of 59 outside QC limits.

SPECIALIZED ASSAYS INC. • 2960 Foster Creighton Dr. • P.O. Box 40566 • Nashville, Tennessee 37204-0566
615-726-0177 • 1-800-765-0980 • Fax 615-726-3404

CASE NARRATIVE

Client: Parsons Engineering Science
Attn: Lynnea Peterson
1700 Broadway, Suite 900
Denver, CO 80290

Client Project: WURTSMITH BIOVENTING

Matrix: SOIL/WATER

Laboratory Project: 117250

Number samples: 12/1

Date Received: 10/17/98

Date Collected: 10/15/98

Sample Receipt Notes: All samples were received in good condition, properly preserved. All analyses were performed within method specified holding times.

QA/QC Summary:

Volatile Organic Method 8260B – Water:

All surrogate, matrix spikes, matrix spike duplicate, and laboratory control sample recoveries for this analytical batch (#4751) were within acceptable quality control limits. The sample used for MS/MSD analysis for this analytical batch was not part of this sample delivery group. The single water sample in this batch is a trip blank, and is reported as not detected for all analytes. Quantitation on unknown concentrations were determined from the initial calibration curve using the average response factor when the % RSD was less than or equal to 15%. All other analytes were calculated using linear regression.

Volatile Organic Method 8260B – Soil:

All surrogate, matrix spike, spike duplicate, and laboratory control sample recoveries were within acceptable quality control limits. The sample used for MS/MSD analysis for this analytical batch was SB9-15-10-12. Due to sample matrix issues, several soil samples in this batch (#4761) required dilution for analysis. Quantitation on unknown concentrations were determined from the initial calibration curve using the average response factor when the % RSD was less than or equal to 15%. All other analytes were calculated using linear regression.

Johnny A. Mitchell

Johnny A. Mitchell
Director of Technical Services
Specialized Assays, Inc.

Page 1 of 2

7A-059011

SPECIALIZED ASSAYS ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, TN 37204
615-726-0177, 800-765-0980
FAX 615/726-3404

Specialized Assays: (800) 765-098

REFERRING CLIENT

Account: 8185
Parsons Engineering/AFCEE Exte
Doug Scott
1700 Broadway Ste 900
Denver, CO 80290
Ph: 303-831-8100 Fax: 303-831-8208

CONTROL NUMBER (FOR LAB USE ONLY) 117250

PROJECT # 726876.69120

P.O. #

PROJECT NAME Wurtsmith Bioventing

ERS (Signature-Please Print)

LAB USE ONLY ACC#	SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	# OF CONT	ANALYSIS REQUESTED
A187305	SB13-21	10/16/98	0915		x	3	8260
A187306	SB11-21	10/16/98	0950		x	3	"
A187307	SB16-8	10/15/98	1620		x	3	"
A187308	SB16-21	10/15/98	1630		x	3	"
A187309	SB14-21	10/15/98	1750		x	3	"
A187310	SB26-21	10/15/98	1640		x	3	"
A187311	SB14-12	10/15/98	1740		x	3	"
A187312	SB12-22	10/15/98	1440		x	3	"
A187313	SB17-26	10/15/98	1400		x	3	"
A187314	SB15-22	10/15/98	1530		x	3	"

quished by: (Signature)	Date / Time	Received by: (Signature)	Received for Laboratory by:	Date / Tim
	10/16/98 1300			10/17/98 9
d by: (Signature)	Date / Time	Received by: (Signature)	Remarks	
Signature)	Date / Time	Received by: (Signature)		
ure)	Date / Time	Received by: (Signature)	SAI Project #: 000901	

...ce in completing the chain of custody form please refer to the instructions found on the opposit

7A-059012

SPECIALIZED ASSAYS ENVIRONMENTAL

2960 Foster Creighton Drive
Nashville, TN 37204
615-726-0177, 800-765-0980
FAX 615/726-3404

Specialized Assays: (800) 765-098

REFERRING CLIENT

Account: 8185
Parsons Engineering/AFCEE Exte
Doug Scott
1700 Broadway Ste 900
Denver, CO 80290
Ph: 303-831-8100 Fax: 303-831-8208

CONTROL NUMBER (FOR LAB USE ONLY) 117250

PROJECT # 726876.69126

P.O. #

S (Signature-Please Print)

PROJECT NAME Wurtsmith Bioventing

AB USE ONLY ACC#	SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	# OF CONT	ANALYSIS REQUESTED
E7315	SB15-10-12	10/15/98	1520		x	3	8260
	SB15-10-12 MS	10/15/98	1520		x	3	" MS
	SB15-10-12 MSD	10/15/98	1520		x	3	" MSD
01E7315	SB10-23	10/15/98	1310		x	3	8260
01E7304	TB-3					1	8260 Trip Blank

	Date / Time	Received by: (Signature)	Received for Laboratory by:	Date / Time
ished by: (Signature)	10/16/98 1300			
ished by: (Signature)		Received by: (Signature)	Remarks	
shed by: (Signature)		Received by: (Signature)		
shed by: (Signature)		Received by: (Signature)	SAI Project #:	

000002

or further assistance in completing the chain of custody form please refer to the instructions found on the opposite s

Cooler Receipt Form

Client: Parsons

Cooler Received On: 10/17/98 And Opened On: 10/17/98 By: Pam R Buckingham

(Signature)

1. Temperature of Cooler when opened 4°C
2. Were custody seals on outside of cooler and intact? (Yes) No
   a. If yes, what kind and where: 2 front/back
   b. Were the signature and date correct? (Yes) No
3. Were custody papers inside cooler? (Yes) No
4. Were custody papers properly filled out (ink, signed, etc)? (Yes) No
5. Did you sign the custody papers in the appropriate place? (Yes) No
6. What kind of packing material was used? bubble wrap
7. Was sufficient ice used (if appropriate)? (Yes) No
8. Did all bottles arrive in good condition (unbroken)? (Yes) No
9. Were all bottle labels complete (#, date, signed, pres, etc)? (Yes) No
10. Did all bottle labels and tags agree with custody papers? (Yes) No
11. Were correct bottles used for the analysis requested? (Yes) No
12. If present, were VOA vials checked for absence of air bubbles and noted if found? (Yes) No
13. Was sufficient amount of sample sent in each bottle? (Yes) No
14. Were correct preservatives used? (Yes) No
15. Corrective action taken, if necessary:
    a. Name of person contacted:
    b. Date

SPECIALIZED ASSAYS, INC.

BTX SOIL PREP LOG

TE: 10/17/98

TCH NO.: 117250

PAGE NO:

MATRIX: Soil

ANALYST:

	SAMPLE ID	SAMPLE WEIGHT (g)	DILUTION	METHOD	WORKLIST	REMARKS
p Blank #				5035	4778	
	127305	5.23				
	127306	5.09				
	127307	5.49				
	127308	5.30				
	127309	4.86				
	127310	4.79				
	127311	5.41				
	127312	5.20				
	127313	5.13				
	127314	4.45				
	127315	4.47				
	127316	5.51				
LCS						
PIKE						
PIKE Dupl						

KING SOLUTIONS:

REAGENTS:

Post-it® Fax Note 7671

Date 4/9	# of pages ▶ 1
To John Ratz	From John Hall
Co./Dept.	Co.
Phone #	Phone #
Fax #	Fax #

FedEx USA Airbill 808219104060 0210

Sender's Copy

1 From (please print and press hard)

Date 10/16/98 Sender's FedEx Account Number 303-831-8100

Sender's Name Parsons Engineering/AFCEE Ext. !

Company 1700 Broadway Ste 900

Address Denver CO 80290 Dept./Floor/Suite/Room

8185

City State ZIP

2 Your Internal Billing Reference Information

3 To (please print and press hard)

Recipient's Name SAMPLE RECEIVING Phone (615) 726-0177

Company SPECIALIZED ASSAYS ENVIRON

Address 2960 FOSTER CREIGHTON DR Dept./Floor/Suite/Room

☐ Check here if residence

City NASHVILLE State TN ZIP 37204-3719

For HOLD at FedEx Location check here: ☐ Hold Weekday ☐ Hold Saturday

For Saturday Delivery check here: ☒ Saturday Delivery ☐ Sunday Delivery

Service Conditions, Declared Value, and Limit of Liability

4a Express Package Service *Packages under 150 lbs*

☒ FedEx Priority Overnight ☐ FedEx Standard Overnight ☐ FedEx First Overnight ☐ FedEx 2Day ☐ FedEx Express Saver

4b Express Freight Service *Packages over 150 lbs*

☐ FedEx Overnight Freight ☐ FedEx 2Day Freight ☐ FedEx Express Saver Freight

5 Packaging ☐ FedEx Letter ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☒ Other Pkg.

6 Special Handling

Does this shipment contain dangerous goods? ☒ No ☐ Yes ☐ Yes

☐ Dry Ice ☐ Cargo Aircraft Only

7 Payment

Bill to: ☐ Sender ☒ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

FedEx Account No. 1499-6491-6

Total Packages	Total Weight	Total Declared Value	Total Charges
		$ .00	$

8 Release Signature

321

Questions?
Call 1·800·Go·FedEx

The World On Time

VOLATILE ORGANICS - WATER

SUMMARY

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

TB-3

Matrix: Water
pH:
Units: ug/l
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-8

Lab Sample ID: 98-A127304
Date Sampled::
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 1:38
Sample QC Group: 4751

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.5	U
71-43-2	Benzene	0.4	U
108-86-1	Bromobenzene	0.3	U
74-97-5	Bromochloromethane	0.4	U
75-25-2	Bromoform	1.2	U
74-83-9	Bromomethane	1.1	U
104-51-8	n-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.3	U
98-06-6	t-Butylbenzene	1.4	U
56-23-5	Carbon tetrachloride	2.1	U
108-90-7	Chlorobenzene	0.4	U
75-00-3	Chloroethane	1.0	U
67-66-3	Chloroform	0.3	U
74-87-3	Chloromethane	1.3	U
95-49-8	2-Chlorotoluene	0.4	U
106-43-4	4-Chlorotoluene	0.6	U
96-12-8	1,2-Dibromo-3-chloropropane	2.6	U
124-48-1	Dibromochloromethane	0.5	U
74-95-3	1,2-Dibromoethane	0.6	U
74-95-3	Dibromomethane	2.4	U
95-50-1	1,2-Dichlorobenzene	0.3	U
541-73-1	1,3-Dichlorobenzene	1.2	U
106-46-7	1,4-Dichlorobenzene	0.3	U
75-71-8	Dichlorodifluoromethane	1.0	U
75-34-3	1,1-Dichloroethane	0.4	U
107-06-2	1,2-Dichloroethane	0.6	U
75-35-4	1,1-Dichloroethene	1.2	U
156-59-2	cis-1,2-Dichloroethene	1.2	U
156-60-5	trans-1,2-Dichloroethene	0.6	U
78-87-5	1,2-Dichloropropane	0.4	U
142-28-9	1,3-Dichloropropane	0.4	U
594-20-7	2,2-Dichloropropane	3.5	U
563-58-6	1,1-Dichloropropene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
100-41-4	Ethylbenzene	0.6	U
87-68-3	Hexachlorobutadiene	1.1	U
98-82-8	Isopropylbenzene	0.5	U
99-87-6	4-Isopropyltoluene	1.2	U

000006

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

TB-3

Matrix: Water
pH:
Units: ug/l

Lab Sample ID: 98-A127304
Date Sampled::
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	0.3	U
91-20-3	Naphthalene	0.4	U
103-65-1	n-Propylbenzene	0.4	U
100-42-5	Styrene	0.4	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.4	U
127-18-4	Tetrachloroethene	1.4	U
108-88-3	Toluene	1.1	U
87-61-6	1,2,3-Trichlorobenzene	0.3	U
120-82-1	1,2,4-Trichlorobenzene	0.4	U
71-55-6	1,1,1-Trichloroethane	0.8	U
79-00-5	1,1,2-Trichloroethane	1.0	U
79-01-6	Trichloroethene	1.0	U
96-18-4	1,2,3-Trichloropropane	3.2	U
95-63-6	1,2,4-Trimethylbenzene	1.3	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
75-01-4	Vinyl chloride	1.1	U
75-27-4	Bromodichloromethane	0.8	U
95-47-6	o-Xylene	0.5	U
108-38-3	m,p-Xylene	0.5	U
75-69-4	Trichlorofluoromethane	0.8	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Water
% Dry Weight:
Units: UG/L
Dilution Factor: 1
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-8

Lab Sample ID: BLANK
Date Sampled:
Date Received: 10/17/98
Analysis Date: 10/20/98
Analysis Time: ~~15:36~~ 17:36 gmm
Sample QC Group: 4751

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
71-43-2	Benzene	0.4	....	U
108-86-1	Bromobenzene	0.3	....	U
74-97-5	Bromochloromethane	0.4	....	U
75-25-2	Bromoform	1.2	....	U
74-83-9	Bromomethane	1.1	....	U
104-51-8	n-Butylbenzene	1.1	....	U
135-98-8	sec-Butylbenzene	1.3	....	U
98-06-6	t-Butylbenzene	1.4	....	U
56-23-5	Carbon tetrachloride	2.1	....	U
108-90-7	Chlorobenzene	0.4	....	U
75-00-3	Chloroethane	1.0	....	U
67-66-3	Chloroform	0.3	....	U
74-87-3	Chloromethane	1.3	....	U
95-49-8	2-Chlorotoluene	0.4	....	U
106-43-4	4-Chlorotoluene	0.6	....	U
96-12-8	1,2-Dibromo-3-chloropropane	2.6	....	U
124-48-1	Dibromochloromethane	0.5	....	U
74-95-3	1,2-Dibromoethane	0.6	....	U
74-95-3	Dibromomethane	2.4	....	U
95-50-1	1,2-Dichlorobenzene	0.3	....	U
541-73-1	1,3-Dichlorobenzene	1.2	....	U
106-46-7	1,4-Dichlorobenzene	0.3	....	U
75-71-8	Dichlorodifluoromethane	1.0	....	U
75-34-3	1,1-Dichloroethane	0.4	....	U
107-06-2	1,2-Dichloroethane	0.6	....	U
75-35-4	1,1-Dichloroethene	1.2	....	U
156-59-2	cis-1,2-Dichloroethene	1.2	....	U
156-60-5	trans-1,2-Dichloroethene	0.6	....	U
78-87-5	1,2-Dichloropropane	0.4	....	U
142-28-9	1,3-Dichloropropane	0.4	....	U
594-20-7	2,2-Dichloropropane	3.5	....	U
563-58-6	1,1-Dichloropropene	1.0	....	U
10061-01-5	cis-1,3-Dichloropropene	1.0	....	U
10061-02-6	trans-1,3-Dichloropropene	1.0	....	U
100-41-4	Ethylbenzene	0.6	....	U
87-68-3	Hexachlorobutadiene	1.1	....	U
98-82-8	Isopropylbenzene	0.5	....	U
99-87-6	4-Isopropyltoluene	1.2	....	U
75-09-2	Methylene chloride	0.3	....	U

000008

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Water
% Dry Weight:
Units: UG/L

Lab Sample ID: BLANK
Date Sampled:
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
91-20-3	Naphthalene	0.4	....	U
103-65-1	n-Propylbenzene	0.4	....	U
100-42-5	Styrene	0.4	....	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	....	U
79-34-5	1,1,2,2-Tetrachloroethane	0.4	....	U
127-18-4	Tetrachloroethene	1.4	....	U
108-88-3	Toluene	1.1	....	U
87-61-6	1,2,3-Trichlorobenzene	0.3	....	U
120-82-1	1,2,4-Trichlorobenzene	0.4	....	U
71-55-6	1,1,1-Trichloroethane	0.8	....	U
79-00-5	1,1,2-Trichloroethane	1.0	....	U
79-01-6	Trichloroethene	1.0	....	U
96-18-4	1,2,3-Trichloropropane	3.2	....	U
95-63-6	1,2,4-Trimethylbenzene	1.3	....	U
108-67-8	1,3,5-Trimethylbenzene	0.5	....	U
75-01-4	Vinyl chloride	1.1	....	U
75-27-4	Bromodichloromethane	0.8	....	U
95-47-6	o-Xylene	1.1	....	U
108-38-3	m,p-Xylene	0.5	....	U
75-69-4	Trichlorofluoromethane	0.8	....	U

2A

WATER VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: SPECIALIZED ASSAYS Contract: _____

Lab Code: SASSAYS Case No.: _____ SAS No.: _____ SDG No.: 117520W

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01	VBLK02	109	97	95	0
02	TB-3	123	98	99	0
03	127137MS	125	100	100	0
04	127137MSD	114	98	97	0
05	CONTROL	115	98	97	0

			QC LIMITS
SMC1	=	1,2-Dichloroethane-d4	(70-131)
SMC2	=	Toluene-d8	(83-115)
SMC3	=	Bromofluorobenzene	(73-119)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D System Monitoring Compound diluted out

FORM 3A

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Matrix Spike Sample: SDG: 117250

QC Group: 4751

Compound	Spike Added	Sample Conc	Spike Conc	% Rec	QC Limits
Benzene	50.0	0.0	50.0	100	58 - 135
Chlorobenzene	50.0	0.0	46.0	92	56 - 126
1,1-Dichloroethene	50.0	0.0	48.0	96	58 - 138
Toluene	50.0	0.0	54.0	108	56 - 135
Trichloroethene	50.0	0.0	47.0	94	52 - 143

Compound	Spike Added	MSD Conc	% Rec	RPD	RPD Limit	Recovery Limits
Benzene	50.0	53.0	106	6	15	58 - 135
Chlorobenzene	50.0	52.0	104	12	19	56 - 126
1,1-Dichloroethene	50.0	51.0	102	6	16	58 - 138
Toluene	50.0	59.0	118	9	20	56 - 135
Trichloroethene	50.0	54.0	108	14	22	52 - 143

Concentration Units: ug/l

RPD: 0 out of 5 outside QC limits.
Spike Recoveries: 0 out of 10 outside QC limits.

FORM 3Aa

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

SDG: 117250 QC Group: 4751

Compound	Known Value	Conc	% Rec	QC Limits
Benzene	50	56	112	73-136
Bromobenzene	50	61	122	76-138
Bromochloromethane	50	57	114	65-145
Bromoform	50	62	124	50-146
Bromomethane	50	46	92	47-145
n-Butylbenzene	50	56	112	72-142
sec-Butylbenzene	50	53	106	65-148
t-Butylbenzene	50	51	102	74-132
Carbon tetrachloride	50	52	104	65-134
Chlorobenzene	50	52	104	72-133
Chloroethane	50	43	86	60-152
Chloroform	50	62	124	75-138
Chloromethane	50	42	84	58-152
2-Chlorotoluene	50	58	116	75-137
4-Chlorotoluene	50	57	114	73-137
1,2-Dibromo-3-chloropropane	50	56	112	70-130
Dibromochloromethane	50	57	114	60-141
1,2-Dibromoethane	50	58	116	66-142
Dibromomethane	50	60	120	70-139
1,2-Dichlorobenzene	50	53	106	72-139
1,3-Dichlorobenzene	50	53	106	72-134
1,4-Dichlorobenzene	50	51	102	74-128
Dichlorodifluoromethane	50	52	104	52-150
1,1-Dichloroethane	50	56	112	70-142
1,2-Dichloroethane	50	61	122	73-144
1,1-Dichloroethene	50	50	100	68-141
cis-1,2-Dichloroethene	50	58	116	70-144
trans-1,2-Dichloroethene	50	56	112	68-131
1,2-Dichloropropane	50	57	114	74-140
1,3-Dichloropropane	50	62	124	75-137
2,2-Dichloropropane	50	53	106	58-133
1,1-Dichloropropene	50	56	112	70-140
cis-1,3-Dichloropropene	50	58	116	69-130
trans-1,3-Dichloropropene	50	59	118	64-133
Ethylbenzene	50	56	112	71-141
Hexachlorobutadiene	50	48	96	58-140
Isopropylbenzene	50	54	108	70-147
4-Isopropyltoluene	50	50	100	68-138
Methylene chloride	50	60	120	64-154

FORM 3Aa

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Naphthalene	50	61	122	42-158
n-Propylbenzene	50	57	114	52-168
Styrene	50	54	108	68-137
1,1,1,2-Tetrachloroethane	50	54	108	67-135
1,1,2,2-Tetrachloroethane	50	63	126	64-155
Tetrachloroethene	50	50	100	69-132
Toluene	50	57	114	75-136
1,2,3-Trichlorobenzene	50	55	110	48-152
1,2,4-Trichlorobenzene	50	52	104	55-142
1,1,1-Trichloroethane	50	55	110	73-136
1,1,2-Trichloroethane	50	60	120	72-138
Trichloroethene	50	50	100	73-136
1,2,3-Trichloropropane	50	64	128	53-147
1,2,4-Trimethylbenzene	50	53	106	73-138
1,3,5-Trimethylbenzene	50	54	108	74-137
Vinyl chloride	50	44	88	54-154
Bromodichloromethane	50	62	124	69-136
o-Xylene	50	56	112	70-145
m,p-Xylene	50	55	110	63-156
Trichlorofluoromethane	50	48	96	66-142

Concentration Units: ug/l

Recoveries: 0 out of 59 outside QC limits.

VOLATILE ORGANICS - SOIL

SUMMARY

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB13-21

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight
Dilution Factor: 100.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127305
Date Sampled: 10/16/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 11:47
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	291.	U
71-43-2	Benzene	465.	
108-86-1	Bromobenzene	233.	U
124-48-1	Bromochloromethane	233.	U
75-25-2	Bromoform	698.	U
74-83-9	Bromomethane	930.	
104-51-8	n-Butylbenzene	581.	U
135-98-8	sec-Butylbenzene	814.	U
98-06-6	t-Butylbenzene	814.	U
56-23-5	Carbon tetrachloride	1160	U
108-90-7	Chlorobenzene	233.	U
75-00-3	Chloroethane	581.	U
67-66-3	Chloroform	233.	U
74-87-3	Chloromethane	814.	U
95-49-8	2-Chlorotoluene	233.	U
106-43-4	4-Chlorotoluene	349.	U
96-12-8	1,2-Dibromo-3-chloropropane	116.	U
124-48-1	Dibromochloromethane	349.	U
74-95-3	1,2-Dibromoethane	349.	U
74-95-3	Dibromomethane	1160	U
95-50-1	1,2-Dichlorobenzene	233.	U
541-73-1	1,3-Dichlorobenzene	698.	U
106-46-7	1,4-Dichlorobenzene	233.	U
75-71-8	Dichlorodifluoromethane	581.	U
75-34-3	1,1-Dichloroethane	233.	U
107-06-2	1,2-Dichloroethane	349.	U
75-35-4	1,1-Dichloroethene	698.	U
156-59-2	cis-1,2-Dichloroethene	698.	U
156-60-5	trans-1,2-Dichloroethene	349.	U
78-87-5	1,2-Dichloropropane	233.	U
142-28-9	1,3-Dichloropropane	233.	U
594-20-7	2,2-Dichloropropane	2330	U
563-58-6	1,1-Dichloropropene	581.	U
10061-01-5	cis-1,3-Dichloropropene	581.	U
10061-02-6	trans-1,3-Dichloropropene	581.	U
100-41-4	Ethylbenzene	5810	
87-68-3	Hexachlorobutadiene	581.	U
98-82-8	Isopropylbenzene	1860	
99-87-6	4-Isopropyltoluene	1740	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB13-21

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight

Lab Sample ID: 98-A127305
Date Sampled: 10/16/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	233.	U
91-20-3	Naphthalene	3370	
103-65-1	n-Propylbenzene	3600	
100-42-5	Styrene	233.	U
630-20-6	1,1,1,2-Tetrachloroethane	349.	U
79-34-5	1,1,2,2-Tetrachloroethane	233.	U
127-18-4	Tetrachloroethene	814.	U
108-88-3	Toluene	581.	U
87-61-6	1,2,3-Trichlorobenzene	233.	U
120-82-1	1,2,4-Trichlorobenzene	233.	U
71-55-6	1,1,1-Trichloroethane	465.	U
79-00-5	1,1,2-Trichloroethane	581.	U
79-01-6	Trichloroethene	1160	U
96-18-4	1,2,3-Trichloropropane	2330	U
95-63-6	1,2,4-Trimethylbenzene	21900	
108-67-8	1,3,5-Trimethylbenzene	7790	
75-01-4	Vinyl chloride	1050	U
75-27-4	Bromodichloromethane	465.	U
6615	o-Xylene	581.	U
6616	m,p-Xylene	22800	
75-69-4	Trichlorofluoromethane	465.	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB11-21

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127306
Date Sampled: 10/16/98
Date Received: 10/17/98
Analysis Date: 10/20/98
Analysis Time: 23:46
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	2.6	....	U
71-43-2	Benzene	2.1	....	U
108-86-1	Bromobenzene	2.1	....	U
124-48-1	Bromochloromethane	2.1	....	U
75-25-2	Bromoform	6.2	....	U
74-83-9	Bromomethane	5.2	....	U
104-51-8	n-Butylbenzene	5.2	....	U
135-98-8	sec-Butylbenzene	7.3	....	U
98-06-6	t-Butylbenzene	7.3	....	U
56-23-5	Carbon tetrachloride	10.4	....	U
108-90-7	Chlorobenzene	2.1	....	U
75-00-3	Chloroethane	5.2	....	U
67-66-3	Chloroform	2.1	....	U
74-87-3	Chloromethane	7.3	....	U
95-49-8	2-Chlorotoluene	2.1	....	U
106-43-4	4-Chlorotoluene	3.1	....	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	....	U
124-48-1	Dibromochloromethane	3.1	....	U
74-95-3	1,2-Dibromoethane	3.1	....	U
74-95-3	Dibromomethane	10.4	....	U
95-50-1	1,2-Dichlorobenzene	2.1	....	U
541-73-1	1,3-Dichlorobenzene	6.2	....	U
106-46-7	1,4-Dichlorobenzene	2.1	....	U
75-71-8	Dichlorodifluoromethane	5.2	....	U
75-34-3	1,1-Dichloroethane	2.1	....	U
107-06-2	1,2-Dichloroethane	3.1	....	U
75-35-4	1,1-Dichloroethene	6.2	....	U
156-59-2	cis-1,2-Dichloroethene	6.2	....	U
156-60-5	trans-1,2-Dichloroethene	3.1	....	U
78-87-5	1,2-Dichloropropane	2.1	....	U
142-28-9	1,3-Dichloropropane	2.1	....	U
594-20-7	2,2-Dichloropropane	20.8	....	U
563-58-6	1,1-Dichloropropene	5.2	....	U
10061-01-5	cis-1,3-Dichloropropene	5.2	....	U
10061-02-6	trans-1,3-Dichloropropene	5.2	....	U
100-41-4	Ethylbenzene	3.1	....	U
87-68-3	Hexachlorobutadiene	5.2	....	U
98-82-8	Isopropylbenzene	8.3	....	U
99-87-6	4-Isopropyltoluene	47.9	....	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB11-21

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A127306
Date Sampled: 10/16/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2.1	U
91-20-3	Naphthalene	45.8	
103-65-1	n-Propylbenzene	2.1	U
100-42-5	Styrene	2.1	U
630-20-6	1,1,1,2-Tetrachloroethane	3.1	U
79-34-5	1,1,2,2-Tetrachloroethane	2.1	U
127-18-4	Tetrachloroethene	7.3	U
108-88-3	Toluene	5.2	U
87-61-6	1,2,3-Trichlorobenzene	2.1	U
120-82-1	1,2,4-Trichlorobenzene	2.1	U
71-55-6	1,1,1-Trichloroethane	4.2	U
79-00-5	1,1,2-Trichloroethane	5.2	U
79-01-6	Trichloroethene	10.4	U
96-18-4	1,2,3-Trichloropropane	20.8	U
95-63-6	1,2,4-Trimethylbenzene	315.	E
108-67-8	1,3,5-Trimethylbenzene	360.	E
75-01-4	Vinyl chloride	9.4	U
75-27-4	Bromodichloromethane	4.2	U
6615	o-Xylene	6.2	
6616	m,p-Xylene	277.	E
75-69-4	Trichlorofluoromethane	4.2	U

000118

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB11-21

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 100.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127306
Date Sampled: 10/16/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 12:24
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	260.	U
71-43-2	Benzene	208.	U
108-86-1	Bromobenzene	208.	U
124-48-1	Bromochloromethane	208.	U
75-25-2	Bromoform	625.	U
74-83-9	Bromomethane	521.	U
104-51-8	n-Butylbenzene	521.	U
135-98-8	sec-Butylbenzene	729.	U
98-06-6	t-Butylbenzene	729.	U
56-23-5	Carbon tetrachloride	1040	U
108-90-7	Chlorobenzene	208.	U
75-00-3	Chloroethane	521.	U
67-66-3	Chloroform	208.	U
74-87-3	Chloromethane	729.	U
95-49-8	2-Chlorotoluene	208.	U
106-43-4	4-Chlorotoluene	312.	U
96-12-8	1,2-Dibromo-3-chloropropane	104.	U
124-48-1	Dibromochloromethane	312.	U
74-95-3	1,2-Dibromoethane	312.	U
74-95-3	Dibromomethane	1040	U
95-50-1	1,2-Dichlorobenzene	208.	U
541-73-1	1,3-Dichlorobenzene	625.	U
106-46-7	1,4-Dichlorobenzene	208.	U
75-71-8	Dichlorodifluoromethane	521.	U
75-34-3	1,1-Dichloroethane	208.	U
107-06-2	1,2-Dichloroethane	312.	U
75-35-4	1,1-Dichloroethene	625.	U
156-59-2	cis-1,2-Dichloroethene	625.	U
156-60-5	trans-1,2-Dichloroethene	312.	U
78-87-5	1,2-Dichloropropane	208.	U
142-28-9	1,3-Dichloropropane	208.	U
594-20-7	2,2-Dichloropropane	2080	U
563-58-6	1,1-Dichloropropene	521.	U
10061-01-5	cis-1,3-Dichloropropene	521.	U
10061-02-6	trans-1,3-Dichloropropene	521.	U
100-41-4	Ethylbenzene	312.	U
87-68-3	Hexachlorobutadiene	521.	U
98-82-8	Isopropylbenzene	833.	U
99-87-6	4-Isopropyltoluene	625.	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB11-21

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A127306
Date Sampled: 10/16/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
75-09-2	Methylene chloride	208.	....	U
91-20-3	Naphthalene	208.	....	
103-65-1	n-Propylbenzene	208.	....	U
100-42-5	Styrene	208.	....	U
630-20-6	1,1,1,2-Tetrachloroethane	312.	....	U
79-34-5	1,1,2,2-Tetrachloroethane	208.	....	U
127-18-4	Tetrachloroethene	729.	....	U
108-88-3	Toluene	521.	....	U
87-61-6	1,2,3-Trichlorobenzene	208.	....	U
120-82-1	1,2,4-Trichlorobenzene	208.	....	U
71-55-6	1,1,1-Trichloroethane	417.	....	U
79-00-5	1,1,2-Trichloroethane	521.	....	U
79-01-6	Trichloroethene	1040	....	U
96-18-4	1,2,3-Trichloropropane	2080	....	U
95-63-6	1,2,4-Trimethylbenzene	521.	....	J
108-67-8	1,3,5-Trimethylbenzene	208.	....	J
75-01-4	Vinyl chloride	938.	....	U
75-27-4	Bromodichloromethane	417.	....	U
6615	o-Xylene	521.	....	U
6616	m,p-Xylene	417.	....	
75-69-4	Trichlorofluoromethane	417.	....	U

000120

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB16-8

Matrix: Soil
% Dry Weight: 94.
Units: ug/kg dry weight
Dilution Factor: 50.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127307
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/22/98
Analysis Time: 22:13
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	133.	U
71-43-2	Benzene	106.	U
108-86-1	Bromobenzene	106.	U
124-48-1	Bromochloromethane	106.	U
75-25-2	Bromoform	319.	U
74-83-9	Bromomethane	266.	U
104-51-8	n-Butylbenzene	266.	U
135-98-8	sec-Butylbenzene	372.	U
98-06-6	t-Butylbenzene	372.	U
56-23-5	Carbon tetrachloride	532.	U
108-90-7	Chlorobenzene	106.	U
75-00-3	Chloroethane	266.	U
67-66-3	Chloroform	106.	U
74-87-3	Chloromethane	372.	U
95-49-8	2-Chlorotoluene	106.	U
106-43-4	4-Chlorotoluene	160.	U
96-12-8	1,2-Dibromo-3-chloropropane	53.2	U
124-48-1	Dibromochloromethane	160.	U
74-95-3	1,2-Dibromoethane	160.	U
74-95-3	Dibromomethane	532.	U
95-50-1	1,2-Dichlorobenzene	106.	U
541-73-1	1,3-Dichlorobenzene	319.	U
106-46-7	1,4-Dichlorobenzene	106.	U
75-71-8	Dichlorodifluoromethane	266.	U
75-34-3	1,1-Dichloroethane	106.	U
107-06-2	1,2-Dichloroethane	160.	U
75-35-4	1,1-Dichloroethene	319.	U
156-59-2	cis-1,2-Dichloroethene	319.	U
156-60-5	trans-1,2-Dichloroethene	160.	U
78-87-5	1,2-Dichloropropane	106.	U
142-28-9	1,3-Dichloropropane	106.	U
594-20-7	2,2-Dichloropropane	1060	U
563-58-6	1,1-Dichloropropene	266.	U
10061-01-5	cis-1,3-Dichloropropene	266.	U
10061-02-6	trans-1,3-Dichloropropene	266.	U
100-41-4	Ethylbenzene	160.	U
87-68-3	Hexachlorobutadiene	266.	U
98-82-8	Isopropylbenzene	426.	U
99-87-6	4-Isopropyltoluene	851.	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB16-8

Matrix: Soil
% Dry Weight: 94.
Units: ug/kg dry weight

Lab Sample ID: 98-A127307
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	106.	U
91-20-3	Naphthalene	106.	
103-65-1	n-Propylbenzene	106.	U
100-42-5	Styrene	106.	U
630-20-6	1,1,1,2-Tetrachloroethane	160.	U
79-34-5	1,1,2,2-Tetrachloroethane	106.	U
127-18-4	Tetrachloroethene	372.	U
108-88-3	Toluene	266.	U
87-61-6	1,2,3-Trichlorobenzene	106.	U
120-82-1	1,2,4-Trichlorobenzene	106.	U
71-55-6	1,1,1-Trichloroethane	213.	U
79-00-5	1,1,2-Trichloroethane	266.	U
79-01-6	Trichloroethene	532.	U
96-18-4	1,2,3-Trichloropropane	1060	U
95-63-6	1,2,4-Trimethylbenzene	2230	
108-67-8	1,3,5-Trimethylbenzene	2020	
75-01-4	Vinyl chloride	479.	U
75-27-4	Bromodichloromethane	213.	U
6615	o-Xylene	585.	
6616	m,p-Xylene	904.	
75-69-4	Trichlorofluoromethane	213.	U

000122

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB16-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127308
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 13:36
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	2870	....	U
71-43-2	Benzene	2300	....	U
108-86-1	Bromobenzene	2300	....	U
124-48-1	Bromochloromethane	2300	....	U
75-25-2	Bromoform	6900	....	U
74-83-9	Bromomethane	5750	....	U
104-51-8	n-Butylbenzene	5750	....	U
135-98-8	sec-Butylbenzene	8050	....	U
98-06-6	t-Butylbenzene	8050	....	U
56-23-5	Carbon tetrachloride	11500	....	U
108-90-7	Chlorobenzene	2300	....	U
75-00-3	Chloroethane	5750	....	U
67-66-3	Chloroform	2300	....	U
74-87-3	Chloromethane	8050	....	U
95-49-8	2-Chlorotoluene	2300	....	U
106-43-4	4-Chlorotoluene	3450	....	U
96-12-8	1,2-Dibromo-3-chloropropane	1150	....	U
124-48-1	Dibromochloromethane	3450	....	U
74-95-3	1,2-Dibromoethane	3450	....	U
74-95-3	Dibromomethane	11500	....	U
95-50-1	1,2-Dichlorobenzene	2300	....	U
541-73-1	1,3-Dichlorobenzene	6900	....	U
106-46-7	1,4-Dichlorobenzene	2300	....	U
75-71-8	Dichlorodifluoromethane	5750	....	U
75-34-3	1,1-Dichloroethane	2300	....	U
107-06-2	1,2-Dichloroethane	3450	....	U
75-35-4	1,1-Dichloroethene	6900	....	U
156-59-2	cis-1,2-Dichloroethene	6900	....	U
156-60-5	trans-1,2-Dichloroethene	3450	....	U
78-87-5	1,2-Dichloropropane	2300	....	U
142-28-9	1,3-Dichloropropane	2300	....	U
594-20-7	2,2-Dichloropropane	23000	....	U
563-58-6	1,1-Dichloropropene	5750	....	U
10061-01-5	cis-1,3-Dichloropropene	5750	....	U
10061-02-6	trans-1,3-Dichloropropene	5750	....	U
100-41-4	Ethylbenzene	116000	....	
87-68-3	Hexachlorobutadiene	5750	....	U
98-82-8	Isopropylbenzene	25300	....	
99-87-6	4-Isopropyltoluene	18400	....	

000123

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB16-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight

Lab Sample ID: 98-A127308
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2300	U
91-20-3	Naphthalene	41400	
103-65-1	n-Propylbenzene	46000	
100-42-5	Styrene	2300	U
630-20-6	1,1,1,2-Tetrachloroethane	3450	U
79-34-5	1,1,2,2-Tetrachloroethane	2300	U
127-18-4	Tetrachloroethene	8050	U
108-88-3	Toluene	5750	U
87-61-6	1,2,3-Trichlorobenzene	2300	U
120-82-1	1,2,4-Trichlorobenzene	2300	U
71-55-6	1,1,1-Trichloroethane	4600	U
79-00-5	1,1,2-Trichloroethane	5750	U
79-01-6	Trichloroethene	11500	U
96-18-4	1,2,3-Trichloropropane	23000	U
95-63-6	1,2,4-Trimethylbenzene	275000	E
108-67-8	1,3,5-Trimethylbenzene	94300	
75-01-4	Vinyl chloride	10300	U
75-27-4	Bromodichloromethane	4600	U
6615	o-Xylene	131000	
6616	m,p-Xylene	444000	
75-69-4	Trichlorofluoromethane	4600	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB16-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight
Dilution Factor: 5000
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127308
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 0:22
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	14400	U
71-43-2	Benzene	11500	U
108-86-1	Bromobenzene	11500	U
124-48-1	Bromochloromethane	11500	U
75-25-2	Bromoform	34500	U
74-83-9	Bromomethane	28700	U
104-51-8	n-Butylbenzene	28700	U
135-98-8	sec-Butylbenzene	40200	U
98-06-6	t-Butylbenzene	40200	U
56-23-5	Carbon tetrachloride	57500	U
108-90-7	Chlorobenzene	11500	U
75-00-3	Chloroethane	28700	U
67-66-3	Chloroform	11500	U
74-87-3	Chloromethane	40200	U
95-49-8	2-Chlorotoluene	11500	U
106-43-4	4-Chlorotoluene	17200	U
96-12-8	1,2-Dibromo-3-chloropropane	5750	U
124-48-1	Dibromochloromethane	17200	U
74-95-3	1,2-Dibromoethane	17200	U
74-95-3	Dibromomethane	57500	U
95-50-1	1,2-Dichlorobenzene	11500	U
541-73-1	1,3-Dichlorobenzene	34500	U
106-46-7	1,4-Dichlorobenzene	11500	U
75-71-8	Dichlorodifluoromethane	28700	U
75-34-3	1,1-Dichloroethane	11500	U
107-06-2	1,2-Dichloroethane	17200	U
75-35-4	1,1-Dichloroethene	34500	U
156-59-2	cis-1,2-Dichloroethene	34500	U
156-60-5	trans-1,2-Dichloroethene	17200	U
78-87-5	1,2-Dichloropropane	11500	U
142-28-9	1,3-Dichloropropane	11500	U
594-20-7	2,2-Dichloropropane	115000	U
563-58-6	1,1-Dichloropropene	28700	U
10061-01-5	cis-1,3-Dichloropropene	28700	U
10061-02-6	trans-1,3-Dichloropropene	28700	U
100-41-4	Ethylbenzene	121000	
87-68-3	Hexachlorobutadiene	28700	U
98-82-8	Isopropylbenzene	28700	J
99-87-6	4-Isopropyltoluene	23000	J

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB16-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight

Lab Sample ID: 98-A127308
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	11500	U
91-20-3	Naphthalene	51700	
103-65-1	n-Propylbenzene	46000	
100-42-5	Styrene	11500	U
630-20-6	1,1,1,2-Tetrachloroethane	17200	U
79-34-5	1,1,2,2-Tetrachloroethane	11500	U
127-18-4	Tetrachloroethene	40200	U
108-88-3	Toluene	28700	U
87-61-6	1,2,3-Trichlorobenzene	11500	U
120-82-1	1,2,4-Trichlorobenzene	11500	U
71-55-6	1,1,1-Trichloroethane	23000	U
79-00-5	1,1,2-Trichloroethane	28700	U
79-01-6	Trichloroethene	57500	U
96-18-4	1,2,3-Trichloropropane	115000	U
95-63-6	1,2,4-Trimethylbenzene	287000	
108-67-8	1,3,5-Trimethylbenzene	97700	
75-01-4	Vinyl chloride	51700	U
75-27-4	Bromodichloromethane	23000	U
6615	o-Xylene	138000	
6616	m,p-Xylene	477000	
75-69-4	Trichlorofluoromethane	23000	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB14-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127309
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 14:13
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2870	U
71-43-2	Benzene	4600	
108-86-1	Bromobenzene	2300	U
124-48-1	Bromochloromethane	2300	U
75-25-2	Bromoform	6900	U
74-83-9	Bromomethane	5750	U
104-51-8	n-Butylbenzene	5750	U
135-98-8	sec-Butylbenzene	8050	U
98-06-6	t-Butylbenzene	8050	U
56-23-5	Carbon tetrachloride	11500	U
108-90-7	Chlorobenzene	2300	U
75-00-3	Chloroethane	5750	U
67-66-3	Chloroform	2300	U
74-87-3	Chloromethane	8050	U
95-49-8	2-Chlorotoluene	2300	U
106-43-4	4-Chlorotoluene	3450	U
96-12-8	1,2-Dibromo-3-chloropropane	1150	U
124-48-1	Dibromochloromethane	3450	U
74-95-3	1,2-Dibromoethane	3450	U
74-95-3	Dibromomethane	11500	U
95-50-1	1,2-Dichlorobenzene	2300	U
541-73-1	1,3-Dichlorobenzene	6900	U
106-46-7	1,4-Dichlorobenzene	2300	U
75-71-8	Dichlorodifluoromethane	5750	U
75-34-3	1,1-Dichloroethane	2300	U
107-06-2	1,2-Dichloroethane	3450	U
75-35-4	1,1-Dichloroethene	6900	U
156-59-2	cis-1,2-Dichloroethene	6900	U
156-60-5	trans-1,2-Dichloroethene	3450	U
78-87-5	1,2-Dichloropropane	2300	U
142-28-9	1,3-Dichloropropane	2300	U
594-20-7	2,2-Dichloropropane	23000	U
563-58-6	1,1-Dichloropropene	5750	U
10061-01-5	cis-1,3-Dichloropropene	5750	U
10061-02-6	trans-1,3-Dichloropropene	5750	U
100-41-4	Ethylbenzene	67800	
87-68-3	Hexachlorobutadiene	5750	U
98-82-8	Isopropylbenzene	17200	
99-87-6	4-Isopropyltoluene	13800	

000126

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB14-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight

Lab Sample ID: 98-A127309
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2300	U
91-20-3	Naphthalene	27600	
103-65-1	n-Propylbenzene	28700	
100-42-5	Styrene	2300	U
630-20-6	1,1,1,2-Tetrachloroethane	3450	U
79-34-5	1,1,2,2-Tetrachloroethane	2300	U
127-18-4	Tetrachloroethene	8050	U
108-88-3	Toluene	5750	U
87-61-6	1,2,3-Trichlorobenzene	2300	U
120-82-1	1,2,4-Trichlorobenzene	2300	U
71-55-6	1,1,1-Trichloroethane	4600	U
79-00-5	1,1,2-Trichloroethane	5750	U
79-01-6	Trichloroethene	11500	U
96-18-4	1,2,3-Trichloropropane	23000	U
95-63-6	1,2,4-Trimethylbenzene	198000	
108-67-8	1,3,5-Trimethylbenzene	69000	
75-01-4	Vinyl chloride	10300	U
75-27-4	Bromodichloromethane	4600	U
6615	o-Xylene	5750	U
6616	m,p-Xylene	282000	
75-69-4	Trichlorofluoromethane	4600	U

000127

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB26-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127310
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 15:51
Sample QC Group: 476i

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2870	U
71-43-2	Benzene	2300	U
108-86-1	Bromobenzene	2300	U
124-48-1	Bromochloromethane	2300	U
75-25-2	Bromoform	6900	U
74-83-9	Bromomethane	5750	U
104-51-8	n-Butylbenzene	5750	U
135-98-8	sec-Butylbenzene	8050	U
98-06-6	t-Butylbenzene	8050	U
56-23-5	Carbon tetrachloride	11500	U
108-90-7	Chlorobenzene	2300	U
75-00-3	Chloroethane	5750	U
67-66-3	Chloroform	2300	U
74-87-3	Chloromethane	8050	U
95-49-8	2-Chlorotoluene	2300	U
106-43-4	4-Chlorotoluene	3450	U
96-12-8	1,2-Dibromo-3-chloropropane	1150	U
124-48-1	Dibromochloromethane	3450	U
74-95-3	1,2-Dibromoethane	3450	U
74-95-3	Dibromomethane	11500	U
95-50-1	1,2-Dichlorobenzene	2300	U
541-73-1	1,3-Dichlorobenzene	6900	U
106-46-7	1,4-Dichlorobenzene	2300	U
75-71-8	Dichlorodifluoromethane	5750	U
75-34-3	1,1-Dichloroethane	2300	U
107-06-2	1,2-Dichloroethane	3450	U
75-35-4	1,1-Dichloroethene	6900	U
156-59-2	cis-1,2-Dichloroethene	6900	U
156-60-5	trans-1,2-Dichloroethene	3450	U
78-87-5	1,2-Dichloropropane	2300	U
142-28-9	1,3-Dichloropropane	2300	U
594-20-7	2,2-Dichloropropane	23000	U
563-58-6	1,1-Dichloropropene	5750	U
10061-01-5	cis-1,3-Dichloropropene	5750	U
10061-02-6	trans-1,3-Dichloropropene	5750	U
100-41-4	Ethylbenzene	140000	
87-68-3	Hexachlorobutadiene	5750	U
98-82-8	Isopropylbenzene	9200	U
99-87-6	4-Isopropyltoluene	14900	

000128

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB26-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight

Lab Sample ID: 98-A127310
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2300	U
91-20-3	Naphthalene	34500	
103-65-1	n-Propylbenzene	37900	
100-42-5	Styrene	2300	U
630-20-6	1,1,1,2-Tetrachloroethane	3450	U
79-34-5	1,1,2,2-Tetrachloroethane	2300	U
127-18-4	Tetrachloroethene	8050	U
108-88-3	Toluene	5750	U
87-61-6	1,2,3-Trichlorobenzene	2300	U
120-82-1	1,2,4-Trichlorobenzene	2300	U
71-55-6	1,1,1-Trichloroethane	4600	U
79-00-5	1,1,2-Trichloroethane	5750	U
79-01-6	Trichloroethene	11500	U
96-18-4	1,2,3-Trichloropropane	23000	U
95-63-6	1,2,4-Trimethylbenzene	218000	
108-67-8	1,3,5-Trimethylbenzene	77000	
75-01-4	Vinyl chloride	10300	U
75-27-4	Bromodichloromethane	4600	U
6615	o-Xylene	159000	
6616	m,p-Xylene	533000	E
75-69-4	Trichlorofluoromethane	4600	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB26-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight
Dilution Factor: 2500
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127310
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 0:58
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	7180	U
71-43-2	Benzene	5750	U
108-86-1	Bromobenzene	5750	U
124-48-1	Bromochloromethane	5750	U
75-25-2	Bromoform	17200	U
74-83-9	Bromomethane	14400	U
104-51-8	n-Butylbenzene	14400	U
135-98-8	sec-Butylbenzene	20100	U
98-06-6	t-Butylbenzene	20100	U
56-23-5	Carbon tetrachloride	28700	U
108-90-7	Chlorobenzene	5750	U
75-00-3	Chloroethane	14400	U
67-66-3	Chloroform	5750	U
74-87-3	Chloromethane	20100	U
95-49-8	2-Chlorotoluene	5750	U
106-43-4	4-Chlorotoluene	8620	U
96-12-8	1,2-Dibromo-3-chloropropane	2870	U
124-48-1	Dibromochloromethane	8620	U
74-95-3	1,2-Dibromoethane	8620	U
74-95-3	Dibromomethane	28700	U
95-50-1	1,2-Dichlorobenzene	5750	U
541-73-1	1,3-Dichlorobenzene	17200	U
106-46-7	1,4-Dichlorobenzene	5750	U
75-71-8	Dichlorodifluoromethane	14400	U
75-34-3	1,1-Dichloroethane	5750	U
107-06-2	1,2-Dichloroethane	8620	U
75-35-4	1,1-Dichloroethene	17200	U
156-59-2	cis-1,2-Dichloroethene	17200	U
156-60-5	trans-1,2-Dichloroethene	8620	U
78-87-5	1,2-Dichloropropane	5750	U
142-28-9	1,3-Dichloropropane	5750	U
594-20-7	2,2-Dichloropropane	57500	U
563-58-6	1,1-Dichloropropene	14400	U
10061-01-5	cis-1,3-Dichloropropene	14400	U
10061-02-6	trans-1,3-Dichloropropene	14400	U
100-41-4	Ethylbenzene	69000	
87-68-3	Hexachlorobutadiene	14400	U
98-82-8	Isopropylbenzene	23000	U
99-87-6	4-Isopropyltoluene	11500	J

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB26-21

Matrix: Soil
% Dry Weight: 87.
Units: ug/kg dry weight

Lab Sample ID: 98-A127310
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	5750	U
91-20-3	Naphthalene	23000	
103-65-1	n-Propylbenzene	23000	
100-42-5	Styrene	5750	U
630-20-6	1,1,1,2-Tetrachloroethane	8620	U
79-34-5	1,1,2,2-Tetrachloroethane	5750	U
127-18-4	Tetrachloroethene	20100	U
108-88-3	Toluene	14400	U
87-61-6	1,2,3-Trichlorobenzene	5750	U
120-82-1	1,2,4-Trichlorobenzene	5750	U
71-55-6	1,1,1-Trichloroethane	11500	U
79-00-5	1,1,2-Trichloroethane	14400	U
79-01-6	Trichloroethene	28700	U
96-18-4	1,2,3-Trichloropropane	57500	U
95-63-6	1,2,4-Trimethylbenzene	147000	
108-67-8	1,3,5-Trimethylbenzene	51700	
75-01-4	Vinyl chloride	25900	U
75-27-4	Bromodichloromethane	11500	U
6615	o-Xylene	80500	
6616	m,p-Xylene	279000	
75-69-4	Trichlorofluoromethane	11500	U

000131

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB14-12

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight
Dilution Factor: 100.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127311
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 1:34
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	291.	U
71-43-2	Benzene	233.	U
108-86-1	Bromobenzene	233.	U
124-48-1	Bromochloromethane	233.	U
75-25-2	Bromoform	698.	U
74-83-9	Bromomethane	581.	U
104-51-8	n-Butylbenzene	581.	U
135-98-8	sec-Butylbenzene	814.	U
98-06-6	t-Butylbenzene	814.	U
56-23-5	Carbon tetrachloride	1160	U
108-90-7	Chlorobenzene	233.	U
75-00-3	Chloroethane	581.	U
67-66-3	Chloroform	233.	U
74-87-3	Chloromethane	814.	U
95-49-8	2-Chlorotoluene	233.	U
106-43-4	4-Chlorotoluene	349.	U
96-12-8	1,2-Dibromo-3-chloropropane	116.	U
124-48-1	Dibromochloromethane	349.	U
74-95-3	1,2-Dibromoethane	349.	U
74-95-3	Dibromomethane	1160	U
95-50-1	1,2-Dichlorobenzene	233.	U
541-73-1	1,3-Dichlorobenzene	698.	U
106-46-7	1,4-Dichlorobenzene	233.	U
75-71-8	Dichlorodifluoromethane	581.	U
75-34-3	1,1-Dichloroethane	233.	U
107-06-2	1,2-Dichloroethane	349.	U
75-35-4	1,1-Dichloroethene	698.	U
156-59-2	cis-1,2-Dichloroethene	698.	U
156-60-5	trans-1,2-Dichloroethene	349.	U
78-87-5	1,2-Dichloropropane	233.	U
142-28-9	1,3-Dichloropropane	233.	U
594-20-7	2,2-Dichloropropane	2330	U
563-58-6	1,1-Dichloropropene	581.	U
10061-01-5	cis-1,3-Dichloropropene	581.	U
10061-02-6	trans-1,3-Dichloropropene	581.	U
100-41-4	Ethylbenzene	1400	
87-68-3	Hexachlorobutadiene	581.	U
98-82-8	Isopropylbenzene	349.	J
99-87-6	4-Isopropyltoluene	465.	J

000132

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB14-12

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight

Lab Sample ID: 98-A127311
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	233.	U
91-20-3	Naphthalene	581.	
103-65-1	n-Propylbenzene	698.	
100-42-5	Styrene	233.	U
630-20-6	1,1,1,2-Tetrachloroethane	349.	U
79-34-5	1,1,2,2-Tetrachloroethane	233.	U
127-18-4	Tetrachloroethene	814.	U
108-88-3	Toluene	581.	U
87-61-6	1,2,3-Trichlorobenzene	233.	U
120-82-1	1,2,4-Trichlorobenzene	233.	U
71-55-6	1,1,1-Trichloroethane	465.	U
79-00-5	1,1,2-Trichloroethane	581.	U
79-01-6	Trichloroethene	1160	U
96-18-4	1,2,3-Trichloropropane	2330	U
95-63-6	1,2,4-Trimethylbenzene	4650	
108-67-8	1,3,5-Trimethylbenzene	1980	
75-01-4	Vinyl chloride	1050	U
75-27-4	Bromodichloromethane	465.	U
6615	o-Xylene	581.	U
6616	m,p-Xylene	7670	
75-69-4	Trichlorofluoromethane	465.	U

000133

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB12-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127312
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 17:04
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.9	U
71-43-2	Benzene	2.3	U
108-86-1	Bromobenzene	2.3	U
124-48-1	Bromochloromethane	2.3	U
75-25-2	Bromoform	7.0	U
74-83-9	Bromomethane	5.8	U
104-51-8	n-Butylbenzene	5.8	U
135-98-8	sec-Butylbenzene	8.1	U
98-06-6	t-Butylbenzene	8.1	U
56-23-5	Carbon tetrachloride	11.6	U
108-90-7	Chlorobenzene	2.3	U
75-00-3	Chloroethane	5.8	U
67-66-3	Chloroform	2.3	U
74-87-3	Chloromethane	8.1	U
95-49-8	2-Chlorotoluene	2.3	U
106-43-4	4-Chlorotoluene	3.5	U
96-12-8	1,2-Dibromo-3-chloropropane	1.2	U
124-48-1	Dibromochloromethane	3.5	U
74-95-3	1,2-Dibromoethane	3.5	U
74-95-3	Dibromomethane	11.6	U
95-50-1	1,2-Dichlorobenzene	2.3	U
541-73-1	1,3-Dichlorobenzene	7.0	U
106-46-7	1,4-Dichlorobenzene	2.3	U
75-71-8	Dichlorodifluoromethane	5.8	U
75-34-3	1,1-Dichloroethane	2.3	U
107-06-2	1,2-Dichloroethane	3.5	U
75-35-4	1,1-Dichloroethene	7.0	U
156-59-2	cis-1,2-Dichloroethene	7.0	U
156-60-5	trans-1,2-Dichloroethene	3.5	U
78-87-5	1,2-Dichloropropane	2.3	U
142-28-9	1,3-Dichloropropane	2.3	U
594-20-7	2,2-Dichloropropane	23.3	U
563-58-6	1,1-Dichloropropene	5.8	U
10061-01-5	cis-1,3-Dichloropropene	5.8	U
10061-02-6	trans-1,3-Dichloropropene	5.8	U
100-41-4	Ethylbenzene	105.	
87-68-3	Hexachlorobutadiene	5.8	U
98-82-8	Isopropylbenzene	15.1	
99-87-6	4-Isopropyltoluene	7.0	

000134

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB12-22

Matrix: Soil
% Dry Weight: 86.
Units: ug/kg dry weight

Lab Sample ID: 98-A127312
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2.3	U
91-20-3	Naphthalene	30.2	
103-65-1	n-Propylbenzene	24.4	
100-42-5	Styrene	2.3	U
630-20-6	1,1,1,2-Tetrachloroethane	3.5	U
79-34-5	1,1,2,2-Tetrachloroethane	2.3	U
127-18-4	Tetrachloroethene	8.1	U
108-88-3	Toluene	5.8	U
87-61-6	1,2,3-Trichlorobenzene	2.3	U
120-82-1	1,2,4-Trichlorobenzene	2.3	U
71-55-6	1,1,1-Trichloroethane	4.7	U
79-00-5	1,1,2-Trichloroethane	5.8	U
79-01-6	Trichloroethene	11.6	U
96-18-4	1,2,3-Trichloropropane	23.3	U
95-63-6	1,2,4-Trimethylbenzene	123.	
108-67-8	1,3,5-Trimethylbenzene	23.3	
75-01-4	Vinyl chloride	10.5	U
75-27-4	Bromodichloromethane	4.7	U
6615	o-Xylene	3.5	J
6616	m,p-Xylene	414.	
75-69-4	Trichlorofluoromethane	4.7	U

000135

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB17-26

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight
Dilution Factor: 1.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127313
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 2:47
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2.6	U
71-43-2	Benzene	2.1	U
108-86-1	Bromobenzene	2.1	U
124-48-1	Bromochloromethane	2.1	U
75-25-2	Bromoform	6.2	U
74-83-9	Bromomethane	5.2	U
104-51-8	n-Butylbenzene	5.2	U
135-98-8	sec-Butylbenzene	7.3	U
98-06-6	t-Butylbenzene	7.3	U
56-23-5	Carbon tetrachloride	10.4	U
108-90-7	Chlorobenzene	2.1	U
75-00-3	Chloroethane	5.2	U
67-66-3	Chloroform	2.1	U
74-87-3	Chloromethane	7.3	U
95-49-8	2-Chlorotoluene	2.1	U
106-43-4	4-Chlorotoluene	3.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U
124-48-1	Dibromochloromethane	3.1	U
74-95-3	1,2-Dibromoethane	3.1	U
74-95-3	Dibromomethane	10.4	U
95-50-1	1,2-Dichlorobenzene	2.1	U
541-73-1	1,3-Dichlorobenzene	6.2	U
106-46-7	1,4-Dichlorobenzene	2.1	U
75-71-8	Dichlorodifluoromethane	5.2	U
75-34-3	1,1-Dichloroethane	2.1	U
107-06-2	1,2-Dichloroethane	3.1	U
75-35-4	1,1-Dichloroethene	6.2	U
156-59-2	cis-1,2-Dichloroethene	6.2	U
156-60-5	trans-1,2-Dichloroethene	3.1	U
78-87-5	1,2-Dichloropropane	2.1	U
142-28-9	1,3-Dichloropropane	2.1	U
594-20-7	2,2-Dichloropropane	20.8	U
563-58-6	1,1-Dichloropropene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
10061-02-6	trans-1,3-Dichloropropene	5.2	U
100-41-4	Ethylbenzene	3.1	U
87-68-3	Hexachlorobutadiene	5.2	U
98-82-8	Isopropylbenzene	8.3	U
99-87-6	4-Isopropyltoluene	6.2	U

000136

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB17-26

Matrix: Soil
% Dry Weight: 96.
Units: ug/kg dry weight

Lab Sample ID: 98-A127313
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2.1	U
91-20-3	Naphthalene	2.1	U
103-65-1	n-Propylbenzene	2.1	U
100-42-5	Styrene	2.1	U
630-20-6	1,1,1,2-Tetrachloroethane	3.1	U
79-34-5	1,1,2,2-Tetrachloroethane	2.1	U
127-18-4	Tetrachloroethene	7.3	U
108-88-3	Toluene	5.2	U
87-61-6	1,2,3-Trichlorobenzene	2.1	U
120-82-1	1,2,4-Trichlorobenzene	2.1	U
71-55-6	1,1,1-Trichloroethane	4.2	U
79-00-5	1,1,2-Trichloroethane	5.2	U
79-01-6	Trichloroethene	10.4	U
96-18-4	1,2,3-Trichloropropane	20.8	U
95-63-6	1,2,4-Trimethylbenzene	7.3	U
108-67-8	1,3,5-Trimethylbenzene	3.1	U
75-01-4	Vinyl chloride	9.4	U
75-27-4	Bromodichloromethane	4.2	U
6615	o-Xylene	5.2	U
6616	m,p-Xylene	3.1	U
75-69-4	Trichlorofluoromethane	4.2	U

000137

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB15-22

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight
Dilution Factor: 5.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127314
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 3:24
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	13.9	....	U
71-43-2	Benzene	11.1	....	U
108-86-1	Bromobenzene	11.1	....	U
124-48-1	Bromochloromethane	11.1	....	U
75-25-2	Bromoform	33.3	....	U
74-83-9	Bromomethane	27.8	....	U
104-51-8	n-Butylbenzene	27.8	....	U
135-98-8	sec-Butylbenzene	38.9	....	U
98-06-6	t-Butylbenzene	38.9	....	U
56-23-5	Carbon tetrachloride	55.6	....	U
108-90-7	Chlorobenzene	11.1	....	U
75-00-3	Chloroethane	27.8	....	U
67-66-3	Chloroform	11.1	....	U
74-87-3	Chloromethane	38.9	....	U
95-49-8	2-Chlorotoluene	11.1	....	U
106-43-4	4-Chlorotoluene	16.7	....	U
96-12-8	1,2-Dibromo-3-chloropropane	5.6	....	U
124-48-1	Dibromochloromethane	16.7	....	U
74-95-3	1,2-Dibromoethane	16.7	....	U
74-95-3	Dibromomethane	55.6	....	U
95-50-1	1,2-Dichlorobenzene	11.1	....	U
541-73-1	1,3-Dichlorobenzene	33.3	....	U
106-46-7	1,4-Dichlorobenzene	11.1	....	U
75-71-8	Dichlorodifluoromethane	27.8	....	U
75-34-3	1,1-Dichloroethane	11.1	....	U
107-06-2	1,2-Dichloroethane	16.7	....	U
75-35-4	1,1-Dichloroethene	33.3	....	U
156-59-2	cis-1,2-Dichloroethene	33.3	....	U
156-60-5	trans-1,2-Dichloroethene	16.7	....	U
78-87-5	1,2-Dichloropropane	11.1	....	U
142-28-9	1,3-Dichloropropane	11.1	....	U
594-20-7	2,2-Dichloropropane	111.	....	U
563-58-6	1,1-Dichloropropene	27.8	....	U
10061-01-5	cis-1,3-Dichloropropene	27.8	....	U
10061-02-6	trans-1,3-Dichloropropene	27.8	....	U
100-41-4	Ethylbenzene	33.3	....	
87-68-3	Hexachlorobutadiene	27.8	....	U
98-82-8	Isopropylbenzene	94.4	....	
99-87-6	4-Isopropyltoluene	156.	....	

000138

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB15-22

Matrix: Soil
% Dry Weight: 90.
Units: ug/kg dry weight

Lab Sample ID: 98-A127314
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
75-09-2	Methylene chloride	11.1	....	U
91-20-3	Naphthalene	55.6	....	
103-65-1	n-Propylbenzene	172.	....	
100-42-5	Styrene	11.1	....	U
630-20-6	1,1,1,2-Tetrachloroethane	16.7	....	U
79-34-5	1,1,2,2-Tetrachloroethane	11.1	....	U
127-18-4	Tetrachloroethene	38.9	....	U
108-88-3	Toluene	27.8	....	U
87-61-6	1,2,3-Trichlorobenzene	11.1	....	U
120-82-1	1,2,4-Trichlorobenzene	11.1	....	U
71-55-6	1,1,1-Trichloroethane	22.2	....	U
79-00-5	1,1,2-Trichloroethane	27.8	....	U
79-01-6	Trichloroethene	55.6	....	U
96-18-4	1,2,3-Trichloropropane	111.	....	U
95-63-6	1,2,4-Trimethylbenzene	1060	....	
108-67-8	1,3,5-Trimethylbenzene	422.	....	
75-01-4	Vinyl chloride	50.0	....	U
75-27-4	Bromodichloromethane	22.2	....	U
6615	o-Xylene	27.8	....	U
6616	m,p-Xylene	133.	....	
75-69-4	Trichlorofluoromethane	22.2	....	U

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB15-10-12

Matrix: Soil
% Dry Weight: 97.
Units: ug/kg dry weight
Dilution Factor: 5.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127315
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 4:00
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	12.9	U
71-43-2	Benzene	10.3	U
108-86-1	Bromobenzene	10.3	U
124-48-1	Bromochloromethane	10.3	U
75-25-2	Bromoform	30.9	U
74-83-9	Bromomethane	25.8	U
104-51-8	n-Butylbenzene	25.8	U
135-98-8	sec-Butylbenzene	36.1	U
98-06-6	t-Butylbenzene	36.1	U
56-23-5	Carbon tetrachloride	51.5	U
108-90-7	Chlorobenzene	10.3	U
75-00-3	Chloroethane	25.8	U
67-66-3	Chloroform	10.3	U
74-87-3	Chloromethane	36.1	U
95-49-8	2-Chlorotoluene	10.3	U
106-43-4	4-Chlorotoluene	15.5	U
96-12-8	1,2-Dibromo-3-chloropropane	5.2	U
124-48-1	Dibromochloromethane	15.5	U
74-95-3	1,2-Dibromoethane	15.5	U
74-95-3	Dibromomethane	51.5	U
95-50-1	1,2-Dichlorobenzene	10.3	U
541-73-1	1,3-Dichlorobenzene	30.9	U
106-46-7	1,4-Dichlorobenzene	10.3	U
75-71-8	Dichlorodifluoromethane	25.8	U
75-34-3	1,1-Dichloroethane	10.3	U
107-06-2	1,2-Dichloroethane	15.5	U
75-35-4	1,1-Dichloroethene	30.9	U
156-59-2	cis-1,2-Dichloroethene	30.9	U
156-60-5	trans-1,2-Dichloroethene	15.5	U
78-87-5	1,2-Dichloropropane	10.3	U
142-28-9	1,3-Dichloropropane	10.3	U
594-20-7	2,2-Dichloropropane	103.	U
563-58-6	1,1-Dichloropropene	25.8	U
10061-01-5	cis-1,3-Dichloropropene	25.8	U
10061-02-6	trans-1,3-Dichloropropene	25.8	U
100-41-4	Ethylbenzene	15.5	U
87-68-3	Hexachlorobutadiene	25.8	U
98-82-8	Isopropylbenzene	41.2	U
99-87-6	4-Isopropyltoluene	30.9	U

000140

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB15-10-12

Matrix: Soil
% Dry Weight: 97.
Units: ug/kg dry weight

Lab Sample ID: 98-A127315
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	10.3	U
91-20-3	Naphthalene	10.3	U
103-65-1	n-Propylbenzene	10.3	U
100-42-5	Styrene	10.3	U
630-20-6	1,1,1,2-Tetrachloroethane	15.5	U
79-34-5	1,1,2,2-Tetrachloroethane	10.3	U
127-18-4	Tetrachloroethene	36.1	U
108-88-3	Toluene	25.8	U
87-61-6	1,2,3-Trichlorobenzene	10.3	U
120-82-1	1,2,4-Trichlorobenzene	10.3	U
71-55-6	1,1,1-Trichloroethane	20.6	U
79-00-5	1,1,2-Trichloroethane	25.8	U
79-01-6	Trichloroethene	51.5	U
96-18-4	1,2,3-Trichloropropane	103.	U
95-63-6	1,2,4-Trimethylbenzene	36.1	
108-67-8	1,3,5-Trimethylbenzene	10.3	J
75-01-4	Vinyl chloride	46.4	U
75-27-4	Bromodichloromethane	20.6	U
6615	o-Xylene	25.8	U
6616	m,p-Xylene	15.5	
75-69-4	Trichlorofluoromethane	20.6	U

000141

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB10-23

Matrix: Soil
% Dry Weight: 89.
Units: ug/kg dry weight
Dilution Factor: 100.
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127316
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 19:28
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
144-10-5	1-Chlorohexane	281.	....	U
71-43-2	Benzene	225.	....	U
108-86-1	Bromobenzene	225.	....	U
124-48-1	Bromochloromethane	225.	....	U
75-25-2	Bromoform	674.	....	U
74-83-9	Bromomethane	562.	....	U
104-51-8	n-Butylbenzene	562.	....	U
135-98-8	sec-Butylbenzene	787.	....	U
98-06-6	t-Butylbenzene	787.	....	U
56-23-5	Carbon tetrachloride	1120	....	U
108-90-7	Chlorobenzene	225.	....	U
75-00-3	Chloroethane	562.	....	U
67-66-3	Chloroform	225.	....	U
74-87-3	Chloromethane	787.	....	U
95-49-8	2-Chlorotoluene	225.	....	U
106-43-4	4-Chlorotoluene	337.	....	U
96-12-8	1,2-Dibromo-3-chloropropane	112.	....	U
124-48-1	Dibromochloromethane	337.	....	U
74-95-3	1,2-Dibromoethane	337.	....	U
74-95-3	Dibromomethane	1120	....	U
95-50-1	1,2-Dichlorobenzene	225.	....	U
541-73-1	1,3-Dichlorobenzene	674.	....	U
106-46-7	1,4-Dichlorobenzene	225.	....	U
75-71-8	Dichlorodifluoromethane	562.	....	U
75-34-3	1,1-Dichloroethane	225.	....	U
107-06-2	1,2-Dichloroethane	337.	....	U
75-35-4	1,1-Dichloroethene	674.	....	U
156-59-2	cis-1,2-Dichloroethene	674.	....	U
156-60-5	trans-1,2-Dichloroethene	337.	....	U
78-87-5	1,2-Dichloropropane	225.	....	U
142-28-9	1,3-Dichloropropane	225.	....	U
594-20-7	2,2-Dichloropropane	2250	....	U
563-58-6	1,1-Dichloropropene	562.	....	U
10061-01-5	cis-1,3-Dichloropropene	562.	....	U
10061-02-6	trans-1,3-Dichloropropene	562.	....	U
100-41-4	Ethylbenzene	12900	....	
87-68-3	Hexachlorobutadiene	562.	....	U
98-82-8	Isopropylbenzene	3930	....	
99-87-6	4-Isopropyltoluene	2130	....	

000142

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB10-23

Matrix: Soil
% Dry Weight: 89.
Units: ug/kg dry weight

Lab Sample ID: 98-A127316
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	225.	U
91-20-3	Naphthalene	5390	
103-65-1	n-Propylbenzene	7080	
100-42-5	Styrene	225.	U
630-20-6	1,1,1,2-Tetrachloroethane	337.	U
79-34-5	1,1,2,2-Tetrachloroethane	225.	U
127-18-4	Tetrachloroethene	787.	U
108-88-3	Toluene	562.	U
87-61-6	1,2,3-Trichlorobenzene	225.	U
120-82-1	1,2,4-Trichlorobenzene	225.	U
71-55-6	1,1,1-Trichloroethane	449.	U
79-00-5	1,1,2-Trichloroethane	562.	U
79-01-6	Trichloroethene	1120	U
96-18-4	1,2,3-Trichloropropane	2250	U
95-63-6	1,2,4-Trimethylbenzene	34900	E
108-67-8	1,3,5-Trimethylbenzene	12200	
75-01-4	Vinyl chloride	1010	U
75-27-4	Bromodichloromethane	449.	U
6615	o-Xylene	562.	U
6616	m,p-Xylene	42600	
75-69-4	Trichlorofluoromethane	449.	U

000143

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB10-23

Matrix: Soil
% Dry Weight: 89.
Units: ug/kg dry weight
Dilution Factor: 1000
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: 98-A127316
Date Sampled: 10/15/98
Date Received: 10/17/98
Analysis Date: 10/21/98
Analysis Time: 4:37
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
144-10-5	1-Chlorohexane	2810	U
71-43-2	Benzene	2250	U
108-86-1	Bromobenzene	2250	U
124-48-1	Bromochloromethane	2250	U
75-25-2	Bromoform	6740	U
74-83-9	Bromomethane	5620	U
104-51-8	n-Butylbenzene	5620	U
135-98-8	sec-Butylbenzene	7870	U
98-06-6	t-Butylbenzene	7870	U
56-23-5	Carbon tetrachloride	11200	U
108-90-7	Chlorobenzene	2250	U
75-00-3	Chloroethane	5620	U
67-66-3	Chloroform	2250	U
74-87-3	Chloromethane	7870	U
95-49-8	2-Chlorotoluene	2250	U
106-43-4	4-Chlorotoluene	3370	U
96-12-8	1,2-Dibromo-3-chloropropane	1120	U
124-48-1	Dibromochloromethane	3370	U
74-95-3	1,2-Dibromoethane	3370	U
74-95-3	Dibromomethane	11200	U
95-50-1	1,2-Dichlorobenzene	2250	U
541-73-1	1,3-Dichlorobenzene	6740	U
106-46-7	1,4-Dichlorobenzene	2250	U
75-71-8	Dichlorodifluoromethane	5620	U
75-34-3	1,1-Dichloroethane	2250	U
107-06-2	1,2-Dichloroethane	3370	U
75-35-4	1,1-Dichloroethene	6740	U
156-59-2	cis-1,2-Dichloroethene	6740	U
156-60-5	trans-1,2-Dichloroethene	3370	U
78-87-5	1,2-Dichloropropane	2250	U
142-28-9	1,3-Dichloropropane	2250	U
594-20-7	2,2-Dichloropropane	22500	U
563-58-6	1,1-Dichloropropene	5620	U
10061-01-5	cis-1,3-Dichloropropene	5620	U
10061-02-6	trans-1,3-Dichloropropene	5620	U
100-41-4	Ethylbenzene	5620	
87-68-3	Hexachlorobutadiene	5620	U
98-82-8	Isopropylbenzene	8990	U
99-87-6	4-Isopropyltoluene	6740	U

000144

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

SB10-23

Matrix: Soil
% Dry Weight: 89.
Units: ug/kg dry weight

Lab Sample ID: 98-A127316
Date Sampled: 10/15/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
75-09-2	Methylene chloride	2250	U
91-20-3	Naphthalene	3370	
103-65-1	n-Propylbenzene	3370	
100-42-5	Styrene	2250	U
630-20-6	1,1,1,2-Tetrachloroethane	3370	U
79-34-5	1,1,2,2-Tetrachloroethane	2250	U
127-18-4	Tetrachloroethene	7870	U
108-88-3	Toluene	5620	U
87-61-6	1,2,3-Trichlorobenzene	2250	U
120-82-1	1,2,4-Trichlorobenzene	2250	U
71-55-6	1,1,1-Trichloroethane	4490	U
79-00-5	1,1,2-Trichloroethane	5620	U
79-01-6	Trichloroethene	11200	U
96-18-4	1,2,3-Trichloropropane	22500	U
95-63-6	1,2,4-Trimethylbenzene	18000	
108-67-8	1,3,5-Trimethylbenzene	6740	
75-01-4	Vinyl chloride	10100	U
75-27-4	Bromodichloromethane	4490	U
6615	o-Xylene	5620	U
6616	m,p-Xylene	20200	
75-69-4	Trichlorofluoromethane	4490	U

000145

COPY 1

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Soil
% Dry Weight: 100
Units: UG/KG
Dilution Factor: 1
Analysis Method: SW8260B
Delivery Group: 117250
Instrument: HP-2

Lab Sample ID: BLANK
Date Sampled: 10/16/98
Date Received: 10/17/98
Analysis Date: 10/18/98
Analysis Time: 10:35
Sample QC Group: 4761

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION		FLAG
71-43-2	Benzene	2.0	....	U
108-86-1	Bromobenzene	2.0	....	U
124-48-1	Bromochloromethane	2.0	....	U
75-25-2	Bromoform	6.0	....	U
74-83-9	Bromomethane	5.0	....	U
104-51-8	n-Butylbenzene	5.0	....	U
135-98-8	sec-Butylbenzene	7.0	....	U
98-06-6	t-Butylbenzene	7.0	....	U
56-23-5	Carbon tetrachloride	10.0	....	U
108-90-7	Chlorobenzene	2.0	....	U
75-00-3	Chloroethane	5.0	....	U
67-66-3	Chloroform	2.0	....	U
74-87-3	Chloromethane	7.0	....	U
95-49-8	2-Chlorotoluene	2.0	....	U
106-43-4	4-Chlorotoluene	3.0	....	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	....	U
124-48-1	Dibromochloromethane	3.0	....	U
74-95-3	1,2-Dibromoethane	3.0	....	U
74-95-3	Dibromomethane	10.0	....	U
95-50-1	1,2-Dichlorobenzene	2.0	....	U
541-73-1	1,3-Dichlorobenzene	6.0	....	U
106-46-7	1,4-Dichlorobenzene	2.0	....	U
75-71-8	Dichlorodifluoromethane	5.0	....	U
75-34-3	1,1-Dichloroethane	2.0	....	U
107-06-2	1,2-Dichloroethane	3.0	....	U
75-35-4	1,1-Dichloroethene	6.0	....	U
156-59-2	cis-1,2-Dichloroethene	6.0	....	U
156-60-5	trans-1,2-Dichloroethene	3.0	....	U
78-87-5	1,2-Dichloropropane	2.0	....	U
142-28-9	1,3-Dichloropropane	2.0	....	U
594-20-7	2,2-Dichloropropane	20.0	....	U
563-58-6	1,1-Dichloropropene	5.0	....	U
10061-01-5	cis-1,3-Dichloropropene	5.0	....	U
10061-02-6	trans-1,3-Dichloropropene	5.0	....	U
100-41-4	Ethylbenzene	3.0	....	U
87-68-3	Hexachlorobutadiene	5.0	....	U
98-82-8	Isopropylbenzene	8.0	....	U
99-87-6	4-Isopropyltoluene	6.0	....	U
75-09-2	Methylene chloride	22.0	....	

SPECIALIZED ASSAYS, INC.

2960 Foster Creighton Dr.
P.O. Box 40566
Nashville, TN 37204-0566
Phone 1-615-726-0177

Sample Identification

BLANK

Matrix: Soil
% Dry Weight: 100
Units: UG/KG

Lab Sample ID: BLANK
Date Sampled: 10/16/98
Date Received: 10/17/98

FORM I

CAS NUMBER	ANALYTE	CONCENTRATION	FLAG
91-20-3	Naphthalene	2.0	U
103-65-1	n-Propylbenzene	2.0	U
100-42-5	Styrene	2.0	U
630-20-6	1,1,1,2-Tetrachloroethane	3.0	U
79-34-5	1,1,2,2-Tetrachloroethane	2.0	U
127-18-4	Tetrachloroethene	7.0	U
108-88-3	Toluene	5.0	U
87-61-6	1,2,3-Trichlorobenzene	2.0	U
120-82-1	1,2,4-Trichlorobenzene	2.0	U
71-55-6	1,1,1-Trichloroethane	4.0	U
79-00-5	1,1,2-Trichloroethane	5.0	U
79-01-6	Trichloroethene	10.0	U
96-18-4	1,2,3-Trichloropropane	20.0	U
95-63-6	1,2,4-Trimethylbenzene	7.0	U
108-67-8	1,3,5-Trimethylbenzene	3.0	U
75-01-4	Vinyl chloride	9.0	U
75-27-4	Bromodichloromethane	4.0	U
6615	o-Xylene	5.0	U
6616	m,p-Xylene	3.0	U
75-69-4	Trichlorofluoromethane	4.0	U

2B

SOIL VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: SPECIALIZED ASSAYS Contract: _____

Lab Code: SASSAYS Case No.: _____ SAS No.: _____ SDG No.: 117250

Level: (low/med) LOW

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01	VBLK02	106	101	101	0
02	SB13-21	99	101	113	0
03	SB11-21	99	104	97	0
04	SB16-21	102	101	96	0
05	SB14-21	100	99	102	0
06	SB26-21	97	98	66	0
07	SB12-22	107	100	98	0
08	SB15-22	98	99	99	0
09	SB10-23	96	103	97	0
10	VBLK04	106	102	104	0
11	SB15-10-12M	99	102	100	0
12	SB15-10-12M	100	102	103	0
13	CONTROL	99	103	97	0
14	VBLK03	112	98	105	0
15	SB11-21B	101	98	101	0
16	SB16-21DL	96	100	78	0
17	SB26-21DL	100	103	73	0
18	SB14-12	101	102	87	0
19	SB17-26	100	105	121	0
20	SB15-22B	105	102	101	0
21	SB15-10-12	102	106	99	0
22	SB10-23DL	99	102	96	0
23	SB16-8	107	101	76	0

			QC LIMITS
SMC1	=	1,2-Dichloroethane-d4	(62-147)
SMC2	=	Toluene-d8	(84-117)
SMC3	=	Bromofluorobenzene	(64-126)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D System Monitoring Compound diluted out

FORM 3B

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Matrix Spike Sample: SB15-10-12 SDG: 117250

QC Group: 4761

Compound	Spike Added	Sample Conc	Spike Conc	% Rec	QC Limits
Benzene	51.5	0.0	56.7	110	58 - 135
Chlorobenzene	51.5	0.0	52.6	102	54 - 136
1,1-Dichloroethene	51.5	0.0	57.7	112	58 - 138
Toluene	51.5	0.0	51.5	100	56 - 135
Trichloroethene	51.5	0.0	54.6	106	52 - 143

Compound	Spike Added	MSD Conc	% Rec	RPD	RPD Limit	Recovery Limits
Benzene	51.5	53.6	104	6	17	58 - 135
Chlorobenzene	51.5	50.5	98	4	14	54 - 136
1,1-Dichloroethene	51.5	55.7	108	4	19	58 - 138
Toluene	51.5	50.5	98	2	18	56 - 135
Trichloroethene	51.5	52.6	102	4	18	52 - 143

Concentration Units: ug/kg

RPD: 0 out of 5 outside QC limits.
Spike Recoveries: 0 out of 10 outside QC limits.

FORM 3Ba

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

SDG: 117250 QC Group: 4761

Compound	Known Value	Conc	% Rec	QC Limits
Benzene	50	56	112	39-151
Bromobenzene	50	51	102	74-122
Bromochloromethane	50	60	120	68-134
Bromoform	50	53	106	31-144
Bromomethane	50	45	90	51-135
n-Butylbenzene	50	47	94	65-127
sec-Butylbenzene	50	51	102	68-129
t-Butylbenzene	50	52	104	68-128
Carbon tetrachloride	50	56	112	53-144
Chlorobenzene	50	52	104	62-130
Chloroethane	50	50	100	56-138
Chloroform	50	53	106	71-132
Chloromethane	50	56	112	65-134
2-Chlorotoluene	50	48	96	72-123
4-Chlorotoluene	50	48	96	70-123
1,2-Dibromo-3-chloropropane	50	55	110	70-130
Dibromochloromethane	50	53	106	41-133
1,2-Dibromoethane	50	57	114	47-136
Dibromomethane	50	49	98	60-141
1,2-Dichlorobenzene	50	47	94	66-128
1,3-Dichlorobenzene	50	44	88	65-128
1,4-Dichlorobenzene	50	44	88	66-129
Dichlorodifluoromethane	50	56	112	50-140
1,1-Dichloroethane	50	58	116	70-132
1,2-Dichloroethane	50	55	110	58-135
1,1-Dichloroethene	50	56	112	69-130
cis-1,2-Dichloroethene	50	54	108	59-140
trans-1,2-Dichloroethene	50	51	102	72-128
1,2-Dichloropropane	50	57	114	45-149
1,3-Dichloropropane	50	55	110	58-138
2,2-Dichloropropane	50	50	100	43-146
1,1-Dichloropropene	50	56	112	56-132
cis-1,3-Dichloropropene	50	52	104	69-130
trans-1,3-Dichloropropene	50	50	100	56-126
Ethylbenzene	50	51	102	61-129
Hexachlorobutadiene	50	45	90	59-138
Isopropylbenzene	50	50	100	70-127
4-Isopropyltoluene	50	47	94	70-127
Methylene chloride	50	54	108	68-142
Naphthalene	50	58	116	54-146
n-Propylbenzene	50	49	98	67-128

000150A

FORM 3Ba

VOLATILE LABORATORY CONTROL RECOVERY

Lab: Specialized Assays, Inc. Project: WURTSMITH BIOVENTING

Styrene	50	50	100	65-128
1,1,1,2-Tetrachloroethane	50	56	112	53-130
1,1,2,2-Tetrachloroethane	50	56	112	37-149
Tetrachloroethene	50	50	100	55-128
Toluene	50	51	102	65-131
1,2,3-Trichlorobenzene	50	40	80	55-137
1,2,4-Trichlorobenzene	50	41	82	48-141
1,1,1-Trichloroethane	50	54	108	60-136
1,1,2-Trichloroethane	50	57	114	56-137
Trichloroethene	50	52	104	61-141
1,2,3-Trichloropropane	50	56	112	39-146
1,2,4-Trimethylbenzene	50	45	90	72-126
1,3,5-Trimethylbenzene	50	65	130#	22-125
Vinyl chloride	50	49	98	57-132
Bromodichloromethane	50	58	116	60-133
o-Xylene	50	52	104	64-126
m,p-Xylene	100	98	98	59-131
Trichlorofluoromethane	50	58	116	56-142

Concentration Units: ug/kg

Recoveries: 1 out of 59 outside QC limits.

000150B