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EXECUTIVE SUMMARY

A comprehensive remedial investigation and alternative analysis has been completed for this site that included both a bench and pilot scale study of soil treatment technology. Both the bench and pilot study results are presented in this report.

A bench study was performed in the winter of 2006 to evaluate both bioremediation and chemical oxidation treatment. Bioremediation using indigenous soil microbes was found to be viable, but would require maintenance of sufficient soil oxygen levels over an estimated twelve-month timeframe where soil temperatures were maintained above 40° Fahrenheit (i.e. two construction seasons). Based on site hydraulic heterogeneity, oxygen maintenance would require ex-situ bio-treatment. Chemical oxidation using sodium persulfate was found viable at 70°F and in a continuously mixed aqueous reactor. However, optimization of sodium persulfate field application where practical aspects of soil mixing would not attain the homogeneity of a continuously mixed aqueous reactor require application at elevated temperatures (95° to 105°F) with field mixing for successful treatment.

A pilot study was performed in the summer of 2006 to evaluate a modified biological treatment called Allu™ processing. Soils were excavated, drained, screened and aerated with the Allu™ process. After six weeks of soil turnovers, virtually all visual staining, petroleum odors and volatile organic compounds were removed from the soils, while simultaneously soil microbe densities increased two to three orders of magnitude. Semi-volatile organic compounds largely remained in the soils, however, initial concentrations are not a significant concern at this site.

Ten treatment technologies were evaluated for application to this site. These technologies ranged from a simple soil cap (with and without groundwater treatment), to complete replacement of excavated soil (disposal of contaminated soil), to excavation and on-site soil treatment, to excavation and on-site soil treatment with chemical oxidation polishing, to in-situ thermal treatment and soil vapor extraction. In-situ treatment options that depend on groundwater hydraulics were

rejected, due to the significant hydraulic heterogeneity measured across the site during the remedial investigation. The sole in-situ technology deemed technically feasible was thermal treatment.

This evaluation revealed that the cost of full site treatment is approximately one-half the cost of landfill disposal for all impacted soils and replacement with clean fill. However, it also revealed that onsite treatment would leave residual semi-volatile organic compounds, some of which will be above the standards, criteria and guidance (SCG) levels. These residual semi-volatile organic compounds are the low volatility, low water solubility compounds with an affinity for strong adsorption to soil organic matter. The residual semi-volatile organic compounds remaining at the site would therefore pose little threat to public health and the environment.

Excavation and on-site Allu processing with the option to dispose of up to 25% of excavated soil (Alternative 3C) is recommended as the remedy for this site, at an estimated cost of $4.3 million. This remedy is protective of human health, has short and long-term effectiveness, is permanent, significantly reduces the toxicity, mobility and volume of onsite contaminants, and is technically feasible. It is acknowledged that this remedy will leave some semi-volatile organic compounds at concentrations close to but above the SCGs. However, the cost of the only remedy evaluated that would meet every compound specific SCG would be approximately double the cost of the recommended alternative.

1.0 PURPOSE AND REPORT ORGANIZATION

This report summarizes the site investigation, including bench and pilot studies and key findings, and evaluates remedial alternatives for full-scale site remediation. The remainder of this report is organized into four main sections: site investigation summary; identification and development of remedial alternatives; analysis of alternatives; and recommendation of a site remediation method.

2.0 SITE INVESTIGATION SUMMARY

2.1 Site Description, History and Investigation Overview

The property is located on Leland Avenue in the City of Utica, Oneida County, New York (refer to *Sheet 1 – General Site Plan and Site Location Map*). The property is approximately 4.5 acres in size, has one intact building, 16 monitoring wells and 26 temporary monitoring wells.

Prior to the spring of 2004, the property was an abandoned bulk petroleum terminal. Since that time, a demolition project removed all but one site structure, including ten bulk petroleum tanks, three aboveground oil blending tanks, a slop tank, an oil/water separator, five loading racks, two pump houses, aboveground and buried piping, and four buildings (refer to *Sheet 2 – Site Infrastructure Removed (IRM)*). Only the former garage was left standing. The site was rough graded and secured with a fence around the entire perimeter.

A review of historical land use indicates the property had been the site of a bulk petroleum terminal from prior to 1950 to the early 1990's. Sanborn Fire Insurance Maps indicate that during the first half of the 1900's, the property was the site of a brickyard having a number of kilns and storage sheds. Prior to construction of the Barge Canal in the early 1900's, the course of the Mohawk River was to the south of the site, but was relocated to the north as part of the Canal construction project. It is possible the movement of the Canal lead to deposition of excavated soils onto the site, as surficial material appears to be non-native fill.

A comprehensive investigation of surface and subsurface soils and groundwater across the former Matt bulk petroleum site in Utica, New York was completed in September 2005. Its purpose was to characterize the nature and extent of site contamination and to develop sufficient information to support selection of a site remediation technology. The scope of this project included the emptying and removal of site infrastructure, including bulk petroleum storage and blending tanks, above and underground piping, loading racks and buildings. The subsequent site contamination investigation included the completion of 54 test pits and 79 soil borings, and installation of 16 permanent groundwater-monitoring wells and 26 temporary monitoring wells. It also included the collection and analysis of in excess of 144 soil samples and 62 groundwater samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals and polychlorinated biphenyls (PCBs), as well as several rounds of groundwater table measurements.

In December 2005, a bench study was initiated to test the feasibility of bioremediation or chemical oxidation treatment of site soils and groundwater. These results were then applied to the performance of a pilot study in the summer of 2006 to scale up and field verify treatment technology to clean up the site. Results from both of these studies and their implications for selection and development of the full-scale site remediation technology are presented within this report.

2.2 Standards, Criteria and Guidance (SCGs)

The following guidance or regulatory criteria have been used to evaluate the analytical results obtained from the investigation activities:

Soil ..... DEC Technical Administrative Guidance Memorandum (TAGM) No. 4046, *Determination of Soil Cleanup Objectives and Cleanup Levels*, dated January 1994 and revised April 10, 2001. Part 375-6.8(b)

Sediment ..... DEC *Technical Guidance for Screening Contaminated Sediments*, dated January 25, 1999.

Groundwater and Surface Water ..... DEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1, *Ambient Water Quality Standards and Guidance Values*, dated June 1998.

The specific SCGs for each of the chemicals of concern (COCs) have been provided on the appropriate analytical summary tables for the various media.

2.3 Nature and Extent of Contamination

The result of this investigation is a finding that substantial site soil and groundwater contamination exists. A zone of grossly contaminated (ZoGC) soil, and an area of concern (AOC) with lesser levels of contamination, exists across approximately 65% of the site. Soil contamination within the zone of grossly contaminated soil lies west and north of the maintenance building, extending north to the Mohawk River, with a spur reaching eastward over the location of former ASTs 2 and 3. The AOC extends further to the east to Leland Avenue and along the northeastern Mohawk River frontage.

The nature of site contamination within the area of concern is mainly one of moderate levels of residual contamination, while the zone of grossly contaminated soil contains free product and significant groundwater contaminant concentrations. The majority of the site contains groundwater with dissolved phase petroleum constituents, primarily VOCs with several SVOCs, at concentrations above the groundwater SCGs. Over half of the site soil samples, representing approximately two-thirds of the site, contain total VOCs at concentrations exceeding the soil SCGs. However, only ten of 75 subsurface soil samples contained one or more SVOC at concentrations above the SCGs.

Vertically, soils in the primary area of concern and in the zone of grossly contaminated soil are impacted above soil SCGs down to, and in some locations into, the silty clay layer at approximately 5 to 10 feet below ground surface. Refer to Figure 3 for the limits of the AOC and ZoGC.

2.4 Contaminant Fate and Transport

Contaminants at this site were primarily derived from gasoline and distillate and residual petroleum fuels. Contaminants are present in both subsurface soils and groundwater. In general, distillates contain an abundance of lower molecular weight compounds, have moderate to high water solubility, and are mobile in the subsurface environment. Residual fuel oils have an abundance of higher molecular weight compounds that have low water solubility and tend to remain close to their release

point. The presence of significant organic carbon in the soil column appears to significantly inhibit subsurface migration patterns.

The environmental fate of individual compounds is primarily dependent upon biological metabolism, although chemical degradation, such as oxidation, also contributes to reduction of compound concentrations. The fate of individual compounds derived from fuel oils tends to mirror their mobility potential. Compounds that are water soluble (mobile) are also more susceptible to biodegradation processes and compounds that have low water solubility tend to remain in place, but have much slower biodegradation rates. The VOCs and lower molecular weight (128 to 178) SVOCs are relatively mobile in the soil and groundwater while the higher weight (>202) SVOCs tend to remain close to their point of release. Although petroleum compounds are susceptible to biodegradation in the subsurface environment, each compound tends to degrade at its own rate as microorganisms selectively ingest and metabolize them. Again, molecular weight is an indicator of the rate of degradation as lower molecular weight compounds tend to be degraded faster than higher weight compounds. Conditions at this site are consistent with this generality. This is evidenced by the abundance of longer chain hydrocarbons indicative of compounds identified as Tentatively Identified Compounds (TICs) that are more prevalent across the site than were STARS[1] petroleum and target compound list (TCL) compounds. Outside factors, such as presence of compounds toxic to microorganisms or concentration of the target compound, also influence degradation rates. Individual compounds found at this site are susceptible to degradation processes, however, oxygen availability as measured in groundwater wells across the site is a limiting factor [dissolved oxygen in site wells is generally well below 1 milligram per liter (mg/L)]. Degradation rates can range from a few days to many years for individual compounds.

The existing soil contamination within the zone of gross contamination is an ongoing contributor to groundwater contamination. Groundwater contamination exists at concentrations above the SCGs site-wide. An ongoing discharge of groundwater at concentrations exceeding these quality

[1]DEC Spill Technology and Remediation Series (STARS) Memo #1 – *Petroleum-Contaminated Soil Guidance Policy*, dated August 1992.

standards into the Mohawk River exists, however the impact to the river is negligible, as the daily mass discharge is estimated to be on the order of 0.5 pounds total VOCs per day. Offsite migration of site contamination has also occurred along Leland Avenue and from the southwest site corner into a low-lying wet area.

Groundwater flows across this site initially from west to east, until it encounters a groundwater divide that splits the flow either toward the Mohawk River or toward the southeast.

Offsite contaminant migration along Leland Avenue is limited. VOCs and SVOCs detected in offsite soils were at concentrations below SCGs, however, one VOC constituent in one of two groundwater samples was slightly above the SCGs. In the low-lying wet area, three offsite soil samples all exceeded one or more SCG for both VOCs and SVOCs, while one onsite sediment sample from a discharge pipe displayed results that were below the SCGs for VOC/SVOCs. One groundwater sample from this area showed results that were below the State Standards for both VOCs and SVOCs. Along the Mohawk River, soil samples from three borings and two surface locations all showed that VOCs and SVOCs are below the SCGs. Groundwater sampled in five monitoring wells located along the bank of the Mohawk River showed that all five wells contained one or more VOC at concentrations above the SCGs and one well contained one SVOC at a concentration above the SCG.

Evidence of contaminant migration onto the site was not found in this investigation.

3.0 IDENTIFICATION AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

3.1 Remedial Action Objectives

The remedial action objectives (RAOs) for this site are to reduce petroleum odors, visual staining and VOCs from site soils to meet SCGs. SVOCs are difficult and expensive to remove and it shall

be the RAO for this site to reduce SVOC concentrations to meet site cleanup standards for restricted industrial uses.

The objectives of this site cleanup should be to protect human health and to render the site suitable for restricted industrial use per its municipal zoning designation and suitable for a planned riverbank green space. A Soil Management Plan and administrative controls should be a part of the long-term site management.

Specific objectives for groundwater and soil include the following:

- Prevent the incidental ingestion and dermal contact with site groundwater that exceeds State drinking water concentration standards and prevent inhalation of volatilized constituents from site groundwater.

- Prevent the ingestion and direct contact with contaminated soil.

- Prevent inhalation of contaminants volatilized from site soils.

A wide variety of treatment technologies capable of attaining these objectives should be considered for application to this site. The remedial alternative selected must address impacted site groundwater and reduce concentrations over an acceptable time period. This site has experienced multiple releases and now contains groundwater across the majority of the site that exceeds SCGs for one or more compounds. Additionally, site soils within the remedial target area contain grossly contaminated soil that extends across the water table surface down to and into an underlying clay layer. This clay layer is encountered at depths of between 5 and 10 feet below ground surface. The remedial approach identified should meet the recommended RAOs and be consistent with the protection of public health.

3.2 General Response Actions

Remediation at this site entails addressing both soil and groundwater contamination. An estimation of the soil and groundwater volumes to be addressed are presented below.

Soil:

Within the zone of gross contamination, impacted soils extend from the ground surface down to and somewhat into the underlying impeding layer located at a depth of 5 to 10 feet below ground surface. Within the AOC, contamination is typically encountered from 2 to 4 feet below ground surface to and into the impeding clay layer.

As contamination often extends from ground surface to the underlying impeding layer (5 to 10 feet), the volume of affected soil is calculated based on an average vertical depth of 8 feet. The following table contains volumes and tonnage of affected soils within the identified zone/area of contamination.

Impacted Areas	Square Feet	Cubic Yards	Tonnage
Gross Contamination	65,900	19,600	36,700
AOC	72,900	21,600	40,500
TOTALS	138,800	41,200	77,200

Note: Soil volume based on above square footage and an 8-foot vertical depth.
Weight based on 1.875 tons per cubic yard of in-place compacted soil.

Groundwater:

The frontage along the Mohawk River bank is a length of approximately 310 feet. If an active system to control groundwater discharge to the River is selected as a remedial alternative, then system design will address a groundwater collection system of this length.

Groundwater at the majority of the 4.5-acre site contains contaminant concentrations above the groundwater SCGs. Impacted groundwater is discharged to the Mohawk River. An examination of the Mohawk River flow in comparison to the estimated annual site groundwater discharge to the river, however, provides perspective on the potential impact of this discharge. Based on hydraulic conductivity measurements obtained from the monitoring well slug tests and groundwater table contouring, an estimate of the groundwater discharge rate to the river was made. The three wells located along the riverbank, MW-1 through MW-3, were determined to have hydraulic conductivities ranging from 1 to 259 gallons per day per square foot. Conductivities in the range of 10 to 300 gallons per day per square foot, coupled with a hydraulic gradient of 8%, were applied to calculate the range of expected daily groundwater discharge volume to the river. This calculated volume ranged from 1,200 to 37,000 gallons per day. This volume was then used to calculate a range of daily mass loading of organics (VOCs plus SVOCs) to the river. This calculation applied the highest total VOC plus SVOC concentration from MW-1 (1,776 micrograms per liter (µg/L)) to the entire discharge length and also applied the average concentration from wells MW-1 through MW-3 (1,066 µg/L). Based on this approach, a daily organic mass loading (VOC plus SVOC) to the Mohawk River from ongoing groundwater discharge is on the order of 0.33 to 0.55 pounds per day (200 pounds per year). The daily Mohawk River flow rate for a one-year time period from October 2002 through September 2003 at Delta Dam near Rome, New York fluctuated from 176 to 1,850 cubic feet per second. These rates equate to daily flows of 113 million to 1.2 billion gallons per day. A waste load allocation on the order of 0.5 pounds per day is well within the assimilative capacity of this river.

If a passive collection trench were installed to intercept this groundwater discharge without any increase in the hydraulic gradient (i.e. no drawdown) then a treatment system capable of handling the high end of this volume would be needed. These ranges equate to annual treatment volumes of 453,000 to 13.6 million gallons per year. It should be noted that an active groundwater trench pumping system (i.e. drawdown of the water table) is likely to artificially increase the natural hydraulic gradient by an estimated 2 to 5-fold, thus increasing the pumped groundwater volume.

Applying a site wide average soil porosity to the soil volume that must be remediated and then doubling this volume to allow for groundwater inflow once groundwater is extracted, the estimated flow rate over a 20-week timeframe (projected treatment time in one season) is in the range of 8 to 15 gallons per minute steady-state. This flow rate is based on an estimated 20% soil porosity, a depth to groundwater of 2 feet below ground surface, a total excavation depth of 8 feet and a groundwater inflow rate equal to the storage volume at the outset of the remedial groundwater action.

3.3 Development of Alternatives

This site contains significant petroleum contamination both in unsaturated soils and in groundwater. The groundwater continues to receive contaminants from the soil column both in the zone of grossly contaminated soil and in the AOC. Remedial action will be targeted at reducing the limited occurrence of free product and addressing the highly impacted soils as a means to reduce the groundwater impact.

Various remedial alternatives were selected for evaluation based on site experience and technical knowledge. Additional research to identify potential remedial alternatives for this site included a review of remedial technology websites of various governmental and private industry groups. These sites offered technology descriptions, effectiveness, limitations, cost data and timeframes to achieve the cleanup standards. These websites established the base and range of established and innovative technologies potentially available for application to the site. The major sites reviewed included the following:

- Air Force Center for Environmental Excellence Technology Transfer
- USEPA Technology Transfer Program: Clu-In
- Federal Remediation Technologies Roundtable
- Innovative Environmental Technologies, Inc. (provides case studies)

- Environmental Restoration: Defense Base Closure and Realignment Commission
- USEPA OSWER Office of Solid Waste and Emergency Response: Innovative Technologies

The following remedial alternatives were selected for evaluation.

Soils:

- Excavation and disposal of soils within the zones of gross contamination and AOC and replacement with clean backfill.
- Excavation of impacted soils and on-site treatment to promote contaminant degradation within these soils. Allu™ (clamshell type) buckets are available to aerate and mix the soil while applying either an oxidizing agent or microbes into the soil. This approach requires the site to be broken into discrete zones for soils excavation and groundwater and soil treatment.
- Thermal soil treatment coupled with vapor extraction to thermally desorb petroleum contaminants from the affected soil column.
- In-situ enhanced bioremediation of soils and groundwater by applying nutrient or microbes and nutrients (either facultative or aerobic microbes) to impacted soils and groundwater to foster a biological population increase. This approach also requires addressing uniform subsurface distribution and maintenance of oxygen.
- In-situ chemical oxidation to treat both soils and groundwater by applying an oxidizing agent to oxidize the petroleum products in the soils and groundwater. The oxidizing agent evaluated was sodium persulfate. (Note: Most chemical oxidants at effective concentrations are toxic to the microorganisms that perform biological degradation of the petroleum compounds.)

- Cap the areas of affected soils and prepare a Soil Management Plan to guide site excavation during the proposed and any subsequent site redevelopment activities.

Groundwater:

- Installation of a passive groundwater interceptor trench adjacent and parallel to the Mohawk River for the collection and treatment of groundwater. A treatment system would be required to treat captured groundwater prior to publicly-owned treatment works (POTW) discharge.

- In-situ chemical oxidation to treat groundwater by injecting an oxidizing agent to oxidize petroleum compounds in groundwater and potentially across the smear zone. The common oxidizing agents to be considered are hydrogen peroxide, Fenton's Reagent and sodium persulfate. (Note: These compounds at the effective concentrations are toxic to the microorganisms that perform biological degradation of the petroleum compounds.)

- Injection and maintenance of sufficient oxygen to the subsurface environment to sustain microbiological processes.

- Dewater the excavation, store in onsite frac tank, treat with carbon and discharge to the POTW.

Following the technology identification and review, detailed information on specific technologies was obtained from vendors, case studies and a literature review. It is well documented in the literature that biodegradation is an effective treatment technology to reduce petroleum contamination in soil and groundwater. However, the nature of this site, with a mixture of all petroleum product releases (old and young), presented a degree of uncertainty deemed unacceptable within the remedial alternative review process. It was agreed that a bench scale and pilot studies to directly test bioremediation and chemical oxidation on site soils could provide greater confidence in the final remedy selection.

3.3.1 Bench Scale Study

A bench scale study was performed to evaluate the site-specific effectiveness of the identified treatment technologies. A work plan to perform bench scale study of bioremediation and chemical oxidation was submitted to, reviewed by, and after response to comments, approved by DEC in December 2005. In early January 2006, a field crew collected site soils in two groupings designated as C-1 and C-2, each from five locations from two representative sectors. Soil collection locations are shown on Figure 3. Soils composited into C-1 were collected from the northwest site corner from within the zone of gross contamination, an area observed to have significant VOC impact. C-1 soil collection locations included the former fuel blending area, SB-62, TP-16, SB-21 and TP-19. These soils were collected from a relatively tight equilateral triangular area of approximately 200 feet per side. C-2 soil was collected from disparate locations stretching from the southwest site corner to the northeast site corner including soils from the zone of gross contamination and the area of concern. C-2 soil locations were collected from the vicinity of SB-43, TP-28, TP-10, between SB-7 and TP-8, and between SB-11 and MW-1. These soils exhibited both significant VOC and SVOC impact.

Soil samples were collected in early January 2006 using a backhoe to excavate down approximately 5 feet below grade and then to pull fresh soil from the open excavation for collection. Sampling equipment was used to collect soil from each location. Sampling equipment and the backhoe bucket were decontaminated between sampling locations using a water-alconox mixture and a brush. Samples were then packaged and shipped to the following sub-contractors for analysis:

- Quantum Consulting Services, Inc. [bio-treatability testing].
- KCH EnviroTech, LLC [chemical oxidation testing with sodium persulfate].

- Microbe Inotech Laboratories, Inc. [microbial strain isolation and testing for the ability to degrade four selected petroleum liquids (gasoline, diesel fuel, No. 6 oil and site free phase product].

A brief description of the methodology and results of bench scale testing is presented in the following sections.

3.3.1.1 Bio-Treatability Testing

Quantum Consulting Services, Inc. (Quantum) performed a 51-day Biotreatability Study on site soils C-1 and C-2. These soils were shipped in separate containers from the site and composited by Quantum. Samples were drawn initially for VOCs, SVOCs, total petroleum hydrocarbons (TPH), total organic carbon, nutrient loading and heterotrophic plate count (HPC) analyses. The soils were then split into four groups and placed into four reactors. HPC is a measure of the total number of microbes per gram of soil. Active bioremediation requires minimum microbial population counts of approximately 10^5 per gram of soil. All soil groups were supplied with air, moisture and micronutrients throughout the study. Proprietary microbes were added to two groups, one each from C-1 and C-2. The soils were periodically mixed and sampled for SVOCs and HPC to assess biodegradation progress. At the study conclusion, samples were analyzed for VOCs, SVOCs and HPC.

The study results provided these insights into bio-degradation processes for site soils.

- As shown in the table below, over the 51-day study HPC counts in all soils increased three to four orders of magnitude, peaking at 10^6 to 10^7 colonies per gram of soil. Biodegradation processes in these soils are present and capable of degrading many soil contaminants. The bioreactor names contain the letter "I", indicating only indigenous bacteria were present, or the letter

"N", indicating the bacterial population was enhanced with the addition of proprietary petroleum degrading bacteria.

Soil Heterotrophic Plate Counts (col/g)

HPC	Bioreactor			
	C-1-I	C-2-N	C-2-I	C-2-N
01/13/06	1×10^2	1×10^4	1×10^2	1×10^4
01/30/06	1×10^4	1×10^5	1×10^4	1×10^5
02/13/06	1×10^5	1×10^6	1×10^5	1×10^6
02/27/06	1×10^5	1×10^6	1×10^5	1×10^6
03/07/06	1×10^6	1×10^7	1×10^6	1×10^7

- Significant heterogeneity in soils was found, as evidenced by substantial variation in analytical results for individual compounds throughout the study. However, as shown in the table below, total petroleum hydrocarbons for all soils steadily declined as the study progressed.

Total Petroleum Hydrocarbons (mg/kg)

Soil Sample ID	Time 0	17 Days	30 Days	51 Days
C-1-I Indigenous Bacteria	1413	1056	1107	622
C-1-N Enhanced Bacteria	1413	1063	1089	992
C-2-I Indigenous Bacteria	805	657	767	332
C-2-N Enhanced Bacteria	805	415	426	289

- The addition of bacteria to soils yielded mixed results. A conclusion is drawn that the addition of bacteria to soils will not significantly advance biodegradation processes in comparison to the implementation cost.

- VOCs are generally consumed first and bacterial activity and populations shift once VOCs are depleted. The addition of small amounts of dextrose

and yeast (10 grams per ton of soil) on an eight-week interval provides an energy source to aid in the transition from VOC to SVOC digestion. During this transition, subdominant microbial populations move to the dominant population and/or microbial enzyme production shifts to long-chain hydrocarbon digestion.

- Nutrients should be added to the soil in a ratio of carbon-nitrogen-phosphorus of 30-10-1. The soil organic carbon content measured in site soils ranged from 5% to 12%.

- The projected timeframe to bio-remediate the soils to meet all TAGM standards was estimated at 12 months of suitable "summer" conditions (i.e. soil temperature maintained to promote biological activity).

A complete copy of this report is contained in Appendix A.

3.3.1.2 Chemical Oxidation Bench Study

KCH Envirotech, LLC (KCH) performed a 14-day bench study of chemical oxidation with sodium persulfate (SP) to degrade petroleum contaminants in site soils. In January 2005, soil samples were collected from ten locations at the site and groundwater samples from three monitoring wells (MW-1, MW-11 and MW-16), all of which were shipped to KCH for bench testing. The four distinct study tasks for this evaluation are presented below.

1. Characterize the soil contaminant concentrations.

2. Determine the total soil oxidant demand and half-life of SP in a continuously mixed aqueous reactor with ongoing measurements of pH, oxidation-reduction potential and conductivity.

3. Evaluate the degradation effectiveness of target COCs by SP and Iron(II)-EDTA catalyzed SP in site soil matrixes.

4. Evaluate the degradation effectiveness of target COCs by SP and Iron(II)-EDTA catalyzed SP in site groundwater.

Soils were composited by KCH into soil groups C-1 and C-2 for study. These soils were then sampled for VOCs, SVOCs, pH, total organic carbon (TOC), and metals including iron (Fe), manganese (Mn), chromium (Cr), arsenic (As), selenium (Se) and lead (Pb). As SP has the ability to mobilize metals into the dissolved phase that are otherwise bound to the soil, the metal analyses were performed to assess the potential groundwater impact if significant mobilization were to occur.

Findings from this study are summarized below.

- Significant heterogeneity in soil contaminant concentrations was found in this study.
- SP alone was as effective as Iron(II)-EDTA catalyzed SP in degrading VOCs.
- Iron(II)-EDTA catalyzed SP did outperform SP alone for SVOC destruction. However, due to increased costs associated with the iron catalyst, the catalyzed reaction is deemed as unwarranted.
- Iron, soil organic matter and COCs were the main contributors to the soil oxidant demand.
- Metal content of soils does not present a concern for significant leaching of metals to groundwater due to the oxidation process.
- Soil SP oxidant demand for C-1 soils ranged from 11 to 23 grams per kilogram (g/kg) and from 14 to 29.5 g/kg of soil for C-2. In solution, oxidant demand was determined to be 20 mg/L.

- Although SP addition to soil lowers soil pH, both C-1 ands C-2 soils exhibited a strong buffering capacity and overall soil pH did not significantly drop.

- In the 14-day test, the SP consumption rate varied with the initial dose (range: 2.5 to 20 mg/L). The soil oxidant demand increased with increasing initial concentration (i.e. efficiency dropped with increasing concentration), although controls indicated that oxidant consumption was directly reduced through reaction with COCs rather than due to mineral-catalyzed decomposition, which was found to be minor.

- The SP consumption data indicated the half-life was positively proportional to the initial persulfate dose (the higher the persulfate concentration, the longer the half-life).

- Although actual degradation rates could not be calculated from the limited data obtained in the tests, the results and the researcher's experience suggests that sufficient degradation may be achieved in the field in a six to eight-week timeframe if proper reaction conditions are maintained.

- Acetone was detected as an intermediate produced during the reactions. It is expected that with continued oxidant exposure SP would degrade the acetone produced.

- The experimental results revealed the need to induce more vigorous reaction conditions in the system so the residual SP could be efficiently applied toward COC destruction efficiency and shortened treatment time.

- It was recommended that the SP alone process should be applied at a higher reaction temperature (e.g., 35°C or 40°C) than was done in this study (20°C).

- Use of an environmentally friendly and biodegradable surfactant (Biosolve at 0.5% concentration) may enhance SP effectiveness by increasing SVOC solubility and dissolution.

- Oxidation with SP was shown effective, however, the exact dose and amount of time required to reduce COCs to the clean-up goals without adding excess SP needs further refinement to optimize and scale up site remediation.

A complete copy of this report is contained in Appendix B.

3.3.1.3 Microbial Strain/Petroleum Response Evaluation

Soil samples were collected in January 2006 from ten site locations, a groundwater sample was collected from a recovery sump, a composite groundwater sample was collected from MW-1 and MW-16, and a free phase product sample was collected from MW-4. These samples were shipped to Microbe Inotech Laboratories, Inc. (MIL) in St. Louis for microbial evaluation of petroleum degrading microorganisms. The laboratory results are provided in Appendix C. MIL specializes in incubating indigenous microbes in the laboratory for subsequent testing of their petroleum substrate degrading ability. The ten soil samples were analyzed for solids nutrient chemistry including organic matter, nitrogen ammonia, nitrogen as nitrite, phosphorous as orthophosphate, nitrogen nitrate and pH. The ten soil and two groundwater samples were then immediately incubated to obtain initial standard bacterial plate counts (in units of colony forming units per gram of soil (CFU/g)). The table below shows the range of initial plate counts for these site samples.

Standard Bacteria Plate Count

Sample Type	24-Hour Count Range	48-Hour Count Range
Soil (CFU/g)	6.6×10^3 to 2.4×10^5	6.7×10^3 to 6.0×10^5
Groundwater (CFU/ml)	2.0×10^1 to 8.2×10^2	9.1×10^2 to 1.1×10^3

Next, differing strains were assigned strain numbers based on physical morphology and color, and the relative population density in each sample was estimated. This information was then reported to Plumley Engineering, and in consultation with MIL,

the seven strains that were prevalent across the twelve samples were selected for further study. These seven strains were then isolated and re-incubated into large homogenous colonies. Four substrates, gasoline, No. 4 oil, No. 6 oil and free phase product from site well MW-4, were added to the microbes in a 96-well microtiter plate to test the biodegradability response (endpoint assay) of these microbial strains to the four substrates. The substrates were added directly to various wells in a 3.45% concentration (5 µl substrate into 145 µl aqueous microbe solution at 40 to 50% turbidity). The microbe solution contained a proprietary growth medium of salts, vitamins and buffer without a major carbon source. The substrate added is the potential carbon source for growth. Each well also contains an indicator solution (tetrazoleum dye redox indicator) whose reduction is a measure of bacterial growth (i.e. metabolic respiration/oxidation of the carbon source). Measurement of microbial activity to degrade the substrate was measured after 24 hours of incubation at 30°C. The amount of reduction in the indicator solution is correlated with microbial growth (i.e. activity to use the substrate as a carbon source). The results are characterized on a qualitative scale of substrate degrading ability (excellent – good – fair – minimal – no effect – growth inhibited). A summary table of Endpoint Assay results is presented below.

Endpoint Assay Results Summary

Strain	Gasoline	Diesel	No. 6 Oil	Free Product (MW-4)
3640A-1-2	No Effect	No Effect	No Effect	No Effect
3640A-1-3	Growth Inhibited	Growth Inhibited	Growth Inhibited	Growth Inhibited
3640A-1-4	No Effect	Growth Inhibited	Growth Inhibited	Growth Inhibited
3640A-1-5	No Effect	No Effect	No Effect	No Effect
3640A-2-10	No Effect	No Effect	No Effect	No Effect
3640A-5-19	Growth Inhibited	No Effect	No Effect	No Effect
3640A-6-20	Growth Inhibited	Growth Inhibited	Growth Inhibited	No Effect

The most populous microbial strains, in isolation, were clearly not good petroleum degraders. Discussion of these negative results with the laboratory led to a potential explanation related to the anoxic site soil conditions. During the remedial site investigation in the spring of 2005, measurements of dissolved oxygen in site monitoring wells ranged from 0.11 to 2.85 mg/L. Only seven of the 40 monitoring wells contained concentrations above 1 mg/L, indicating essentially anoxic conditions in the subsurface. In hindsight, the laboratory suggested that the prevalent soil bacteria aerobically incubated may have been the incorrect target group for the endpoint assay. Given the subsurface anoxic conditions, it was reasoned that perhaps aerobic microbes at the low percentages should have been selected for the endpoint assay (the exact opposite of the strains selected). MIL offered to repeat the test, however, this would have required the collection and shipment of a new set of soil samples. It was decided not to repeat this test and agreement was reached with MIL for a reduced cost of the testing completed.

In summary, this testing yielded the conclusions presented below.

- At least 25 different strains of bacteria are present in the site soil and groundwater.
- Based on the ten soil samples analyzed for nitrogen and phosphorous, there is a sufficient nutrient base present in the native soil to sustain microbial growth for at least one to two months.
- The seven most prominent strains isolated from newly excavated soils and tested for their ability to degrade gasoline, No. 4 oil, No. 6 oil and site free phase product, showed no ability to degrade any of these petroleum products.

3.3.2 Pilot Study Results

A pilot study was proposed for this site to obtain data on the timing, effectiveness, soil particulate and odor generation during ex-situ treatment, heavy construction equipment

needs, soil moisture impacts to treatment effectiveness and timing, chemical oxidation polishing under site conditions, bio-enhancement efficacy, visual staining and odor reduction by the treatment process, optimization of soil processing for full-scale site treatment, and soil microbial response to aeration. All parties agreed in June 2006 to conduct a pilot study over the summer of 2006 to guide preparation and engineering design of the full remediation project.

A work plan for a field pilot study of soil remediation was submitted to the DEC in early July 2006 and approved. In late July 2006, an eight-week pilot study was initiated. The following seven subsection present results and conclusion from this study.

3.3.2.1 Soil Excavation

The initial project task was to re-grade a portion of the site to control infiltrating rainwater and groundwater drained from excavated soils. This was accomplished by constructing soil berms and cutting shallow trenches within the crude soil cells. The locations of the two soil treatment cells were within the zone of gross contamination and in the area of concern. After inspection of the cell construction, the excavation of soils from two site locations containing significantly impacted soils commenced. Locations of Excavations 1, 2 and 3 are shown on Figure 4. All soils were initially screened to remove large boulders, cinder blocks, metal railroad tie plates and other material detrimental to the Allu™ bucket. Screening also served to allow segregation of the two excavations into four soil piles.

Excavation 1 was made on July 25 at a location along Leland Avenue. An estimated volume of 550 cubic yards was excavated. This volume fell short of the planned 1,000 cubic yards due to shallow water table conditions. Without hydraulic control, additional excavation was halted. Due to the presence of a significant fraction of fine-grained soils, this pile required approximately one and one-half weeks to drain off groundwater and dry in the sun. These soils remained soft, weak and unconsolidated for over one week, as evidenced by difficulty to walk over them

without sinking into them. Subsequently, the soils were screened and split into two piles designated as Piles III and IV.

While the soils from Excavation 1 were draining, Excavation 2 was made at a location near the northwest site corner near the Mohawk River. Approximately 600 cubic yards was excavated and stockpiled east of the excavation. This soil volume was below the design volume of 1,000 cubic yards due to an encountered shallow impacted clay layer at approximately 6 feet in depth and the limits of a former building foundation. Excavation 2 soils contained a significant fraction of granular material with greater structural strength than Excavation 1 soils. Immediately upon completing soil removal from Excavation 2, the operator drove the excavator on top of the pile and consolidated it into a smaller area by scooping soils closer to the pile center from 360 degrees around the machine. The excavator bucket was then changed to the soil-screening bucket and screening of Excavation 2 soils began immediately. These soils were segregated into two soil piles, designated as Piles I and II.

On August 1, a third small excavation of approximately 30 cubic yards was made at the location of SB-54 (from the remedial investigation) and designated as Pile V. SB-54 is the location of a significant VOC plume containing benzene-toluene-ethylbenzene-xylene (BTEX) and methyl-tertiary-butyl ether (MTBE). These soils were stockpiled north of Piles I and II, but inside the treatment cell.

The first two weeks of this study (nine working days) were required to excavate and screen the soils. Seven working days were required to complete the initial soil screening, due to excessive soil moisture content. Beginning on August 7 and over the course of the ensuing six weeks (weeks 3 through 8), the soils were treated using the Allu™ bucket process to turn and aerate soils. The bucket size used was a 2.3 cubic yard capacity. The manufacturer of Allu™ buckets produces a bucket one size larger at a volume of 2.8 cubic yards.

The soils excavated contained unacceptably high VOCs, strong petroleum odors and visual staining. The goal of Allu™ processing was to remove VOCs, odors and visual staining and to reduce SVOCs in comparison to the SCGs.

3.3.2.2 Allu™ Processing

The following table shows Allu™ process results in terms of soil turns per pile over time.

Pilot Study Overview: Weekly Soil Turns and Study Actions

Week #	Date	West Allu		East Allu		SB-54	Comment
		Pile I	Pile II	Pile III	Pile IV	Pile V	
1, 2	07/24 and 31/06	1	1	1	1	1	Soil drying/screening; Initial Sampling 07/27, 07/29; Excavate SB-54 on 08/01/06
3	08/07/06	2	1	0.5	1	1	Begin continuous Allu™ processing
4	08/14/06	2	2	1.5	2	3	08/15 Sampling; three Bio-Tubs start 08/16
5	08/21/06	2	1	2	3	2	Soil Moisture moderated
6	08/28/06	2	2	2	1	3	08/30 Sampling; Soil moisture optimum; Nine Chem-Ox Tubs start 09/01
7	09/04/06	1	1	3	3	3	Uncovered piles: rain infiltration
8	09/11/06	1	1	3	3	5	Final Sampling 9/19
TOTAL		11	9	13	14	18	

3.3.2.3 Bio-Enhancement Study

On August 16, approximately 1.5 cubic feet of soil was collected from Piles II, IV and V for testing of bio-enhancement with proprietary microbes and micronutrients supplied by Biogenesis Enterprises, Inc. Soils within each of the tubs were turned two to three times per week by hand trowel. The plastic tubs were loosely covered to

keep out rain but allow in ample oxygen. In addition, the covers were periodically removed during the day. The soils were maintained with moisture to allow for microbial growth. These soils were sampled for SVOCs and HPC as indicators of whether enhanced biological processes would exceed the Allu™ process alone in successfully treating the soil.

Additionally, routine sampling and analysis of the soil piles was performed to determine the heterotrophic plate count (HPC) in the soils. The Bio-Treatability Bench Study and a literature review indicated that active bioremediation for SVOCs would require six to twelve months to meet SCGs. However, biological populations were known to be able to increase significantly within the pilot study timeframe. Therefore, a simple measure of the microbe population density by analyzing the HPC in soil over time yielded microbial counts in number of colonies per gram of soil. Thus HPC was tracked as an indicator of microbial population change (increase or decrease) over time to demonstrate whether the Allu™ processing could sustain the necessary soil oxygen levels to promote vigorous bacterial growth. It was known at the outset this approach would not prove that increased soil microbial populations lead directly to biodegradation of SCGs. However, it was known that soil microbes require a carbon source for growth and there were two known carbon sources in the site soils: natural organic matter and COCs. The results and implications of these measurements are discussed in Section 3.3.2.6.

3.3.2.4 Chemical Oxidation Polishing Study

On September 1, three field bench study volumes of 1.5 cubic yards of soil were collected from each of soil piles II, IV and V. These soils were collected to study whether chemical oxidation polishing of soils after substantial Allu™ processing would significantly reduce residual SVOC concentrations. At the time of sample collection, the soils had experienced the following turnovers:

Soil Turnovers at Start of Chemical Oxidation Bench Study (09/01/06)

Soil Pile #	Number of Complete Soil Turnovers
II	7
IV	8
V	10

Based on results of the Chemical Oxidation Treatability Study performed in the winter of 2006, site soils have a chemical oxidant demand ranging from 11 to 29.5 g/kg of soil. Based on this data, this field study was performed with three soil samples (1.5 cubic yards each) from each of the three piles. Applying a soil density of 1.5 tons per cubic yard, the approximate mass of each sample was calculated. Chemical oxidant was applied to the soil at 100%, 50% and 10% dosage based on a full dosage of 30 gram oxidant per kilogram of soil.

A 1:1 mixture of sodium persulfate and sodium percarbonate was added to these soils. As both of these compounds are chemical oxidants, the total of the two compounds comprised the dosage (i.e. 30 gram dose comprised of 15 grams of each oxidant). The oxidant mixture was selected through discussions with Solvay Chemicals, Inc. (Solvay), the manufacturer and patent petitioner for the application of sodium percarbonate with sodium persulfate for chemical oxidation of hydrocarbons. The pending patent filed by Solvay is for a 1:1 ratio application (each constituent applied at one-half the dose of sodium persulfate alone) of sodium persulfate and sodium percarbonate to degrade hydrocarbons at ambient soil temperature. In contrast, sodium persulfate alone was found to require significantly elevated soil temperature (i.e. 95°C to 105°C).

Each soil was sampled 19 days later. At the end of this field test, SVOC concentrations in soils dosed with the 100% chemical oxidant contained the highest contaminant concentrations and the 10% dose contained the lowest. These results

were the reverse of the expected. The highest SVOC concentrations were present in the highest dose soil, mid-level concentrations in the mid-range dose and lowest concentrations in the lowest dose soils. This correlation held for all individual compounds in two of the soil sets. The third soil from Pile II yielded mostly non-detect results for constituents analyzed, however there were six compounds above the minimum detection limit in the 100% dose soils, no compounds detected in the 50% dose soil and only one compound detected in the 10% dose soil.

These results, while yielding an unexpected result, indicate the simple mechanical mixing of chemical oxidant into soils, as can be accomplished in a full-scale remedial program, is unlikely to succeed in significantly reducing site SVOCs to meet the SCGs within a short timeframe.

3.3.2.5 Community Air Monitoring

Particulate Monitoring:

Dust monitoring was conducted in accordance with the approved Work Plan and the New York State Department of Health (DOH) generic community air monitoring plan. The DOH particulate action level is defined as the difference between upwind and downwind concentrations. When this calculated value reaches 100 $\mu g/m^3$ as a 15-minute average, action is required to mitigate the airborne particulate concentration. A value of 150 $\mu g/m^3$ is the threshold where work is stopped and an evaluation of particulate controls is made. Work then resumes after successful particulate control measures are implemented.

A pair of DusTRAK 8520 Aerosol Monitors were utilized to record the PM_{10} concentrations at the site during the pilot testing activities. Visual observations of particulate generation were also recorded. Wind direction was recorded prior to the start of the PM_{10} monitoring. One unit was placed upwind of the work zone, while

the other unit was placed downwind of the work zone. Each unit documented the potential on and offsite exposure for the protection of public health. Each unit was equipped with an enclosure to provide protection from environmental conditions such as rain, direct sunlight, etc.

A data analysis program, supplied with the monitors, utilized recorded PM_{10} concentrations to calculate the average, the 8-hour time-weighted average, and the minimum and maximum readings for each monitoring period. A separate computer program was generated to calculate the 15-minute rolling averages for the monitoring period. A one-minute monitoring frequency was selected to provide adequate data points for exposure review and recorded data was downloaded at regular intervals during the pilot study to allow for data review. In this analysis, upwind data was subtracted from downwind data. Although the actual exposure levels may not be determined through such an analysis, the DEC action level applies to fugitive dust suppression at hazardous waste sites due to onsite particulate generating activity. An action level exceedance may not lead to an exceedance of the EPA standard due to the significantly longer averaging period (i.e. 24-hour versus 15-minute). Therefore, the analysis was geared toward identification of whether a site activity can generate a fugitive dust concentration that needs to be actively managed during the full-scale site remediation.

The pilot study was conducted from July 25, 2006 through September 15, 2006 (53 days). No work was conducted on weekends (14 days). Three additional days were lost: one national holiday, one day for equipment maintenance and one day to a rainout. A total of 36 days of field work involving soil disturbance was completed during the course of the pilot study. Particulate monitoring was conducted on each day. Monitoring data from three of these days was lost due to monitoring equipment malfunction. Data from the remaining 33 monitoring periods is presented in *Table 1 - Particulate Monitoring Data Summary.*

A summary of the data set review is presented below:

- All 33 data sets were screened. Ten data sets did not contain any maximum recorded instantaneous readings that exceeded 100 $\mu g/m^3$. Fifteen-minute rolling averages for these ten data sets were not calculated, as all averages would be below the 100 $\mu g/m^3$ State Action Level.

- Fifteen-minute rolling averages for the remaining 23 data sets were calculated and reviewed. The upwind rolling averages were then subtracted from the downwind rolling averages to calculate the total 15-minute average concentration difference. These total 15-minute average concentration differences were then compared to the 100 $\mu g/m^3$ State Action Level. The maximum 15-minute average concentration differences exceeded 100 $\mu g/m^3$ on four of the monitoring days: July 27, August 10, August 11 and August 24. The maximum 15-minute average concentration differences for the remaining 19 nineteen data sets did not exceed the State Action Level.

- The PM_{10} readings and the 15-minute rolling average readings for concentration differences exceeding 100 $\mu g/m^3$ were graphed. Review of this data revealed the following conclusions.

    - The PM_{10} readings recorded on July 27, 2006 show a single 2,037 $\mu g/m^3$ spike at 3:43 p.m. on the downwind monitor. Excavator operation for the day ceased at 3:40 pm. The particulate spike corresponds to the excavator shutdown for the day. It was concluded that no exceedance of the State Action Level occurred on this day. Graphs of the data for this monitoring event are attached.

    - The PM_{10} readings recorded on August 10, 2006 show a single 2,453 $\mu g/m^3$ spike at 5:02 p.m. on the downwind monitor. Excavator

operation ceased at 4:30 p.m. for equipment maintenance. That particulate spike corresponds to the dust monitor being shut down for the day. Smaller but identifiable spikes at startup and shutdown were recorded for other days as well. It was concluded that no exceedance of the State Action Level occurred on this day. Graphs of the data for this monitoring event are attached.

- The PM_{10} readings recorded on August 11, 2006 show a 562 $\mu g/m^3$ spike at 12:20 p.m. and a 2,173 $\mu g/m^3$ spike at 12:22 p.m. on the upwind monitor. These particulate readings correspond to the time when site personnel were offsite for lunch. The units were also checked during the lunch break. It was concluded that no exceedance of the State Action Level occurred on this day. Graphs of the data for this monitoring event are attached.

- The PM_{10} readings recorded on August 24, 2006 show ten readings greater than 500 $\mu g/m^3$, with a peak reading of 1,830 $\mu g/m^3$ spike at 1:35 p.m. on the upwind monitor. Activities for the day included moving one of the treatment piles across the site. Field notes for the day record the observation of dust generated as a result of the dump truck moving the pile. There was an exceedance of the State Action Level on this day, however, this was a one-time occurrence and once routine site activity resumed, no further action level exceedances were recorded for the remainder of this project. Graphs of the data for this monitoring event are attached.

- Shifting winds on some days may have caused the "upwind" monitor to record particulate concentrations greater than the "downwind" monitor. The adjacent "upwind" parcel was observed to have little to no dust generating activity during this pilot study.

- The potential for exceedance of the State Action Level during full-scale site remediation was identified during this study and contingency for dust suppression will be incorporated into the remedial design.

VOC Monitoring:

Periodic monitoring of ambient air concentrations around the open excavations and soil piles indicated very low ambient readings within approximately 10 feet of the soil piles and no readings at greater distance. In addition, general petroleum odors were observed during initial soil excavation and in close proximity to soil piles early in the Allu™ processing program that diminished throughout the study.

3.3.2.6 Pilot Study Results and Conclusions

Figures 5 through 9 show graphs of VOC photoionization detection (PID) meter readings in the soil piles versus the number of soil turnovers achieved through the Allu™ process. Soil PID readings were measured using a field portable device containing a 10.2 electron-volt (eV) lamp. A fresh soil surface was exposed and a soil sample placed into a small sealed plastic bag. The soil bag was allowed to sit for five to ten minutes before headspace readings were taken by puncturing the bag with the PID tip.

Graphs for all piles show significant PID VOC reductions. The table below shows the number of soil turnovers required to achieve 80% and 90% reductions in VOCs, as measured by PID and the initial and final VOC analytical results for these soils.

Soil Origin	Pile #	Total Turns @ 80% PID VOC Reduction	Total Turns @ 90% PID VOC Reduction	Initial Total VOCs* (mg/kg)	Final Total VOCs (mg/kg)	Total Number of Soil Turnovers
West Allu	I	7	11	36	ND	11
West Allu	II	3	8	36	ND	9
East Allu	III	2	3	7	ND	13
East Allu	IV	2	3	7	ND	14
SB-54	V	6	11	3,995	0.01	18

*Pre-treatment average VOC concentrations from pre-treatment sample results for Pile #I through #IV. Pile #V initial VOC shown is the grab sample result for soil boring SB-54 (4 to 6-foot depth) from the 2004 remedial investigation indicating high VOC content consistent with field observations in this pilot study.

Total SVOC reductions attained through the pilot study are summarized below.

Pile #	Pre-Treatment Total SVOCs* (mg/kg)	Post-Treatment Total SVOCs$^{\Delta}$ (mg/kg)
I	2.3	ND
II	9.5	2.5
III	40.2	36.5
IV	40.2	22.1
V (SB-54)	452**	22.6

*Data averaged from seven initial pilot study samples.

**Grab sample data from 2004 Remedial Investigation at Boring SB-54, 4 to 6-foot depth. Pilot Study excavation depth was 4 feet. SB-54 boring log indicates PID reading from 800 to 2,000 parts per million (ppm) in the depth range of 1 to 5 feet bgs.

$^{\Delta}$Re-analysis data with extraction methodology consistent with prior samples for all samples except Pile #I.

As the above table suggests, the Allu™ processing provided mixed results in reducing SVOC soil concentrations over the six-week period of active Allu™ processing. However, it is known that active bioremediation of SVOCs requires much more time than six weeks. The HPC data demonstrates that soil microbial

populations increased by one to two orders of magnitude within three weeks of soil excavation to levels almost one order of magnitude above the minimum threshold to sustain vigorous bioremediation. It was expected, and is supported in the literature, that the increase in microbial activity, as evidenced by the population density increase, led to some VOC/ SVOC contaminant degradation during the pilot test period and that conditions were directly created to enhance the biodegradation process.

The progression of soil HPC over time throughout the Pilot Study is shown in the table below. HPC counts in Piles #I through #IV followed similar patterns of increase at week two, decrease at week four, rebound at week six and overall peak at week eight. HPC counts were obtained from samples collected at the project start, then at regular intervals over the eight-week project. Another view of the response of soil biota is suggested by graphs of HPC counts versus soil PID VOC readings (Figures 10 - 14). These graphs suggest biological population increases in the presence of soil VOC, then fall when VOCs concentrations decline before rebounding and peaking at the study end.

Pilot Study: HPC Average Count and Number of Samples (#)

Pile #	HPC Average 07/31/06	(#)	HPC Average 08/15/06	(#)	HPC Average 08/30/06	(#)	HPC Average 09/19/06	(#)
I_B	13 K	4	500 K	3	200 K	3	800 K	4
II	7K	5	500 K	3	80 K	3	400 K	5
III_B	3 K	10	400 K	5	130 K	3	500 K	4
IV	3 K	10	600 K	3	230 K	3	750 K	5
V_B	NS	0	50 K	3	100 K	3	400 K	4

Notes: 1. Fertilizer (21:5:20), dextrose, and yeast added to Pile #I on 08/10.
2. Fertilizer (21:5:20), sucrose, and yeast added to Pile #III on 08/11.
3. One quart Miracle Gro Liquafeed (12:4:8), 500 ml dextrose (50 %) and 0.5 pound yeast added to Pile #V on 09/11.
4. Presence of "B" after Soil Pile number indicates micronutrients added during study.
5. NS indicates not sampled.

In summary, the Allu™ processing performed vigorously for six weeks leads to the following conclusions.

- Complete removal of visual soil staining and odors (faint residual only) from all soils. A site inspection of all soil piles by the DEC and the DOH on September 19, 2006 demonstrated that soil improvement was significant and meets the DEC cleanup standards for these indicators.

- Near total removal of soil VOCs, only traces remain in few samples. The pilot study results indicate that VOCs are treatable with the Allu™ process and meet SCGs.

- Heterotrophic Plate Counts demonstrate that conditions for microbial degradation processes were favorable and may have contributed to reduction of VOCs and readily biodegradable SVOCs in the soil.

- Significant increases in soil microbial density, regardless of fertilizer or micronutrient additions, occurred after two weeks of active Allu™ processing. A decline in microbial density was observed at approximately four weeks, coinciding with a precipitous decline in soil VOC content as measured in the field using a PID meter. A rebound and increase above the early peak, respectively, occurred at week six and further accelerated to the highest densities measured in week eight.

- An HPC count dip occurs over the time period when 80% to 85% of VOCs have been removed from the soil. This observed phenomena is consistent with an expected response that causes bacteria density to drop in the transition from VOC to SVOC digestion. A possible explanation for this dip is that the bacteria struggle to alter internal enzyme production to those necessary for PAH (i.e. SVOC) digestion, with a concomitant die-off of organisms unable to complete this transition or that a different microbial strain surges to predominance. This phenomenon was observed in the bench scale bio-treatability study and was noted in that report. During the pilot study, a subsequent population increase was observed in Piles #I through #IV. Pile #V did not show a population decline in this study, however this Pile

retained PID VOCs for the longest duration in this study and also received an addition of fertilizer, dextrose and yeast on September 11. A smaller quantity of micronutrients (yeast and dextrose) were added to Piles #I and #III on August 10 and 11, respectively. However, microbial counts subsequently increased in all soil piles to roughly equal levels after VOC depletion, and this response does not correlate with the Piles that received micro-nutrients (Piles #I, #III and #V) in comparison to those that did not (Piles #II and #IV).

- Partial SVOC reduction in all soil piles. The SVOCs at this site are mostly below the SCGs, except for several involatile and insoluble compounds with low cleanup goals which still exceed the SCGs by up to an order of magnitude. [It is noted that Soil Piles #I, #II and #V meet the SCGs for restricted industrial sites in the proposed Part 375-6 regulations for Environmental Restoration Program sites. Pile #IV meets Part 375-6 SCGs for all but benzo(a)pyrene, while Pile #III meets these SCGs all but benzo(a)pyrene and benzo(a,h)anthracene.]

- Literature review indicates the early loss of soil VOCs may inhibit microbial degradation of SVOCs (PAHs) where microbial co-metabolism of a mixed VOC/SVOC substrate predominates. However, the literature also has identified several microbial strains capable of PAH degradation of up to four-ring PAHs as the sole carbon source.

- The soil turnover rate of three turns per week for PAH dominated soil is probably too high and should be reduced to one and a half to two turnovers weekly to retain VOCs in the soil longer and promote co-metabolic biodegradation of COCs. All soils showed heterogeneity with regard to decline of VOCs in the soils. A range of from three to eleven soil turnovers were required to reduce all soil PID VOCs by 90%. A minimum of 12 soil turnovers drawn out over a longer time period (eight to ten weeks) is recommended for full-scale site remediation. This slower turnover rate will retain VOCs in the soils longer and promote co-metabolism of VOCs and SVOCs. Once soils VOCs are depleted, further soil turnovers are unlikely to be cost-effective in reducing SVOC concentrations.

- Particulate generation from the site activity was visually and instrumentally observed once. Instrumental monitoring performed per DEC dust monitoring indicated this occurrence was attributable to dry surface soil conditions and trucking of Soil Pile II across the site (a unique occurrence in the pilot study, but not infrequent in a full-scale design). In addition, no significant petroleum odors or VOC PID readings were observed to emanate greater than approximately 20 feet from the soil piles during the treatment phase. However, under full-scale remedial phase conditions, both VOC odors and dust control are expected to be necessary at times and the Work Plan will address field measures to be implemented if visual, olfactory, or instrumental monitoring indicates they are required.

- No clear relation to covered soil piles and contaminant residual end results were evident through this study. However, covered soil piles in the early stage when excavated soil contained excess groundwater prevented an increase in soil moisture content from thunderstorm downpours that would have slowed the Allu™ process rate.

- Chemical Oxidation testing that simulated projected mixing, soil moisture, and timeframe in the full-scale remediation was not found to enhance destruction of high ring PAHs in site soils following Allu™ processing.

- A literature review indicates that soil type, contaminant type and distribution, pH, moisture, and oxygen content are primary factors governing biodegradation of VOC/SVOC contaminated soil. The addition of surfactants to increase bioavailability of PAHs for microbial degradation must be done carefully as it has been shown to both enhance and inhibit PAH biodegradation in accordance with a complex set of governing factors that vary between sites. The addition of nutrients to soils is not supported in the literature as beneficial for many sites.[2]

[2]Van Hamme, Jonathan D. , Singh, Ajay, Ward, Owen P., Recent Advances in Petroleum Microbiology, Microbiology and Molecular Biology Reviews, December 2003, p. 503-549, Vol. 67, No. 4.

- The addition of proprietary microbes to soil after Allu™ processing did not result in significant reduction of residual PAHs. Furthermore, the literature indicates the risk exists that the introduction of non-native microbes could inhibit native microbial biodegradation or establish overall negative microbial interactions that inhibit biodegradation of COCs.[3]

- A literature review indicates that petroleum-degrading bacteria have been shown to secrete natural surfactants to enhance the bioavailability of contaminants. In addition, symbiotic relationships between microorganisms were also found, whereby supportive interactions between microbes served the overall group with one type of organism secreting surfactant to enhance bio-availability and another digesting the contaminant, neither of which could thrive alone in the environment.[4]

- Processing rates for the Allu™ bucket soil processing steadily increased in this study as the soil moisture content declined. On August 3, it required approximately three minutes per bucket to Allu soils from either Piles #III or #IV, however, this rate dropped to one minute by August 14 and declined significantly as soil moisture content fell. Piles #I and #II were more granular from the start and displayed a per bucket process rate of 18 seconds on August 8, a rate that also showed some improvement as soil moisture content declined. All soil process rates accelerated in the last two weeks as soil moisture contents reached a balance between maintenance of soil microbes and dryness to accelerate Allu™ processing.

A copy of all laboratory analytical data from the pilot study is provided in electronic format on compact disk in Appendix E.

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[3]Vasileva-Tonkova, Evgenia, Galabova, Danka, "Hydrolytic Enzymes and Surfactants of Bacterial Isolates from Lubricant-Contaminated Wastewater," Bulgarian Academy of Sciences, Institute of Microbiology, August 15, 2002, pp 87-92.

[4]ibid.

4.0 ANALYSIS OF ALTERNATIVES

4.1 Introduction

The former Matt Petroleum site contains widespread soil and groundwater contamination. Selection of a site remedy for both soils and groundwater must be protective of human health and the environment, be consistent with future development plans and manage residual risk.

4.2 Analysis of Individual Alternatives

A total of ten remedial alternatives were evaluated in detail for soil and groundwater at this site. Restoration of this site for future development will require the selected alternative address impacts to both media. The Remedial Investigation demonstrated that soil contamination within identified zones is significant, is an ongoing contributor to groundwater contamination, and must be reduced. The target area for remediation consists of the two mapped zones presented in the Remedial Investigation Report, referred to as the zone of gross contamination and the area of concern. Together, these two areas comprise approximately 3.3 acres of 4.5-acre site.

Through evaluation of literature and technical remediation web sites, the following remedial alternatives were evaluated for application to this site.

Alternative #	Media	Remedial Alternative
1A	Soil/ Groundwater	Soil Cap: Natural Groundwater Attenuation Cap soils in affected area/zones. Remove free product from groundwater surface and natural attenuation for groundwater.
1B	Soil/ Groundwater	Soil Cap: Active Groundwater Treatment Trenches Cap all soil. Treat groundwater with passive collection trenches along Leland Avenue and Mohawk River to treat groundwater with granular activated carbon and discharge to POTW.
2A	Soil/ Groundwater	Excavation to 5 feet, Offsite Disposal, Clean Fill Excavate and dispose all soils down to 5-foot depth within the primary area of concern and within the zone of gross contamination. Replace with clean fill. Control and treat groundwater during soil excavation.

Alternative #	Media	Remedial Alternative
2B	Soil/ Groundwater	Excavation to 8 feet, Offsite Disposal, Clean Fill Excavate all soils within the zone of gross contamination and area of concern *down to clay, 8-foot average*. Replace with clean fill. Control and treat groundwater during soil excavation.
3A	Soil/ Groundwater	Excavation to 5 feet, 100% Allu, Replace Soils Excavate soils within the zone of gross contamination and area of concern down to 5 foot depth; onsite ex-situ treatment with Allu™ Bucket, replace/compact treated soils.
3B	Soil/ Groundwater	Excavation to 8 feet, 100% Allu, Replace Soils Excavate soils within the zone of gross contamination and area of concern *down to clay*; onsite ex-situ treatment with Allu™ Bucket, replace/compact treated soils.
3C	Soil	Excavation to 8 feet, 25% Disposal, Allu, Replace Soils Excavate soils within the zone of gross contamination and area of concern *down to clay*; offsite disposal of most highly impacted soils; onsite ex-situ treatment with Allu™ Bucket, replace/ compact treated soils.
4A	Soil	Excavation to 8 feet, Allu and Chem-Ox with Hydrogen Peroxide, Replace Soils Excavate soils within the zone of gross contamination and area of concern *down to clay*; treat with hydrogen peroxide mixed in by Allu™ Bucket, replace/compact treated soils.
4B	Soil	Excavation to 8 feet, Allu and Chem-Ox with Sodium Persulfate, Replace Soils Excavate soils within the zone of gross contamination and area of concern *down to clay*; treat with sodium persulfate mixed in by Allu™ Bucket, replace/compact treated soils.
5	Soil	In-Situ Thermal Treatment, Soil Vapor Extraction Thermally treat soils in-situ, soil vapor extraction and ground-water dewatering to expose the smear zone.

Detailed evaluation of each of these alternatives is presented below.

Alternative #1A: Soil Cap, Natural Groundwater Attenuation

This alternative involves placing a clean soil cap across the site and monitoring the groundwater to document that the plume remains stable. It includes natural attenuation of groundwater with ongoing groundwater quality monitoring as part of the Operations, Maintenance & Management (OM&M)

Plan. A soils management plan would then be prepared to govern any future soil disturbance at this site.

The total estimated cost for this remedial action to address soil contamination is approximately $0.2 million and it can be completed within approximately one month in the field. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: Low cost. Remedial investigation demonstrated low level of offsite contaminant migration despite high VOC levels in groundwater (high organic content in soils may be sequestering contaminants).

***Disadvantages*:** This alternative does not clean contaminated site soil or groundwater. The duration of time necessary to attain SCGs is unknown, but expected to be significant. Very low dissolved oxygen content in groundwater suggests that at best, anaerobic digestion of contaminants, which progresses at 10% the rate of aerobic digestion, may occur.

Alternative #1B: Soil Cap, Groundwater Treatment

This alternative involves soil capping as described in Alternative 1A, but adds active groundwater treatment via passive interceptor trenches along Leland Avenue and the Mohawk River to capture impacted groundwater prior to discharge from the site. Trenches would be installed down to the clay layer and groundwater collected, treated with granular activated carbon and discharged to the publicly owned treatment works (POTW). This system would be designed to passively collect groundwater with minimal drawdown of the water table to maintain treatment volume at a minimum.

Substantial contamination would remain at this site. A soils management plan would be required to govern any future soil disturbance at this site.

The total estimated cost for this remedial action to address soil contamination is approximately $0.9 million, with an ongoing annual cost ranging from $20,000 to $35,000. The soil cap and initial

groundwater treatment can be completed in four to six weeks in the field, but would require ongoing operations and maintenance for the passive dewatering and treatment system. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: Low cost. Remedial investigation demonstrated low level of offsite contaminant migration despite high VOC levels in groundwater. High organic content in soils may be sequestering contaminants. Directly addresses groundwater contamination with a passive approach.

***Disadvantages*:** This alternative does not treat VOCs in soils, resulting in continued contaminant release to groundwater. An extended operational period for the passive groundwater collection system would be required. This alternative provides minimal address to groundwater contamination through well pumping (i.e. remove free product in existing two to three wells) and the passive collection system. Ongoing associated operation and maintenance costs and uncertainty for the duration of ongoing operations are significant negatives.

Alternative #2A: Excavate Soils Down to 5 feet Only, Dispose and Replace with Clean Fill

This alternative involves the excavation of site soils in cells down to a five-foot depth (this depth reaches below the groundwater surface) for disposal and replacement with clean fill. This alternative involves the excavation of approximately 26,000 cubic yards (48,200 tons) of soil. As the water table would be exposed, this approach allows for skimming of the groundwater surface to remove free product (if present). Once completed, site redevelopment may proceed without restriction in the top 5 feet of the soil zone.

Substantial contamination below 5 feet in depth would remain at this site. A soils management plan would then be required to govern any future soil disturbance at this site.

Any building constructed would be required to install a slab-on-grade structure with a sub-slab depressurization system incorporated into the design. This alternative would result in clean near surface soils, but would leave petroleum-contaminated soils in place at depths below 5 feet.

The total estimated cost for this remedial action to address soil contamination is approximately $3.6 million and can be completed in approximately three to six months in the field. Refer to Table 20 for a cost comparison of all remedial alternatives.

***Advantages*:** Removes all contaminated soils within 5 feet of ground surface, allows for access to groundwater to skim free product from surface and treatment of pumped groundwater. Soil put back would be free of contamination. The time required to complete this alternative is one construction season. The site has been shown to retain contamination mainly within its borders, with little offsite migration (possible due to high organic content as a sequestering agent) that lowers concern over contamination left in the ground. The 5-foot depth was chosen to minimize impacts to future site redevelopment, as most construction activity occurs within 5 feet of ground surface.

Disadvantages: This alternative leaves significant soil contamination in soils below a 5-foot depth that would continue to impact groundwater. Some recontamination of treated soils may occur after soil re-compaction. Significant effort to mobilize equipment and planning is not fully utilized to "attack" the entire impacted soil and groundwater zones. Soil excavation of this volume may create dust and VOC odor control issues.

Alternative #2B: Excavate and Dispose of All Contaminated Soil

This alternative involves large-scale excavation of soils down to and below the water table to remove all affected soils. Excavation would be performed down to the impeding clay layer that was encountered between 5 and 12 feet below ground surface. For the purpose of estimating soil volume, a depth of 8 feet was uniformly applied. It is estimated that approximately 41,000 cubic yards (77,000 tons) of affected soils would be excavated. Within the soil excavation process, groundwater would be pumped to establish hydraulic control, treated and discharged to the POTW. This alternative includes direct landfill disposal of all excavated soils from within the impacted areas.

The total estimated cost for this remedial action to address soil contamination is approximately $6.0 million and can be completed in approximately six to eight months in the field. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: Extensively remediates site, resulting in least restricted future site use. Contaminated soils from the AOC and ZoGC are replaced with clean soil and extensive groundwater remediation is accomplished. (As this alternative extensively remediates the site and provides clean fill, it represents a cost ceiling that should not be exceeded in remedy selection.)

Disadvantages: High cost. This alternative moves contamination from this site to another site (landfill) and creates transportation issues when the soil cannot be transported to the landfill at the same rate of excavation. Soil excavation of this volume may create dust and VOC odor control issues.

Alternative #3A: Excavate Soils to 5 feet, Onsite Allu Treatment, Replace Soils

This alternative involves the excavation of 26,000 cubic yards (48,000 tons) of contaminated soils, down to a depth of 5 feet below ground surface for onsite ex-situ Allu™ process soil treatment. Treatment would consist of ex-situ mechanical aeration by an Allu™ Bucket to enhance natural degradation of petroleum in soils. This alternative requires soil excavation, draining and Allu™ processing. The site would be segmented into three or four sections for Allu™ processing to treat these soils over two construction seasons.

Substantial contamination below 5 feet would remain at this site. A soils management plan would then be required to govern any future soil disturbance at this site.

Excavated soils would be stockpiled onsite in a constructed soil treatment cell designed to contain water leachate (precipitation and initial groundwater drainage) for treatment prior to discharge. At the completion of the soil treatment, each cell would be further segmented into smaller sections for sampling to characterize the treatment effectiveness. Sections whose sample results meet treatment standards would be designated for backfill at the site. Based on the 2006 pilot study results, twelve soil turnovers are required to fully treat site soils. This treatment can be performed over a ten-week time period per segment.

The total estimated cost for this remedial action to address soil contamination is approximately $2.1 million and will require nearly two construction (summer) seasons to complete. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: Provides same level of treatment as Alternative 2A, but at nearly half the cost.

***Disadvantages*:** This alternative could allow contaminated soils (at depth) to remain in place as an ongoing source of groundwater contamination and potentially to impact treated soils below the water table. As with Alternative 2A, significant effort to mobilize equipment and planning is not fully utilized to treat the entire impacted soil/groundwater zones. Ex-situ soils treatment at this volume may create dust and VOC odor control issues.

Alternative #3B: Excavate Soils, 100% Onsite Allu™ Treatment, Re-Inter Soils

This alternative involves the excavation of 42,000 cubic yards (77,000 tons) of contaminated soils, down to the underlying clay layer (a depth of 5 to 12 feet below ground surface), for onsite ex-situ soil treatment. Treatment would be as described under Alternative 3A. This alternative will leave residual SVOCs with low mobility (i.e. low water solubility, low volatility, high adsorption capacity to soil organic matter) that pose little threat to human health or the environment. A soils management plan would then be required to govern any future soil disturbance at this site.

Note that this alternative does NOT include direct landfill disposal of up to 25% of the impacted soils, which is incorporated into Alternative 3C. It is presented, however, to clearly show the cost and technical differences associated with full onsite treatment and onsite treatment with some offsite disposal. An important distinction between this alternative and Alternative 3C is the inherent difficultly involved in making field decisions about which soils are too heavily impacted for treatment.

The total estimated cost for this remedial action to address soil contamination is approximately $3.3 million and would require two full construction (summer) seasons to complete. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: This alternative addresses all site contamination as did Alternative 2B, but at half the cost.

Disadvantages: This alternative results in a restricted future use designation, due to residual contamination that will remain. There is concern that this alternative may not be able to successfully treat all soils encountered, especially when oil saturated soils or impacted soils with significant clay content are excavated. These types of highly impacted soils are resistant to this treatment technique, and the process could fail with these soils. Ex-situ soils treatment at this volume may create dust and VOC odor control issues.

Alternative #3C: Excavate Soils, Ex-Situ Treatment and Replacement, Dispose up to 25%

As with Alternative 3B, this alternative involves the excavation of 42,000 cubic yards (77,000 tons) of contaminated soils for onsite ex-situ soil treatment, except that the option to dispose of up to 25% of site soils is included for flexibility in treatment options for heavily impacted soils (granular or clay). This alternative will leave residual SVOCs with low mobility (i.e. low water solubility, low volatility, high adsorption capacity to soil organic matter) that pose little threat to human health or the environment. A soils management plan would then be required to govern any future soil disturbance at this site.

The total estimated cost for this remedial action to address soil contamination is approximately $4.3 million and would require two full construction (summer) seasons to complete. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: This alternative extensively addresses site contamination with the flexibility to dispose of highly impacted soils, which may include disposal of soils immediately after excavation and also some soils resistant to the treatment process (if encountered, although the pilot study suggests that proper initial segregation will minimize disposal of post treatment soils). Cost is midway between full disposal and full onsite treatment, but could be lower if less than 25% of excavated soils are ultimately disposed to a landfill.

Disadvantages: Same as for Alternative 3B, plus the difficulty in making field decisions to segregate excavated (often water saturated soils) into treatable and untreatable (i.e. disposal) piles.

Alternative #4A: Excavate Soils, Ex-Situ Allu Process with Hydrogen Peroxide Treatment and Replacement

This alternative involves the excavation of 42,000 cubic yards (77,000 tons) of impacted soils in segments down to the underlying clay layer (a depth of 5 to 12 feet below ground surface, an average depth of 8 feet) for onsite ex-situ soil treatment. Treatment would consist of ex-situ mechanical aeration by an Allu™ Bucket (as described in Alternative 3C) and added chemical oxidation through the addition of hydrogen peroxide to chemically degrade COCs. The oxidant would be added after eight to ten soil turnovers are completed to degrade residual VOCs and SVOCs. As hydrogen peroxide spontaneously decomposes with an approximate half-life of 4 hours, the benefit from the oxidant is primarily derived within 24 hours of application. Currently the oxidant demand can only be estimated, as no direct testing was done. Soil organic matter content exerts an oxidant demand that is additive to that of the soil contaminants, and according to the literature, typically exceeds the contaminant oxidant demand. Site soils contain significant natural organic matter that will exert a high background oxidant demand. The fundamental process is that described in Alternative 3C, with the addition of chemical oxidation.

This alternative will leave residual SVOCs with low mobility (i.e. low water solubility, low volatility, high adsorption capacity to soil organic matter) that pose little threat to human health or the environment. A soils management plan would then be required to govern any future soil disturbance at this site.

The total estimated cost for this remedial action to address soil contamination is in the range of $4.8 to $8.0 million and would require two full construction (summer) seasons to complete. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: Similar to Alternative 3C, but with added chemical oxidation polishing to address residual SVOC contamination.

***Disadvantages*:** High cost. The estimated mass of oxidant required represents a substantial cost. Where site soils contain significant silts or clays, the contact between oxidant and contaminant necessary to allow the oxidation process to occur would be inhibited. There is uncertainty that the addition of the oxidant will be effective, due to this inherent mixing uncertainty and whether the added cost would provide significant additional treatment.

Alternative #4B: Excavate Soils, Ex-Situ Allu Process with Sodium Persulfate Treatment and Replacement

This alternative involves the excavation of 42,000 cubic yards (77,000 tons) of impacted soils in segments down to the underlying clay layer (a depth of 5 to 12 feet below ground surface) for onsite ex-situ soil treatment. Treatment would consist of ex-situ mechanical aeration by an Allu™ Bucket (as described in Alternative 3C) and added chemical oxidation through the addition of sodium persulfate to chemically degrade COCs. The oxidant would be added after eight to ten soil turnovers are completed to degrade residual VOCs and SVOCs.

Sodium persulfate was shown in the bench study test inside a continuously mixed aqueous reactor to be able to degrade the COCs to meet SCGs, but at a recommended soil temperature of 95°F to 105°F. Both the degree of soil mixing and the maintenance of elevated soil temperature and moisture content to promote optimum reaction kinetics in the soil between contaminants and oxidant are critical to success. The oxidant cost is high, in part due to the high organic matter content of site soils. Soil organic matter content exerts an oxidant demand that is additive to that of the soil contaminants, and according to the literature, typically exceeds the contaminant oxidant demand. As both soil mixing and temperature are important factors to control, this process was only evaluated based on ex-situ soil treatment. The fundamental process is that described in Alternative 3B, with the addition of chemical oxidation. A soils management plan would then be required to govern any future soil disturbance at this site. Cost of this alternative is based on the bench scale study. High end costs for Alternatives 4A and 4B are similar.

This alternative will leave residual SVOCs with low mobility (i.e. low water solubility, low volatility, high adsorption capacity to soil organic matter) that pose little threat to human health or

the environment. A soils management plan would then be required to govern any future soil disturbance at this site.

The total estimated cost for this remedial action to address soil contamination is in the range of $8.5 to $10.0 million and would require two full construction (summer) seasons to complete. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: Similar to Alternative 3C but with added chemical oxidation polishing to address residual SVOC contamination.

***Disadvantages*:** High cost. The estimated mass of oxidant required represents a substantial cost. Where site soils contain significant silts or clays, the contact between oxidant and contaminant necessary to allow the oxidation process to occur would be inhibited. There is uncertainty that the addition of the oxidant will be effective due to this inherent mixing uncertainty and whether the added cost would provide significant additional treatment.

Alternative #5: In-Situ Thermal Treatment of Soils

This alternative involves in-situ treatment of 42,000 cubic yards (77,000 tons) of impacted soils by applying heat to the subsurface to volatilize sorbed constituents and extract them from the soil column via a vapor extraction system. This technology involves the application of four components: hydraulic control of the groundwater table to induce drawdown and expose the smear zone; a distribution system to deliver heat to the subsurface; a vapor collection system; and a vapor treatment system. Due to the shallow depth to groundwater at this site, ranging from 3 to 8 feet below ground surface, and the contaminant penetration depth in some areas of 8 to 12 feet, this approach would require the application of enough heat to elevate groundwater temperature to volatilize petroleum hydrocarbons. As a significant portion of the petroleum hydrocarbon is comprised of long chain hydrocarbons with low vapor pressures (i.e. SVOCs), this approach may have limited effectiveness in removing low volatility SVOC residual compounds. Residual SVOCs are likely to be low mobility compounds (i.e. low water solubility, low volatility, high adsorption capacity to soil organic

matter) that pose little threat to human health or the environment. A soils management plan would then be required to govern any future soil disturbance at this site.

The total estimated cost for this remedial action to address soil contamination is in the range of $4.5 to $7.7 million and may require more than one construction (summer) season to complete. Refer to Table 20 for a cost comparison of all remedial alternatives.

Advantages: No excavation is required, so planning and management of excavation activities, groundwater pumping and treatment, and site geometry considerations (open excavations, groundwater pump and treat, onsite soil treatment cells, site workers and heavy equipment moving in limited space, safety considerations) are all eliminated or minimized. Also, the elimination of ex-situ soil handling minimizes dust and odor control issues.

***Disadvantages*:** High cost. The estimated cost for electricity, the heat source, is subject to dramatic variation with the fluctuation of energy costs. This alternative requires additional energy to operate the vapor extraction system. The ultimate repository for the vapors extracted is likely to be granular activated carbon, which requires still more energy for transportation and disposal (incineration). In addition, carbon adsorbs water, thereby reducing COC adsorption capacity. Dewatering to lower the water table or the addition of enough heat to boil groundwater adds energy needs and costs to this alternative. As the cost evaluation is based on completed projects prior to the recent spike in energy costs, this estimate may under-represent the actual cost.

4.3 Comparative Analysis

Table 20 shows the comparative costs in total dollars, and in cost per cubic yard and ton of soil. Appendix D presents planning estimate cost breakdowns per alternative. Table 21 presents a comparison of all alternatives against the seven required criteria listed below for a remedial alternative analysis.

- Protection of environment and public health
- Compliance with SCGs

- Long-term effectiveness
- Contaminant reduction
- Short-term effectiveness
- Implementability
- Community acceptance

In all, ten remedial alternatives were presented in this report. A greater number of alternatives were considered prior to the pilot study and were eliminated based on observed site conditions and study results (i.e. in-situ bioremediation and in-situ chemical oxidation). The alternatives evaluated actually represent five fundamental treatment options:

1. Cap and Treat
2. Excavate and Dispose
3. Excavate and Allu Treat
4. Excavate and Allu Treat with Chemical Oxidant Polishing
5. In-Situ Thermal Treatment

The ten alternatives evaluated apply variations to the above fundamental treatment options. Evaluation of these alternatives on the feasibility merits alone would indicate that all but Alternative 3B are likely to succeed to varying degrees. Alternative 3B would require excavation into clay and oil saturated soils that would not be readily treatable.

Presentation of Alternative 3B, however, provides comparison of the true cost differences among Alternative 2B (excavation and disposal of all contaminated soil), Alternative 3C (excavation and Allu treatment of all contaminated soil with up to 25 % disposed) and Alternatives 4A and 4B, which add chemical oxidation polishing to Alternative 3C. Based on these cost comparisons, it is twice as expensive to dispose of rather than treat the soils. When viewed in this contrast, one remedial alternative rises above all others in implementability, reliability, consistency and ability to treat site soils to meet SCGs.

5.0 RECOMMENDED REMEDIAL ALTERNATIVE

This site has received substantial investigation. The nature and extent of contamination was determined and a variety of potential remedies evaluated. Refinement of treatment options and implementability occurred through completion of bench and pilot scale studies. Based on evaluation of all costs, technical feasibility, long and short-term effectiveness, protection of the environment and health and compliance with the SCGs, the recommended alternative for this site is to excavate soils for treatment with the Allu process, including the option to dispose of up to 25% of the excavated soils (Alternative 3C). This alternative presents the best option to attain significant reduction of site COCs in both soil and groundwater. As this technology was tested in the pilot study and was shown to be successful, selection of this alternative provides greater certainty than most of the alternatives. While it is not the lowest cost alternative, it is the lowest cost alternative that addresses all site and technical issues. Selection of this alternative will require two full construction seasons to complete.

5.1 Overall Protectiveness of Human Health

clean material to go top 2' cover requirement

The recommended alternative will result in near total reduction of VOC, stains and odors from site soils, and will reduce SVOCs to a much lesser degree. This alternative will leave SVOCs in the soil. However, it is recognized that site contamination above the SCGs applies primarily to VOCs, not SVOCs. Much of the SVOC impacted site soil meets the proposed Part 375-6 cleanup standards for restricted industrial use sites. Residual SVOC in soils will be those compounds with low volatility and strong sorption properties to soil organic matter. Organic matter content in the soil has been shown to be at high concentrations across this site. This remedy will reduce construction worker and future site worker exposure, as remaining residual will remain buried below the ground surface with low migration potential. Site construction activity would be governed by a soil management plan and subsurface soil disturbance would be subject this plan. Future site structures may be required to install a sub-slab depressurization system. This remedy would be protective of human health, as the remaining exposure pathways after remedy completion would be limited to site

construction activity and building occupancy, both of which can be readily addressed with engineering controls.

5.2 Compliance with SCGs

The proposed remedy will comply with VOC, odor, and visual soil SCGs. This site would meet most SVOC SCGs for a restricted industrial use site under the proposed Part 375-6 cleanup standards for Environmental Restoration Program sites. It is possible that some post-treatment samples will provide results indicating minor exceedances of the restricted industrial use SCGs. However, these compounds would be within several times of the SCGs, and their physical properties indicate they would have low subsurface mobility.

VOC SCGs in soil for the protection of groundwater should be fully attained based on the pilot study results. During the soil treatment, groundwater from the open excavations will be treated and discharged to the POTW. While it is expected that residual SVOCs will remain in treated soils, the SVOCs resistant to treatment are low volatility, low water solubility and high soil sorption capacity compounds. Therefore, at the conclusion of the site remedy, groundwater will be significantly improved.

5.3 Short-Term Effectiveness

The recommended remedy can treat approximately one-half of the affected soil and groundwater in one construction (20-week) season and the entire site in two construction seasons. Once complete, the entire site will be remediated and treated soils re-compacted to allow for site redevelopment.

5.4 Long-Term Effectiveness and Permanence

Once remediation is complete after the second construction season ends, the site will be fully remediated and residual contamination with low mobility and low water solubility SVOCs will remain. This remedy would be permanent for this site.

5.5 Reduction of Toxicity, Mobility and Volume

This remedy will significantly reduce the volume and mobility of COCs through destruction and volatilization. Residual SVOC contamination will not be reduced in toxicity. However, residuals would have low volatility and remain strongly adsorbed to soil particles. In addition, the pilot study demonstrated that Allu™ processed soils continued to increase in microbial counts 30 to 35 days after the last soil turnover, suggesting that microbial processes may work to reduce residuals for at least this long after active processing ceases. In addition, placement back into the ground in shallow lifts during re-compaction acts as one final soil aeration event.

5.6 Feasibility

The proposed remedy is feasible and technically viable, as demonstrated in the pilot study.

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Leland Avenue, City of Utica, Oneida County, New York

TABLE 1 - PARTICULATE MONITORING DATA SUMMARY

Monitoring Date	Min Conc. (ug/m^3)	Max Conc. (ug/m^3)	State Action Level (ug/m^3)	Max 15-min Ave Difference (ug/m^3)
07/25/06	55	215	100	86.4
07/26/06	32	193	100	15.9
07/27/06	73	2,037	100	***141.1***
07/28/06	lost data		100	NR
07/29/06	weekend		100	NR
07/30/06	weekend		100	NR
07/31/06	lost data		100	NR
08/01/06	53	302	100	16.1
08/02/06	73	271	100	39.9
08/03/06	13	124	100	23.7
08/04/06	15	28	100	NFR
08/05/06	weekend		100	NR
08/06/06	weekend		100	NR
08/07/06	mechanical repairs		100	NR
08/08/06	2	312	100	8.1
08/09/06	6	215	100	57.7
08/10/06	13	2,453	100	***167.1***
08/11/06	3	2,173	100	***184.9***
08/12/06	weekend		100	NR
08/13/06	weekend		100	NR
08/14/06	9	299	100	59.5
08/15/06	8	33	100	NFR
08/16/06	6	80	100	NFR
08/17/06	6	475	100	46.9
08/18/06	23	88	100	NFR
08/19/06	weekend		100	NR
08/20/06	weekend		100	NR
08/21/06	6	53	100	NFR
08/22/06	12	175	100	23.8
08/23/06	6	39	100	NFR
08/24/06	7	1,830	100	***354.1***
08/25/06	8	862	100	70.7
08/26/06	weekend		100	NR
08/27/06	weekend		100	NR
08/28/06	13	103	100	6.4
08/29/06	rain - no work completed		100	NR
08/30/06	17	80	100	NFR
08/31/06	4	524	100	36.6
09/01/06	5	91	100	NFR
09/02/06	weekend		100	NR
09/03/06	weekend		100	NR
09/04/06	Labor Day		100	NR
09/05/06	lost data		100	NR
09/06/06	19	60	100	NFR
09/07/06	21	147	100	14.1
09/08/06	38	154	100	27.6
09/09/06	weekend		100	NR
09/10/06	weekend		100	NR
09/11/06	2	229	100	18.7
09/12/06	4	392	100	57.8
09/13/06	12	182	100	13.5
09/14/06	14	1,144	100	12.5
09/15/06	6	30	100	NFR

Notes:
Minimum concentration is lowest recorded reading of both the upwind and downwind monitors.
Maximum concentration is lowest recorded reading of both the upwind and downwind monitors.
State Action Level is from New York State Department of Health *Generic Community Air Monitoring Plan*, dated January 6, 2000
Maximum 15-min average difference is largest difference between upwind and downwind 15-minute rolling averages.
(ug/m^3) micrograms per cubic meter
Exceedances of State Action Level are in ***BOLD***.
NR - no data recorded for this day
NFR - No further data review required, as maximum recorded particulate concentration was below 100 ug/m^3.

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TABLE 2 - PILOT STUDY PILE I SOIL SAMPLES – HETEROTROPHIC PLATE COUNT

Matrix: Soil

Date Sampled	Treatment Stage	Results (col/g)			
07/31/06	initial screening	**WA-HPC-16**	**WA-HPC-17**	**WA-HPC-18**	**WA-HPC-19**
		13,700	17,100	18,800	1,070
08/15/06	5 turnovers & nutrients	**WAB-HPC-35**	**WAB-HPC-36**	**WAB-HPC-37**	
		498,000	284,000	708,000	
08/30/06	10 turnovers & nutrients	**WAB-HPC-56**	**WAB-HPC-57**	**WAB-HPC-58**	
		380,000	150,000	108,000	
09/19/06	13 turnovers & nurients	**WAB-HPC-97**	**WAB-HPC-98**	**WAB-HPC-99**	**WAB-HPC-100**
		1,160,000	464,000	384,000	1,200,000
10/16/06	Active treatment end 9/13/06	**WAB-HPC-188**	**WAB-HPC-189**	**WAB-HPC-190**	**WAB-HPC-191**
		446,000	390,000	238,000	180,000

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TABLE 3 - PILOT STUDY PILE II SOIL SAMPLES – HETEROTROPHIC PLATE COUNT

Matrix: Soil

Date Sampled	Treatment Stage	Results (col/g)				
07/31/06	initial screening	**WA-HPC-11**	**WA-HPC-12**	**WA-HPC-13**	**WA-HPC-14**	**WA-HPC-15**
		18,200	1,520	1,540	12,000	500
08/15/06	5 turnovers	**WA-HPC-28**	**WA-HPC-29**	**WA-HPC-30**		
		990,000	212,000	266,000		
08/30/06	8 turnovers	**WA-HPC-63**	**WA-HPC-64**	**WA-HPC-65**		
		138,000	48,000	44,000		
09/19/06	11 turnovers	**WA-HPC-113**	**WA-HPC-114**	**WA-HPC-115**	**WA-HPC-116**	**BIO-163**
		788,000	450,000	460,000	112,000	316,000
10/16/06	Active treatment end 9/15/06	**WA-HPC-198**	**WA-HPC-199**	**WA-HPC-200**	**WA-HPC-201**	
		828,000	158,000	1,858,000	358,000	

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TABLE 4 - PILOT STUDY PILE III SOIL SAMPLES – HETEROTROPHIC PLATE COUNT

Matrix: Soil

Date Sampled	Treatment Stage	Results (col/g)				
07/31/05	initial screening	**EA-HPC-1**	**EA-HPC-2**	**EA-HPC-3**	**EA-HPC-4**	**EA-HPC-5**
		1,130	1,660	3,620	3,020	3,850
07/31/05	initial screening	**EA-HPC-6**	**EA-HPC-7**	**EA-HPC-8**	**EA-HPC-9**	**EA-HPC-10**
		1,210	1,680	2,270	14,800	340
08/15/06	3 turnovers & nutrients	**EAB-HPC-49**	**EAB-HPC-50**	**EAB-HPC-51**		
		232,000	288,000	598,000		
08/30/06	7 turnovers & nutrients	**EAB-HPC-70**	**EAB-HPC-71**	**EAB-HPC-72**		
		200,000	108,000	86,000		
09/19/06	14 turnovers & nutrients	**EAB-HPC-128**	**EAB-HPC-129**	**EAB-HPC-130**	**EAB-HPC-131**	
		458,000	130,000	994,000	406,000	
10/16/06	Active treatment end 9/14/06	**EAB-HPC-176**	**EAB-HPC-177**	**EAB-HPC-178**	**EAB-HPC-179**	
		1,234,000	186,000	662,000	468,000	

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TABLE 5 - PILOT STUDY PILE IV SOIL SAMPLES – HETEROTROPHIC PLATE COUNT

Matrix: Soil

Date Sampled	Treatment Stage	Results (col/g)				
07/31/06	initial screening	**EA-HPC-1**	**EA-HPC-2**	**EA-HPC-3**	**EA-HPC-4**	**EA-HPC-5**
		1,130	1,660	3,620	3,020	3,850
07/31/06	initial screening	**EA-HPC-6**	**EA-HPC-7**	**EA-HPC-8**	**EA-HPC-9**	**EA-HPC-10**
		1,210	1,680	2,270	14,800	340
08/15/06	4 turnovers	**EA-HPC-42**	**EA-HPC-43**	**EA-HPC-44**		
		740,000	736,000	422,000		
08/30/06	8 turnovers	**EA-HPC-77**	**EA-HPC-78**	**EA-HPC-79**		
		332,000	168,000	196,000		
09/19/06	15 turnovers	**EA-HPC-144**	**EA-HPC-145**	**EA-HPC-146**	**EA-HPC-147**	**BIO-161**
		772,000	1,350,000	194,000	590,000	834,000
10/16/06	Active treatment end on 9/14	**EA-HPC-180**	**EA-HPC-181**	**EA-HPC-182**	**EA-HPC-183**	
		482,000	574,000	1,264,000	270,000	

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TABLE 6 - PILOT STUDY PILE V SOIL SAMPLES – HETEROTROPHIC PLATE COUNT

Matrix: Soil

Date Sampled	Treatment Stage	Results (col/g)			
08/15/06	3 turnovers	**SB54-HPC-21**	**SB54-HPC-22**	**SB54-HPC-23**	
		82,000	54,000	6,000	
08/30/06	8 turnovers	**SB54-HPC-84**	**SB54-HPC-85**	**SB54-HPC-86**	
		38,000	160,000	100,000	
09/16/06	18 turnovers	**SB54-HPC-158**	**SB54-HPC-159**	**SB54-HPC-160**	**BIO-162**
		192,000	194,000	262,000	918,000
10/16/06	18 turnovers	**SB54-HPC-184**	**SB54-HPC-185**	**SB54-HPC-186**	**SB54-HPC-187**
		220,000	106,000	222,000	432,000

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TABLE 7 - PILOT STUDY PILES I and II SOIL SAMPLES - VOCs (STARS LIST plus TICs)
EPA METHOD 8260

Date Sampled: As Shown — **Matrix:** Soil — **Matrix:** Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)										Compound Concentration (mg/kg)											
		WA-19	WA-20	WA-21	WA-22	WA-23	WA-24	WA-25	WA-26	WA-27	WA-28	WA-117	WA-118	WA-119	WA-120	WA-121 COMP	WA-122 COMP	WAB-101	WAB-102	WAB-103	WAB-104	WAB-105 COMP	WAB-106 COMP
		07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06
		Samples collected after initial screening to remove large debris										Samples collected after 11 turnovers						Samples collected after 13 turnovers and addition of nutrients					
1,2,4-Trimethylbenzene	13		1.30	9.50	1.60	0.15			0.30	3.90													
1,3,5-Trimethylbenzene	3.3			***4.50***	2.60				0.39	0.28													
Benzene	0.06																						
Ethylbenzene	5.5									0.30													
Isoproylbenzene (Cymene)	5									0.95													
Methyl-tert-butyl-ether (MTBE)	0.12																						
Naphthalene	13			1.50						0.57													
n-Butylbenzene	18		1.60	2.00	0.87	0.05			0.17	1.60													
n-Propylbenzene	14			1.60						1.60													
o-Xylene[2]	1.2																						
p- & m-Xylene[2]	1.2			***1.30***						0.24													
Total Xylenes	1.2			1.30						0.24													
p-Isopropyltoluene (Cumene)	11					0.03			0.06	1.00													
sec-Butylbenzene	25		1.10							0.74													
tert-Butylbenzene	---																						
Toluene	1.5																						
Total STARS List VOCs	---	ND	4.00	20.40	5.07	0.23	ND	ND	0.92	11.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TICs VOCs	---	0.28	196.90	37.70	15.09	3.41	ND	ND	4.64	57.70	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	10	0.28	***200.90***	***58.10***	***20.16***	3.64	ND	ND	5.56	***68.88***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] The Recommended Soil Cleanup Level for Total Xylenes is 1.2 mg/kg.

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

mg/kg - milligrams per kilogram (parts per million, ppm)

ND < Not detected less than

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
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TABLE 8 - PILOT STUDY PILES III and IV - VOCs (STARS LIST plus TICs)
EPA METHOD 8260

Date Sampled: As Shown

Matrix: Soil

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)																					
		EA-9	EA-10	EA-11	EA-12	EA-13	EA-14	EA-15	EA-16	EA-17	EA-18	EA-148	EA-149	EA-150	EA-151	EA-152 COMP	EA-153 COMP	EAB-132	EAB-133	EAB-134	EAB-135	EAB-136 COMP	EAB-137 COMP
		07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	07/27/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06
		Samples collected after initial screening to remove large debris										Samples collected after 15 turnovers						Samples collected after 14 turnovers and addition of nutrients					
1,2,4-Trimethylbenzene	13																						
1,3,5-Trimethylbenzene	3.3																						
Benzene	0.06																						
Ethylbenzene	5.5																						
Isoproylbenzene (Cymer	5																						
Methyl-tert-butyl-ether (	0.12																						
Naphthalene	13	0.03	0.03	0.03						0.05													
n-Butylbenzene	18		0.03	0.03			0.55	0.03															
n-Propylbenzene	14	0.03																					
o-Xylene[2]	1.2																						
p- & m-Xylene[2]	1.2																						
Total Xylenes	1.2																						
p-Isopropyltoluene (Cun	11	0.04																					
sec-Butylbenzene	25	0.05		0.04																			
tert-Butylbenzene	---																						
Toluene	1.5																						
Total STARS List VOC	---	0.14	0.06	0.10	ND	ND	0.55	0.03	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TICs VOCs	---	5.29	3.22	2.54	5.85	ND	36.30	2.89	5.14	5.34	4.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	10	5.43	3.28	2.64	5.85	ND	***36.85***	2.91	5.14	5.39	4.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] The Recommended Soil Cleanup Level for Total Xylenes is 1.2 mg/kg.

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

mg/kg - milligrams per kilogram (parts per million, ppm)

ND < Not detected less than

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
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TABLE 9 - PILOT STUDY PILE V SOIL SAMPLES – VOCs (STARS LIST plus TICs) EPA METHOD 8260 ANALYSIS

Date Sampled: As Shown **Matrix:** Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)	
		SB54-156	SB54-157 COMP
		09/19/06	09/19/06
		Samples collected after 18 turnovers	
1,2,4-Trimethylbenzene	13		
1,3,5-Trimethylbenzene	3.3		
Benzene	0.06		
Ethylbenzene	5.5		
Isoproylbenzene (Cymene)	5		
Methyl-tert-butyl-ether (MTBE)	0.12		
Naphthalene	13		
n-Butylbenzene	18		
n-Propylbenzene	14		
o-Xylene[2]	1.2		
p- & m-Xylene[2]	1.2		
Total Xylenes	1.2		
p-Isopropyltoluene (Cumene)	11		
sec-Butylbenzene	25		
tert-Butylbenzene	---		
Toluene	1.5		
Total STARS List VOCs	---	ND	ND
Total TICs VOCs	---	ND	0.02
Total VOCs	10	ND	0.02

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated 4-10-01.

[2] The Recommended Soil Cleanup Level for Total Xylenes is 1.2 mg/kg.

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

mg/kg - milligrams per kilogram (parts per million, ppm)

ND < Not detected less than

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 10 - PILOT STUDY PILE I SOIL SAMPLES - SVOCs (STARS LIST and TICs)
EPA METHOD 8270

Date Sampled: As Shown

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)											Compound Concentration (mg/kg)									
		WA-20	WA-21	WA-22	WA-23	WA-24	WA-27	WA-28	WAB-38	WAB-39	WAB-40	WAB-41	WAB-59	WAB-60	WAB-61	WAB-62	WAB-91	WAB-92	WAB-93	WAB-94	WAB-95	WAB-96
		07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	08/15/06	08/15/06	08/15/06	08/15/06	08/30/06	08/30/06	08/30/06	08/30/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06
		Samples collected after initial screening to remove large debris							Samples collected after 5 turnovers and addition of nutrients				Samples collected after 10 turnovers and addition of nutrients				Samples collected after 13 turnovers and addition of nutrients					
Acenaphthene	50																					
Anthracene	50																					
Benzo(a)anthracene	0.224[2]																					
Benzo(a)pyrene	0.061[2]																					
Benzo(b)fluoranthene	1.1													0.2								
Benzo(g,h,i)perylene	50																					
Benzo(k)fluoranthene	1.1																					
Chrysene	0.4			0.2			0.2							0.2								
Dibenzo(a,h)anthracene	0.014[2]																					
Fluoranthene	50			0.3			0.3	0.2					0.2		0.2							
Fluorene	50																					
Indeno(1,2,3-cd)pyrene	3.2																					
Naphthalene	13																					
Phenanthrene	50						0.2	0.2														
Pyrene	50			0.3			0.2						0.2									
Total STARS List SVOCs	---	**ND**	**ND**	**0.7**	**ND**	**ND**	**0.9**	**0.3**	**ND**	**ND**	**ND**	**ND**	**0.4**	**0.4**	**0.2**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Total TICs SVOCs	---	**0.7**	**0.4**	**3.2**	**2.2**	**2.9**	**2.6**	**1.9**	**ND**	**0.4**	**0.8**	**ND**	**ND**	**ND**	**0.8**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Total SVOCs	**500**	**0.7**	**0.4**	**3.9**	**2.2**	**2.9**	**3.5**	**2.3**	**ND**	**0.4**	**0.8**	**ND**	**0.4**	**0.4**	**0.9**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

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TABLE 11 - PILOT STUDY PILE II SOIL SAMPLES - SVOCs (STARS LIST plus TICs)
EPA METHOD 8270

Date Sampled: As Shown

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)																											
		WA-15	WA-16	WA-17	WA-18	WA-19	WA-25	WA-26	WA-31	WA-32	WA-33	WA-34	WA-66	WA-67	WA-68	WA-69	WA-107	WA-107 R	WA-108	WA-108 R	WA-109	WA-109 R	WA-110	WA-110 R	WA-111	WA-111 R	WA-112	WA-112 R
		07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	08/15/06	08/15/06	08/15/06	08/15/06	08/30/06	08/30/06	08/30/06	08/30/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06
		Samples collected after initial screening to remove large debris							Samples collected after 5 turnovers				Samples collected after 8 turnovers				Samples collected after 11 turnovers											
Acenaphthene	50																											
Anthracene	50																			0.2								
Benzo(a)anthracene	0.224[2]					***1.0***			0.2	***0.3***	***0.3***	0.2								0.5	***1.3***	***0.4***						
Benzo(a)pyrene	0.061[2]					***0.9***																						
Benzo(b)fluoranthene	1.1																											
Benzo(g,h,i)perylene	50																											
Benzo(k)fluoranthene	1.1					1.0																						
Chrysene	0.4			0.2		***1.2***			0.3	0.4	0.4	0.2								0.4		0.4					***0.5***	
Dibenzo(a,h)anthracene	0.014[2]																											
Fluoranthene	50			0.3		3.4			0.5	0.8	0.8	0.3	0.2	0.2	0.3	0.4	0.6	0.4	0.9	1.2	2.9	0.8	0.5	0.3	1.0	0.6	0.8	0.5
Fluorene	50																											
Indeno(1,2,3-cd)pyrene	3.2																											
Naphthalene	13																											
Phenanthrene	50			0.2		3.5			0.4	0.6	0.3				0.2				0.6	1.0	2.2	0.5			0.8	0.4	0.5	
Pyrene	50			0.2		2.4			0.4	0.6	0.6	0.3	0.2	0.2	0.3	0.3	0.6	0.4	0.8	1.1	2.2	0.7	0.5		0.8	0.5	0.7	0.5
Total STARS List SVOC	**---**	**ND**	**ND**	**0.9**	**ND**	**13.4**	**ND**	**ND**	**1.8**	**2.7**	**2.4**	**1.0**	**0.4**	**0.4**	**0.8**	**0.6**	**1.2**	**0.8**	**2.2**	**4.4**	**8.6**	**2.8**	**1.0**	**0.3**	**2.6**	**1.4**	**2.6**	**1.0**
Total TICs SVOCs	**---**	**ND**	**ND**	**5.3**	**16.9**	**10.8**	**4.8**	**14.5**	**3.0**	**6.9**	**5.4**	**3.8**	**0.8**	**ND**	**1.8**	**3.0**	**1.1**	**ND**	**2.3**	**2.1**	**32.0**	**2.0**	**2.1**	**ND**	**7.3**	**ND**	**2.5**	**ND**
Total SVOCs	**500**	**ND**	**ND**	**6.2**	**16.9**	**24.1**	**4.8**	**14.5**	**4.8**	**9.5**	**7.8**	**4.8**	**1.2**	**0.4**	**2.6**	**3.6**	**2.3**	**0.8**	**4.5**	**6.5**	**40.6**	**4.8**	**3.2**	**0.3**	**9.9**	**1.4**	**5.0**	**1.0**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

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TABLE 12 - PILOT STUDY PILES III and IV SOIL SAMPLES – SVOCs (STARS LIST plus TICs)
EPA METHOD 8270 ANALYSIS

Date Sampled: As Shown

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)													
		EA-1	EA-2	EA-3	EA-4	EA-5	EA-6	EA-7	EA-8	EA-9	EA-10	EA-11	EA-12	EA-13	EA-14
		07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06	07/31/06
		Samples collected after initial screening to remove large debris													
Acenaphthene	50	0.9	0.4	0.2						0.5					
Anthracene	50	2.3	0.7	0.3	1.5			0.2		1.0		0.3			
Benzo(a)anthracene	0.224[2]	***2.9***	***2.1***	***0.9***	***3.2***	***0.4***		***0.4***		***2.0***	***0.3***	***0.9***			
Benzo(a)pyrene	0.061[2]	***3.3***	***1.9***	***0.5***	***3.0***	***0.3***				***1.7***	***0.2***	***0.5***			
Benzo(b)fluoranthene	1.1	***2.4***	***1.8***	0.5	***2.3***	0.2				***1.8***	0.2	0.5			
Benzo(g,h,i)perylene	50	1.0	0.3		1.4					0.3					
Benzo(k)fluoranthene	1.1	***3.2***	***1.5***	0.5	***2.2***	0.2				1.1	0.2	0.5			
Chrysene	0.4	***3.5***	***2.4***	***0.8***	***3.1***	0.3		0.3		***2.1***	0.3	***0.7***			
Dibenzo(a,h)anthracene	0.014[2]		***0.3***		***0.8***					***0.3***					
Fluoranthene	50	7.9	2.1	1.2	7.4	0.6		0.6	0.2	2.6	0.5	1.2	1.4		
Fluorene	50	1.7	0.7	0.3	1.0					0.7					
Indeno(1,2,3-cd)pyrene	3.2	1.2	0.4		1.4					0.5		0.2			
Naphthalene	13									0.5					
Phenanthrene	50	7.8	1.6	0.8	4.7	0.3		0.5	0.2	2.4	0.3	0.7	1.0		0.2
Pyrene	50	6.7	2.2	1.3	6.7	0.6		0.6	0.2	2.2	0.5	1.3	1.2		
Total STARS SVOCs	**---**	**44.8**	**18.3**	**7.4**	**38.7**	**2.9**	**ND**	**2.6**	**0.6**	**19.7**	**2.6**	**6.7**	**3.6**	**ND**	**0.2**
Total TICs SVOCs	**---**	**92.1**	**25.0**	**20.9**	**52.5**	**5.6**	**51.7**	**18.3**	**3.2**	**33.3**	**5.2**	**19.7**	**30.9**	**39.9**	**16.4**
Total SVOCs	**500**	**136.9**	**43.3**	**28.4**	**91.2**	**8.4**	**51.7**	**21.0**	**3.9**	**53.0**	**7.7**	**26.4**	**34.5**	**39.9**	**16.6**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit. Compounds exceeding Recommended Soil Cleanup Levels are denoted in BOLD

* Benzo(a)Pyrene standard for industrial sites listed as it is below GW Protection value, most other cases GW Protect value more stringent

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 13- PILOT STUDY PILE III SOIL SAMPLES – SVOCs (STARS LIST plus TICs)
EPA METHOD 8270 ANALYSIS

Date Sampled: As Shown

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)																			
		EAB-52	EAB-53	EAB-54	EAB-55	EAB-73	EAB-74	EAB-75	EAB-76	EAB-122	EAB-122 RE	EAB-123	EAB-123 RE	EAB-124	EAB-124 RE	EAB-125	EAB-125 RE	EAB-126	EAB-126 RE	EAB-127	EAB-127 RE
		08/15/06	08/15/06	08/15/06	08/15/06	08/30/06	08/30/06	08/30/06	08/30/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06
		Samples collected after 3 turnovers and addition of nutrients				Samples collected after 7 turnovers and addition of nutrients				Samples collected after 14 turnovers and addition of nutrients											
Acenaphthene	50		0.4				0.6	0.4	0.3								1.7			0.5	
Anthracene	50	1.4	0.8	0.4	0.3	0.4	1.3	1.0	0.6	0.8	1.2	0.5		0.7			4.0	0.9	0.7	1.4	0.3
Benzo(a)anthracene	0.224[2]	***2.9***	***1.6***	***0.8***	***0.7***	***0.9***	***1.8***	***1.8***	***1.5***	***1.7***	***1.2***	***1.3***	***1.2***	***1.3***	***1.5***	***1.2***	***9.8***	***2.0***	***2.0***	***2.3***	***0.9***
Benzo(a)pyrene	0.061[2]	***2.1***	***1.1***	***0.6***	***0.6***	***0.4***	***0.9***	***0.8***	***1.2***	***1.6***		***1.2***		***1.1***	***1.1***	***1.0***	***8.0***	***1.8***	***1.3***	***1.9***	***0.4***
Benzo(b)fluoranthene	1.1	***1.6***	1.0	0.5	0.5	0.5	0.9	0.7	***1.3***	***1.3***		1.1		1.1	1.0	***1.2***	***4.2***	***1.5***	***1.2***	***1.7***	0.4
Benzo(g,h,i)perylene	50		0.3	0.2					0.3								4.3			0.5	
Benzo(k)fluoranthene	1.1	***1.6***	0.8	0.5	0.5	0.4	0.8	0.7	0.7	1.8		1.2		1.1	1.0	1.1	***7.4***	2.0	1.1	1.9	0.4
Chrysene	0.4	***2.8***	***1.5***	***0.8***	***0.7***	***0.5***	***1.2***	***1.1***	***1.2***	***1.9***	***1.1***	***1.5***	***1.0***	***1.4***	***1.2***	***1.3***	***8.2***	***2.1***	***1.5***	***2.4***	***0.8***
Dibenzo(a,h)anthracene	0.014[2]		***0.3***						0.2								***1.9***				
Fluoranthene	50	4.9	2.7	1.2	1.2	1.2	0.3	2.7	2.6	3.2	2.0	2.2	2.0	2.4	2.7	2.2	19.0	3.8	3.4	4.2	1.4
F[illegible]rene	50		0.6	0.2	0.2	0.2	0.8	0.6	0.4								2.4			0.9	
[illegible]c(1,2,3-cd)pyrene	3.2		0.2	0.2	0.3				0.4								***3.8***	0.5	0.4	0.6	
Naphthalene	13		0.3				0.8	0.3	0.2												
Phenanthrene	50	3.6	2.2	0.9	0.8	0.9	3.1	2.3	1.7	2.4	1.1	1.5	1.2	1.9	1.6	1.4	14.0	2.7	2.3	4.1	0.8
Pyrene	50	4.3	2.4	1.1	1.2	1.1	2.5	2.3	2.1	2.9	2.3	2.0	2.0	2.1	2.7	2.0	17.0	3.3	3.2	3.7	1.4
Total STARS List SVOCs	**---**	**25.2**	**16.3**	**7.3**	**6.9**	**6.5**	**14.9**	**14.6**	**14.6**	**17.6**	**8.9**	**12.5**	**7.4**	**13.1**	**12.8**	**11.4**	**105.7**	**20.6**	**17.1**	**26.2**	**6.7**
Total TICs SVOCs	**---**	**7.1**	**16.6**	**7.0**	**7.5**	**9.9**	**13.9**	**12.5**	**15.9**	**8.7**	**15.4**	**9.8**	**10.8**	**7.0**	**12.8**	**11.9**		**11.1**	**12.8**	**15.8**	**9.0**
Total SVOCs	**500**	**32.3**	**32.9**	**14.3**	**14.4**	**16.4**	**28.8**	**27.2**	**30.6**	**26.3**	**24.3**	**22.3**	**18.1**	**20.1**	**25.6**	**23.3**	**105.7**	**31.7**	**29.9**	**42.0**	**15.6**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 14 - PILOT STUDY PILE IV SOIL SAMPLES - SVOCs (STARS LIST plus TICs)
EPA METHOD 8270

Date Sampled: As Shown

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	# Carbon Rings	Compound Concentration (mg/kg)																									
			EA-45	EA-46	EA-47	EA-48	EA-80	EA-81	EA-82	EA-83	EA-138	EA-138 RE	EA-139	EA-139 RE	EA-140	EA-140 RE	EA-141	EA-141 RE	EA-142	EA-142 RE	EA-143	EA-143 RE	WA-192	WA-193	WA-194	WA-195	WA-196	WA-197
			08/15/06	08/15/06	08/15/06	08/15/06	08/30/06	08/30/06	08/30/06	08/30/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	10/16/06	10/16/06	10/16/06	10/16/06	10/16/06	10/16/06
			Samples collected after 4 turnovers				Samples collected after 8 turnovers				Samples collected after 15 turnovers																	
Acenaphthene	50	2				0.3															1.6		0.4					0.4
Anthracene	50	3	0.3	0.3	0.4	0.8	0.2	0.5	0.2	0.4	0.5	1.1		0.5	1.5	0.8	1.0	0.5	0.6	0.4	3.9	0.2	1.2	0.8			0.2	0.9
Benzo(a)anthracene	0.224[2]	4	***0.4***	***0.4***	***0.5***	***1.2***	***0.6***	***1.2***	***0.5***	***0.8***	***1.5***	***1.7***	***1.7***	***1.4***	***4.2***	***1.5***	***2.4***	***1.7***	***1.6***	***1.5***	***7.0***	***0.6***	***2.1***	***2.5***	***0.3***	***0.4***	***0.5***	***1.5***
Benzo(a)pyrene	0.061[2]	5	***0.5***	***0.5***	***0.7***	***1.0***	***0.6***	***1.0***	***0.5***	***0.7***	***0.9***	***1.0***	***1.1***	***0.8***	***2.4***	***0.9***	***1.4***	***0.9***	***0.9***	***0.7***	***4.4***	***0.3***	***1.2***	***1.5***	***0.2***	***0.3***	***0.4***	***0.9***
Benzo(b)fluoranthene	1.1	4	0.3	0.3	0.5	0.8	0.6	1.1	0.5	0.7	0.7		0.8	0.9	***2.6***	***0.9***	1.1	0.9	***6.8***	0.6	***4.8***	0.3	1.1	***1.3***	0.2	0.3	0.3	0.7
Benzo(g,h,i)perylene	50	6						0.2													0.5		0.4					0.2
Benzo(k)fluoranthene	1.1	4	0.4	0.4	0.5	0.8	0.5	0.3	0.5	0.6	1.0	1.0	1.0	0.7	***2.2***	***0.8***	***1.3***	0.9	0.9	0.7	***3.2***	0.3	1.1	***1.4***	0.2	0.3	0.3	0.8
Chrysene	0.4	4	***0.5***	***0.5***	***0.7***	***1.4***	***0.6***	***1.1***	***0.5***	***0.7***	***1.4***	***1.4***	***1.4***	***1.0***	***3.6***	***1.3***	***2.0***	***1.4***	***1.3***	***1.1***	***6.8***	***0.5***	***1.6***	***1.8***	0.2	0.3	0.4	***1.2***
Dibenzo(a,h)anthracene	0.014[2]	5						***0.2***													***0.5***							
Fluoranthene	50	3	1.0	1.0	1.4	2.7	1.2	2.1	0.9	1.5	2.3	3.6	2.3	2.2	5.9	3.0	3.5	2.5	2.3	2.2	9.6	1.0	4.3	5.3	0.4	0.7	0.8	3.0
Fluorene	50	2	0.2	0.2	0.2	0.4		0.2		0.3					0.8	0.4	0.5			0.2	2.6		0.6					0.5
Indeno(1,2,3-cd)pyrene	3.2	5						0.3	0.2						0.6						0.7		0.4					0.3
Naphthalene	13	2				0.6															1.0							
Phenanthrene	50	3	1.0	0.9	1.2	2.9	0.6	1.3	0.5	1.1	1.7	3.3	1.3	1.4	3.8	2.6	2.8	1.3	1.6	1.3	9.7	0.5	3.7	3.5	0.3	0.4	0.5	2.9
Pyrene	50	4	0.9	0.9	1.2	2.5	1.2	1.8	0.9	1.3	2.4	3.2	2.5	2.3	5.7	2.9	3.6	2.6	2.4	2.4	9.3	1.1	3.8	4.7	0.5	0.7	0.8	2.8
Total STARS List SVOC	---	**NA**	**5.5**	**5.5**	**7.2**	**15.5**	**6.2**	**11.2**	**5.2**	**8.0**	**12.4**	**16.3**	**12.1**	**11.1**	**33.3**	**15.1**	**19.6**	**12.7**	**18.4**	**11.1**	**65.6**	**4.7**	**21.9**	**22.8**	**2.3**	**3.3**	**4.3**	**16.1**
Total TICs SVOCs	---	**NA**	**16.5**	**12.3**	**11.0**	**16.6**	**15.2**	**20.5**	**9.4**	**11.4**	**14.9**	**13.3**	**3.9**	**8.9**	**20.2**	**9.3**	**13.1**	**12.6**	**9.6**	**10.2**	**24.9**	**7.4**	**17.8**	**15.3**	**3.4**	**4.7**	**5.1**	**8.2**
Total SVOCs	**500**	**NA**	**22.0**	**17.8**	**18.2**	**32.1**	**21.4**	**31.8**	**14.6**	**19.4**	**27.3**	**29.6**	**16.0**	**20.0**	**53.5**	**24.4**	**32.7**	**25.3**	**28.0**	**21.3**	**90.6**	**12.1**	**39.7**	**38.1**	**5.7**	**7.9**	**9.4**	**24.3**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.
[2] or Method Detection Limit (MDL)
STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.
--- No Recommended Cleanup Level
TICs - Tentatively identified compounds
mg/kg - milligrams per kilogram (parts per million, ppm)
Blank cells indicate ND < Not detected less than method dection limit
Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 15 - PILOT STUDY PILE V SOIL SAMPLES – SVOCs (STARS LIST plus 20 TICs)
EPA METHOD 8270 ANALYSIS

Date Sampled: As Shown

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)																			
		SB54-24	SB54-25	SB54-26	SB54-27	SB54-87	SB54-88	SB54-89	SB54-90	SB54-154	SB54-154 RE	SB54-155	SB54-155 RE	BIO-165	BIO-165 RE	CHEM-173 (100%)	CHEM-173 RE (100%)	CHEM-174 (50%)	CHEM-174 RE (50%)	CHEM-175 (10%)	CHEM-175 RE (10%)
		08/15/06	08/15/06	08/15/06	08/15/06	08/30/06	08/30/06	08/30/06	08/30/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06	09/19/06
		Samples collected after 3 - 4 turnovers				Samples collected after 7 - 8 turnovers				Samples collected after 18 turnovers				Sample collected from biological additive tub		Samples collected from chemical tubs					
Acenaphthene	50												0.5								
Anthracene	50	0.2						3.0					0.8	0.8		0.6	0.7				
Benzo(a)anthracene	0.224[2]	***0.9***	***0.5***	***0.3***	***0.5***	***0.3***	***0.3***	***7.9***	***0.7***	***0.7***	***0.5***		***1.3***	***1.1***	***0.3***	***1.0***	***0.9***	***0.6***	***0.4***	***0.5***	
Benzo(a)pyrene	0.061[2]	***0.6***	***0.3***		***0.4***	***0.3***	***0.3***		***0.4***	***0.7***	***0.3***		***0.5***	***0.7***		***0.8***		***0.6***		***0.5***	
Benzo(b)fluoranthene	1.1	0.6	0.2		0.4	0.3	0.3	***5.8***	0.4	0.7	0.4		0.6	0.7		0.9		0.6		0.5	
Benzo(g,h,i)perylene	50	0.3						2.9													
Benzo(k)fluoranthene	1.1	0.6	0.3		0.3	0.3	0.3	***3.8***		0.6	0.4		0.6	0.6		0.9	0.4	0.7		0.6	
Chrysene	0.4	***0.9***	0.4	0.2	***0.6***	0.3	0.3	***6.8***	0.4	***0.9***	***0.5***		***1.3***	***0.9***	0.3	***1.2***	***0.8***	***0.7***	0.4	***0.6***	
Dibenzo(a,h)anthracene	0.014[2]							***2.2***	***0.5***												
Fluoranthene	50	1.2	0.7	0.5	0.9	0.5	0.6	11.2		1.3	0.9	0.8	3.4	2.0	0.4	2.2	2.2	1.0	0.7	0.9	0.5
Fluorene	50								1.0				0.5	0.6							
Indeno(1,2,3-cd)pyrene	3.2	0.3						3.2													
Naphthalene	13	0.3		0.3	0.4									0.7		0.5				0.5	
Phenanthrene	50	0.6	0.4	0.4	0.5	0.2	0.4	8.5	0.5	0.8	0.6	0.5	3.4	2.4	0.2	2.1	2.3	0.6	0.4	0.5	
Pyrene	50	1.3	0.7	0.6	1.0	0.6	0.6	8.4	1.2	1.3	1.0	0.8	3.0	1.9	0.5	2.0	2.1	1.1	0.8	1.0	0.6
Total STARS List SVOCs	---	**7.7**	**3.4**	**2.3**	**4.9**	**2.9**	**3.1**	**63.7**	**5.0**	**6.9**	**4.6**	**2.1**	**15.9**	**12.4**	**1.6**	**12.2**	**9.4**	**5.8**	**2.7**	**5.6**	**1.1**
Total TICs SVOCs	---	**16.4**	**15.8**	**19.7**	**22.3**	**8.5**	**6.1**	**40.4**	**11.3**	**8.3**	**10.0**	**2.7**	**14.6**	**11.4**	**4.1**	**10.7**	**8.8**	**11.7**	**3.5**	**11.6**	**3.7**
Total SVOCs	**500**	**24.1**	**19.2**	**22.0**	**27.2**	**11.4**	**9.2**	**104.1**	**16.3**	**15.2**	**14.6**	**4.8**	**30.5**	**23.8**	**5.8**	**22.9**	**18.2**	**17.5**	**6.2**	**17.2**	**4.8**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 16 - PILOT STUDY INITIAL CONCENTRATIONS OF SOILS IN CHEMICAL OXIDATION STUDY – SVOCs (STARS LIST plus 20 TICs)
EPA METHOD 8270 ANALYSIS

Date Sampled: 08/30/06 **Matrix:** Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)											
		SB54-87	SB54-88	SB54-89	SB54-90	WA-66	WA-67	WA-68	WA-69	EA-80	EA-81	EA-82	EA-83
		SB-54 samples collected after 7 - 8 turnovers				Pile II samples collected after 8 turnovers				Pile IV samples collected after 8 turnovers			
Acenaphthene	50												
Anthracene	50			3.0									
Benzo(a)anthracene	0.224[2]	***0.3***	***0.3***	***7.9***	***0.7***					0.2	0.5	0.2	0.4
Benzo(a)pyrene	0.061[2]	***0.3***	***0.3***		***0.4***					***0.6***	***1.2***	***0.5***	***0.8***
Benzo(b)fluoranthene	1.1	0.3	0.3	***5.8***	0.4					***0.6***	***1.0***	***0.5***	***0.7***
Benzo(g,h,i)perylene	50			2.9						0.6	1.1	0.5	0.7
Benzo(k)fluoranthene	1.1	0.3	0.3	***3.8***							0.2		
Chrysene	0.4	0.3	0.3	***6.8***	0.4					0.5	0.3	0.5	0.6
Dibenzo(a,h)anthracene	0.014[2]			***2.2***	***0.5***					***0.6***	***1.1***	***0.5***	***0.7***
Fluoranthene	50	0.5	0.6	11.2		0.2	0.2	0.3	0.4		***0.2***		
Fluorene	50				1.0					1.2	2.1	0.9	1.5
Indeno(1,2,3-cd)pyrene	3.2			3.2							0.2		0.3
Naphthalene	13										0.3	0.2	
Phenanthrene	50	0.2	0.4	8.5	0.5			0.2					
Pyrene	50	0.6	0.6	8.4	1.2	0.2	0.2	0.3	0.3	0.6	1.3	0.5	1.1
Total STARS List SVOCs	**---**	**2.9**	**3.1**	**63.7**	**5.0**	**0.4**	**0.4**	**0.8**	**0.6**	1.2	1.8	0.9	1.3
Total TICs SVOCs	**---**	**8.5**	**6.1**	**40.4**	**11.3**	**0.8**	**ND**	**1.8**	**3.0**	**6.2**	**11.2**	**5.2**	**8.0**
Total SVOCs	**500**	**11.4**	**9.2**	**104.1**	**16.3**	**1.2**	**0.4**	**2.6**	**3.6**	**21.4**	**31.8**	**14.6**	**19.4**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 17 - PILOT STUDY PILE V \SOIL SAMPLES–SVOCs (STARS LIST plus 20 TICs)
EPA METHOD 8270 ANALYSIS

Date Sampled: As Shown

Matrix: Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	# Carbon Rings	Compound Concentration (mg/kg)											
			BIO-165	BIO-166	BIO-164	CHEM-173 (100%)	CHEM-174 (50%)	CHEM-175 (10%)	CHEM-167 (100%)	CHEM-168 (50%)	CHEM-169 (10%)	CHEM-170 (100%)	CHEM-171 (50%)	CHEM-172 (10%)
			09/19/06	9/19/06	9/19/06	09/19/06	09/19/06	09/19/06	9/19/06	9/19/06	9/19/06	9/19/06	9/19/06	9/19/06
			SB54	WA	EA	SB54	SB54	SB54	Pile II	Pile II	Pile II	Pile IV	Pile IV	Pile IV
Acenaphthene	50	2										0.5		
Anthracene	50	3	0.8			0.6			0.5			2.0	0.6	0.5
Benzo(a)anthracene	0.224[2]	4	***1.1***			***1.0***	***0.6***	***0.5***	0.8			***4.3***	***1.5***	***1.2***
Benzo(a)pyrene	0.061[2]	5	***0.7***			***0.8***	***0.6***	***0.5***				***3.1***	***1.2***	***1.0***
Benzo(b)fluoranthene	1.1	4	0.7			0.9	0.6	0.5				***2.9***	***1.2***	***1.0***
Benzo(g,h,i)perylene	50	6										0.1		
Benzo(k)fluoranthene	1.1	4	0.6			0.9	0.7	0.6				***3.1***	***1.4***	***1.2***
Chrysene	0.4	4	***0.9***			***1.2***	***0.7***	***0.6***	0.7			***4.5***	***1.7***	***1.4***
Dibenzo(a,h)anthracene	0.014[2]	5										***0.7***		
Fluoranthene	50	3	2.0	0.7	0.6	2.2	1.0	0.9	1.8		0.7	7.2	3.0	2.4
Fluorene	50	2	0.6									0.8		
Indeno(1,2,3-cd)pyrene	3.2	5										1.2		0.5
Naphthalene	13	2	0.7			0.5		0.5						
Phenanthrene	50	3	2.4	0.5		2.1	0.6	0.5	2.0			4.8	2.3	1.6
Pyrene	50	4	1.9	0.6	0.6	2.0	1.1	1.0	1.3			6.8	2.7	2.2
Total STARS List SVOCs	---	**NA**	**12.4**	**1.8**	**1.2**	**12.2**	**5.8**	**5.6**	**7.2**	**ND**	**0.7**	**42.0**	**15.6**	**13.0**
Total TICs SVOCs	---	**NA**	**11.4**	**1.5**	**5.1**	**10.7**	**11.7**	**11.6**	**6.1**	**2.8**	**1.4**	**44.3**	**21.2**	**15.6**
Total SVOCs	**500**	**NA**	**23.8**	**3.3**	**6.3**	**22.9**	**17.5**	**17.2**	**13.3**	**2.8**	**2.1**	**86.4**	**36.8**	**28.5**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 18 - BENCH TEST SOIL SAMPLES – SVOCs (STARS LIST plus TICs)
EPA METHOD 8270 ANALYSIS

Date Sampled: As Shown **Matrix:** Soil

Compound	Recommended Soil Cleanup Level[1] (mg/kg)	Compound Concentration (mg/kg)							
		C-1	C-2	EB-91 (Pile II)	BIO-166 (Pile II)	EB-92 (Pile IV)	BIO-164 (Pile IV)	EB-93 (Pile V)	BIO-165 (Pile V)
		07/28/06	07/28/06	08/30/06	9/19/06	08/30/06	9/19/06	08/30/06	09/19/06
Acenaphthene	50								
Anthracene	50		1.5	0.2					0.8
Benzo(a)anthracene	0.224[2]		***4.1***	***0.5***		***0.3***			***1.1***
Benzo(a)pyrene	0.061[2]		***3.0***	***0.3***		***0.3***			***0.7***
Benzo(b)fluoranthene	1.1		***2.7***	0.3		0.3			0.7
Benzo(g,h,i)perylene	50		0.8						
Benzo(k)fluoranthene	1.1		***2.6***	0.4		0.3		0.2	0.6
Chrysene	0.4		***3.7***	0.4		0.3		0.2	***0.9***
Dibenzo(a,h)anthracene	0.014[2]								
Fluoranthene	50	0.8	6.1	0.9	0.7	0.7	0.6	0.3	2.0
Fluorene	50								0.6
Indeno(1,2,3-cd)pyrene	3.2		1.1						
Naphthalene	13								0.7
Phenanthrene	50		3.9	0.6	0.5	0.5			2.4
Pyrene	50		5.5	0.66	0.6	0.62	0.6	0.35	1.9
STARS SVOCs	---	**0.8**	**35.0**	**4.1**	**1.8**	**3.4**	**1.2**	**1.0**	**12.4**
Total TICs SVOCs	---	**111.0**	**23.3**	**0.9**	**1.5**	**8.3**	**5.1**	**3.0**	**11.4**
Total SVOCs	**500**	**111.8**	**58.3**	**5.0**	**3.3**	**11.8**	**6.3**	**4.0**	**23.8**

	Sample Date:	8/15/06	9/19/06	8/15/06	9/19/06	8/15/06	9/19/06
	HPC	212 - 990 K	316 K	422 - 740 K	834 K	6 - 82 K	918 K

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

Enhanced Bio (EB) samples collected from three plastic tubs (2 cu. ft volume) with added microbes + nutrients established 08/16/06

ENVIRONMENTAL RESTORATION PROJECT
MATT PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 19 - PILOT STUDY SOIL SAMPLES–TOTAL ORGANIC CARBON EPA METHOD 9060 ANALYSIS

Matrix: Soil

Date Sampled	Results (mg/kg)			
	S-1 EAST ALLU EAST PILE	S-2 EAST ALLU WEST PILE	S-3 WEST ALLU EAST PILE	S-4 WEST ALLU WEST PILE
08/10/06	25,900	22,900	76,000	122,000
Total SVOCs	**25,900**	**22,900**	**76,000**	**122,000**

Notes:

[1] Ref: NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994 and DEC memorandum dated April 10, 2001.

[2] or Method Detection Limit (MDL)

STARS - DEC Spill Technology and Remediation Series (STARS) Memo #1 - Petroleum-Contaminated Soil Guidance Policy, dated August 1992.

--- No Recommended Cleanup Level

TICs - Tentatively identified compounds

mg/kg - milligrams per kilogram (parts per million, ppm)

Blank cells indicate ND < Not detected less than method dection limit

Compounds that exceeded Recommended Soil Cleanup Levels are denoted in ***BOLD***

Matt Petroleum Site
Table 20 - Remedial Alternative Evaluation: Cost Comparison

Alt #	Description	GW Treated?	Planning Estimate Low	Estimate	High	Cost Per Cu. Yd.	Cost Per Ton	Comment
1A	Soil Cap and Natural Attenuation	Partial		$190,000		---	---	One foot clean fill across site, pump free product from wells
1B	Soil Cap and Groundwater Treatment w/Trenches	Yes		$900,000		$22	$12	3 trenches across site to deliver H2O2, high natural soil oxidant demand likely, Add in Cap cost of Option 1A
2A	Excavate to 5', dispose, replace w/clean fill	Partial		$3,600,000		$142	$76	Significant contamination in soils below 5 feet will remain
2B	Excavate to 8', dispose, replace w/clean fill	Yes		$6,000,000		$146	$78	Successful treatment of impacted clays/heavy petroleum soils unlikely.
3A	Excavate to 5', treat onsite w/Allu bucket, replace treated soil	"		$2,100,000		$82	$44	Significant contamination in soils below 5 feet will remain
3B	Excavate to 8', treat onsite w/Allu bucket, replace treated soil	Yes		$3,300,000		$80	$43	No offsite soil disposal in cost
3C	**Excavate to 8', treat onsite w/Allu bucket, replace treated soil + 25% soil disposed**	**Yes**		**$4,300,000**		**$105**	**$56**	**RECOMMENDED ALTERNATIVE**
4A	Ex-Situ Allu Bucket soil treatment w/Hydrogen Peroxide	Yes	$4,800,000		$8,000,000	$116 - $195	$62 - $104	High natural soil oxidant demand likely
4B	Ex-Situ Allu Bucket soil treatment w/Sodium Persulfate	Yes	$8,500,000		$10,000,000	$206 - $242	$110 - $129	Sodium Persulfate Chem Ox
5	In-situ Thermal Treatment	No	$4,500,000	$5,400,000	$7,700,000	$110 - $187	$59 - $100	6-phase Elec. Resistive Heat

ENVIRONMENTAL RESTORATION PROJECT
MATT'S PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 21 - COMPARISON OF REMEDIAL ALTERNATIVES

General Method	Treatment Options	Media Treated		EFFECTIVENESS - COMPLICATIONS							Estimated Project Cost ($ Million)
		Soil	Groundwater	Protection of Environment and Public Health	Compliance with SCGs	Long Term Effectiveness	Contaminant Reduction	Short Term Effectiveness	Implementability	Community Acceptance	
2. Ex situ excavation of AOC and ZoGC soils with standard excavating equipment to target depth and backfilling with new soils.	2B. Landfill disposal of impacted soil down to and into clay (8' depth ave), replace with imported backfill	Yes	Pump GW f/excavation to onsite treatment system and release to POTW. Can add option details during design.	-Extensively removes soil contamination; treats groundwater	-Provides compliance with SCGs	-Renders site suitable for intended uses; soil foundation properties can be controlled	-Impacted soils will be removed and replaced with clean fill.	High, once soils replaced and GW treated. Field completion in 6-8 months (may exceed one construction season)	--Feasible; Potential VOC exposure/odor during construction from soils or large open excavations may require engineering control	Good. Site restored for commercial or industrial uses.	$6.0
							-Stormwater and groundwater control plans required		-Groundwater treatment will be required to avoid clean fill placement into contaminated GW		
3. Ex situ excavation of AOC and ZoGC soils with standard excavating equipment to target depth and backfilling with treated soils.	3A. **On-site treatment of the top five feet of soil in the AOC/ZoGC** with Allu Processing equipment, no soil landfill	Yes	Pump GW f/excavation to onsite treatment system and release to POTW. Can add details during design.	--Extensively treats top 5 feet of AOC/ZoGC soil to remove VOCs, petroleum odors, and visual staining.	Treatment options are able to attain SCGs for VOCs, odor, visual staining	-Renders site suitable for intended uses; soil foundation properties can be controlled	-Expect to attain SCGs for VOCs, odors, stains	Treatment will require nearly two construction seasons to complete.	Allu process demonstrated in pilot study	Endpoint is to meet SCGs in upper 5 feet of soil, acceptance could be an issue	$2.1
			-Excavating opens up groundwater for dissolved phase treatment and free product skimming	"--Residual SVOCs will be low mobility, low volatility, with high soil adsorption properties with minimal exposure potential when in ground; Institutional controls required for soil/groundwater mgmt.	--Will leave SVOC residual in succesfully treated soils, some soil (petrol saturated, clay impacted) may significantly exceed SCGs		-Limited PAHs on site, difficult to treat. Near SCGs, but some may exceed		suitable for site contaminants, space available, timeframe to complete reasonable	" " "	
	3B. **On-site treatment of all impacted soils in AOC/ZoGC** with Allu Processing equipment, no soil landfilled.	Yes	Pump GW f/excavation to onsite treatment system and release to POTW. Can add details during design.	--Extensively treats AOC/ZoGC soil to remove VOCs, petroleum odors, and visual staining; Institutional controls required for soil / groundwater mgmt.	Treatment options are able to attain SCGs for VOCs, odor, visual staining	-Renders site suitable for intended uses; soil foundation properties can be controlled	-Expect to attain SCGs for VOCs, odors, stains	Treatment will require two construction seasons to complete.	Allu process demonstrated in pilot study	Good. Site restored for commercial or industrial uses.	$3.3

ENVIRONMENTAL RESTORATION PROJECT
MATT'S PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 21 - COMPARISON OF REMEDIAL ALTERNATIVES

General Method	Treatment Options	Media Treated		EFFECTIVENESS - COMPLICATIONS							Estimated Project Cost ($ Million)
		Soil	Groundwater	Protection of Environment and Public Health	Compliance with SCGs	Long Term Effectiveness	Contaminant Reduction	Short Term Effectiveness	Implementability	Community Acceptance	
3. Ex situ excavation of AOC and ZoGC soils with standard excavating equipment to target depth and backfilling with treated soils.			-Excavating opens up groundwater for dissolved phase treatment and free product skimming	"--Residual SVOCs will be low mobility, low volatility, with high soil adsorption properties with minimal exposure potential when in ground	--Will leave SVOC residual in succesfully treated soils, some soil (petrol saturated, clay impacted) may significantly exceed SCGs		-Limited PAHs on site, difficult to treat. Near SCGs, but some may exceed		suitable for site contaminants, space available, timeframe to complete reasonable		
	3C. **On-site treatment of all impacted soils in AOC/ZoGC** with Allu Processing equipment, up to 25% soil landfilled (for	Yes	Pump GW f/excavation to onsite treatment system and release to POTW. Can add details during design.	--Extensively treats AOC/ZoGC soil to remove VOCs, petroleum odors, and visual staining; Institutional controls required for soil / groundwater mgmt.	Treatment options are able to attain SCGs for VOCs, odor, visual staining	-Renders site suitable for intended uses; soil foundation properties can be controlled; option to landfill provides flexibility to dispose and process treatable soils.	-Expect to attain SCGs for VOCs, odors, stains	Treatment will require two construction seasons to complete.	Allu process demonstrated in pilot study	Good. Site restored for commercial or industrial uses.	$4.3
			-Excavating opens up groundwater for dissolved phase treatment and free product skimming	"--Residual SVOCs will be low mobility, low volatility, with high soil adsorption properties with minimal exposure potential when in ground	--Will leave SVOC residual, may exceed but be close to SCGs	--Remedy is permanent.	-Limited PAHs on site, difficult to treat. Near SCGs, but some may exceed		suitable for site contaminants, space available, timeframe to complete reasonable		
4. Ex situ excavation of AOC / ZoGC soils with standard excavating equipment to target depth and backfilling with treated soils.	4A. **On-site treatment of all AOC/ZoGC soils** with Allu equipment; Hydrogen peroxide polishing to treat SVOC residual; up to 25% soil landfilled (saturated petroleum or clay impacted soils).	Yes	Pump GW f/excavation to onsite treatment system and release to POTW. Can add details during design.	--Extensively treats AOC/ZoGC soil to remove VOCs, petroleum odors, and visual staining; Institutional controls **may/may not** be required for soil / groundwater mgmt.	Treatment options are able to attain SCGs for VOCs, odor, visual staining, and potentially all SVOCs	-Renders site suitable for intended uses; soil foundation properties can be controlled; option to landfill provides flexibility to dispose and process treatable soils.	-Expect to attain SCGs for VOCs, odors, stains, SVOCs	Treatment will require two construction seasons to complete.	Allu process successful in Pilot Study, Chem-Ox technology well established, but mixing to bring oxidant into contact with COCs may be incomplete. Peroxide spontaneously decays whether it contacts contaminant or not.	Good. Site restored for commercial or industrial uses.	$4.8 - $8.0
			-Excavating opens up groundwater for dissolved phase treatment and free product skimming			--Remedy is permanent.			suitable for site contaminants, space available, timeframe to complete reasonable		

ENVIRONMENTAL RESTORATION PROJECT
MATT'S PETROLEUM SITE
DEC Site No. B00192-6
Leland Avenue, City of Utica, Oneida County, New York

TABLE 21 - COMPARISON OF REMEDIAL ALTERNATIVES

General Method	Treatment Options	Media Treated		EFFECTIVENESS - COMPLICATIONS							Estimated Project Cost ($ Million)
		Soil	Groundwater	Protection of Environment and Public Health	Compliance with SCGs	Long Term Effectiveness	Contaminant Reduction	Short Term Effectiveness	Implementability	Community Acceptance	
4. Ex situ excavation of AOC / ZoGC soils with standard excavating equipment to target depth and backfilling with treated soils.	4B. **On-site treatment of AOC/ZoGC soils** with Allu equipment, Sodium Persulfate polishing to treat SVOC residual, up to 25% soil landfilled (saturated petroleum or clay impacted soils).	Yes	--Pump GW f/excavation to onsite treatment system and release to POTW. Can add details during design.	--Extensively treats AOC/ZoGC soil to remove VOCs, petroleum odors, and visual staining; Institutional controls **may/may not** be required for soil / groundwater mgmt.	Treatment options are able to attain SCGs for VOCs, odor, visual staining, and potentially all SVOCs	-Renders site suitable for intended uses; soil foundation properties can be controlled; option to landfill provides flexibility to dispose and process treatable soils.	-Expect to attain SCGs for VOCs, odors, stains, SVOCs	Treatment will require two construction seasons to complete.	Allu process successful in Pilot Study, Chem-Ox technology well established, but mixing to bring oxidant into contact with COCs may be incomplete. Sodium Persulfate has much less spontaneous decay than peroxide.	Good. Site restored for commercial or industrial uses.	$8.5 - $10.0
			--Excavating opens up groundwater for dissolved phase treatment and free product skimming			--Remedy is permanent.	--Treatability study results good indicator of suitability for sodium persulfate at this site		suitable for site contaminants, space available, timeframe to complete reasonable		
In situ Methods: 5. Thermal treatment of in-place target soil profile throughout AOC /ZoGC	Soil heating with specialty thermal technology	Yes	Yes	-Effective in removing COCs; Institutional controls may/may not be required for soil / groundwater mgmt.	Able to attain SGCs when coupled with soil vapor removal technology	-Renders site suitable for intended uses; soil foundation properties intact	-site soil heterogeneities pose complexities	-Main COCs can be removed, but captured/unmobilized COC residuals may remain	-Requires an efficient capture / in-situ delivery system	Good. Site restored for commercial or industrial uses.	$4.5 - $7.7
				-Avoids large excavations and potential VOC construction exposures		--May not remove all COCs due to soil heterogeneity, but if enough heat, most are mobilized for removal out of the ground	--Need comprehensive capture system so mobilized contaminants not released into groundwater		--Proven Technology		

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TABLE 21 - COMPARISON OF REMEDIAL ALTERNATIVES

General Method	Treatment Options	Media Treated		EFFECTIVENESS - COMPLICATIONS							Estimated Project Cost ($ Million)
		Soil	Groundwater	Protection of Environment and Public Health	Compliance with SCGs	Long Term Effectiveness	Contaminant Reduction	Short Term Effectiveness	Implementability	Community Acceptance	
1. Cap / Controls	1A) Soil Cap / Monitored Natural Attenuation	No	No	--Cap provides physical contact barrier at surface; --Quick, easy implementation	Not in foreseeable future	Low, emphasize separation of comtaminants from exposure pathways	-No COC treatment or reductions provided	Good, once cap in place, site is available for development	Good, easy to install a surface cap	-Potential community acceptance problems	$0.2
				--Soil management plan required for all subsurface disturbances		--natural degradation will eventually occur	-Requires long term site monitoring and maintenance of various site controls			--site suitable for industrial uses	
				---Institutional controls required for soil mgmt, groundwater restrictions			-Construction projects will require monitoring and soil/groundwater handling plans				
	1B) Soil Cap / Passive groundwater collection trenches	No		--Cap provides physical contact barrier at surface	Not in foreseeable future	Low, emphasize separation of comtaminants from exposure pathways	-No COC treatment or reductions provided	Good, once cap in place, site is available for development	Good, easy to install surface cap and passive trench collection system	-Potential community acceptance problems; --site suitable for industrial	$0.9
				--Soil /Groundwater Management Plan required for all subsurface disturbances		--natural degradation will eventually occur	-Requires long term site monitoring and maintenance of various site controls	Ongoing groundwater treatment does not affect redevelopment			
	-- treatment of collected groundwater requiring ongoing O&M		Yes	-- prevent offsite migration of impacted groundwater	Not in foreseeable future	may require long period of ongoing O&M to collect / treat groundwater	-Construction projects will require monitoring and soil/groundwater handling plans				
Ex Situ Methods: 2. Ex situ excavation of AOC and ZoGC soils with standard excavating equipment to target depth and backfilling with clean or treated soils.	2A. Landfill disposal of impacted soil to 5' depth, replace with imported backfill	Yes	Pump GW f/excavation to onsite treatment system and release to POTW. Can add option details during design.	--Removal of upper five foot allows for most site construction without active soil management: Post remedy exposures controlled by sub-slab depressurization system, Soil Mgmt. Plan required.	-Provides COC reductions and reasonable compliance with SCGs, except for petroleum saturated or clay impacted soils	-Renders site suitable for intended uses; soil foundation properties can be controlled	"-Depth of COCs in confining bed variable; excavating to a target elevation may require "leaving some behind" or removing some unimpacted soil	High, once soils replaced and GW treated, site remedy is complete. One full construction season to complete	--Feasible; Potential VOC exposure/odor during construction from soils or large open excavations may require engineering control	Good. Site restored for commercial or industrial uses.	$3.6
				--Institutional controls required for soil mgmt, groundwater restrictions	--residual contamination remain below 5 foot depth	Soil re-contamination potential from bottom up	-Stormwater and groundwater control plans required		-Groundwater treatment will be required to avoid clean fill placement into contaminated GW		

APPENDIX A

BIOTREATABILITY STUDY REPORT

Quantum Consulting Services, Inc
11 Westwood Road, East Brunswick New Jersey 08816
Phone 732-846-3990: Fax 732-8467-5307

BIOTREABILITY STUDY REPORT CONTAMINATED SOIL MATT PETROLEUM UTICA, NEW YORK.

Prepared for

Plumley Engineering, P.C.
8232 Loop Road
Baldwinville, NY 13027

Performed by

Quantum Consulting Services Inc.
Charles F. Bruno, PhD.
Technical Director

April 24,2006

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Appendix

Quantum Consulting Services Inc.
11 Westwood Road, East Brunswick New Jersey
Phone 732-846-3990: Fax 732-846-5307

PROJECT BACKGROUND

On January 6, 2006, Quantum Consulting Services, Inc (QCSI) received three ice coolers containing 16-ounce mason jars filled with soil from collected from a site located in Utica, New York. These soil samples were collected from various test pits located on this site. In addition to the soil samples one cooler contained groundwater collected from two (2) monitoring wells. All three coolers were stored in a cool room until the equipment required to conduct the biotreatability study had been purchased and set up.

These soils were tested in a 51-day soil biotreatability study to determine the effectiveness and estimate a timeframe to successfully bioremediate the soils. The soils were collected from two areas at the site and labeled C-1 and C-2. Soils in each of these areas were collected by Plumley Engineering in early January 2006 from five locations in each of the two areas of the site and shipped to QCSI. The Biotreatability Study entailed four reactor chambers, two each with C-1 and C-2 soils. All reactors were given air, moisture, and nutrients. One each of the C-1 and C-2 reactors was also dosed with laboratory prepared bacteria to enhance the indigenous soil bacteria population.

Project procedure

On January 13, 2006, all of the mason jars containing soil from the area labeled C-1 were emptied into a large box lined with plastic. The soil in the plastic lined box was mixed and samples of the soil in this container were placed into sample bottles and sent to the to A State Certified laboratory to determine the Total Organic Carbon (TOC) and the concentration of Volatile and Semi volatile Compounds. Additional soil samples were also collected and sent to another laboratory to determine the total aerobic count. The total weight of the soil collected from these jars was 12.650 kilograms (kgs). Six kgs of this soil were placed in a small reactor labeled C-1-I. All soil in this reactor was to be biotreated with only the indigenous bacteria. Six kgs were also placed in another reactor labeled C-1-N. The soil in this reactor was to be biotreated with laboratory developed and indigenous bacteria.

All of the mason jars containing soil from the test Pits labeled C-2 were transferred into another box containing a plastic liner and mixed. The total weight of the soil from these mason jars was 13.680 kilograms. Soil samples were also placed in sample bottles and sent to the State Certified laboratory to determine the TOC and the concentration of

Volatile and Semi-Volatile compounds. Additional soil samples were sent to another laboratory to determine the total aerobic count. Six kgs of soil were weighted out and transferred to a third reactor labeled C-2-I. The soil in this reactor was to be biotreated with only indigenous bacteria. Another six kgs of soil was transferred to a fourth bioreactor. This bioreactor was labeled C-2-N. Laboratory developed bacteria were also added to the soil in this bioreactor. Each bioreactor had been with fitted with aeration system consisting of tubing that allowed air to pass through and an aerator. Lids were placed on each reactor and a tube was inserted in the top of the lid to allow air to escape. The air that escaped the bioreactor was to pass through a carbon trap. Since the system used to trap the air was undersized however, most of the air leaked out through the sides of the lids.

Since the concentration of TOC had not yet been determined no nutrients were added to the bioreactors. Only water was added to the bioreactors containing the indigenous bacteria at his time. Laboratory developed bacteria in water were added to the bioreactors labeled N.

On January 16, 2006, nutrients were added to all bioreactors. Based on the TOC concentration, nitrogen and phosphorus were added to obtain a C: N: P ration of 30:10:1. Water was added to each bioreactor to obtain a 25-30% moisture concentration

One hundred milliliters of groundwater received from MW-1and MW-16 was transferred into 3 different 250- milliliter Erlenmeyer flasks. Nitrogen and phosphorous was added to each flasks. Each flask was aerated using a rotary shaker. After five days of aeration the water in each flask was transferred to sample bottles and submitted to the laboratory to determine the concentration of volatile organics.

Sampling Procedure

On January 30, 2006, soil samples were collected from each bioreactor and submitted to the laboratory to determine the Total Petroleum Hydrocarbon (TPHC), Volatile Organic and Semi-Volatile compounds. These soil sample were labeled C-1-I-2 (Indigenous) C-1-N-2 (laboratory bacteria). Soil samples from the C-2 bioreactor were labeled C-2-I-2 and C-2-N-2. Soil samples were also collected to determine the total bacterial cell count in each bioreactor. After each sampling period the soil in each bioreactor was mixed thoroughly and the lids were placed back on to the bioreactor. Water was added to each bioreactor to maintain a 25-30 % moisture level.

On February 13 soil samples were collected from each bioreactor following the same protocol indicated in the January 30th sampling procedure. The soil samples collected were labeled C-1-I-3 (indigenous) C-1-N-3 (laboratory Bacteria), C-2- I-3 and C-2-N-3. At this time the bioremediation of the contaminated soil in all reactors had been operating for 30 days.

On March 7, 2006, after 51 days of bioremediation the final soil samples were collected and submitted to the laboratory for analysis. Again, the concentration of TPHC, Volatile Organics and Semi-Volatile organics in the soil was to be determined by the State Certified laboratory.

Sampling Schedule for Total Bacterial Count

Soil samples were collected approximately every 2 weeks from each bioreactor in addition to times when the soil was analyzed to determine the TPHC, Volatiles and Semi-Volatiles.

The pH of the soil

The pH of the soil throughout the bioremediation period was determined to be between 7.4 to 7.5. This pH range is considered to be satisfactory for bioremediation.

Temperature of Bioreactors

The temperature of the soil in the bioreactors was maintained between 65 to70°F. Originally, plans had been made to conduct this study at a temperature ranging from 70 to 75 ° F. Under aeration and the equipment and facility that had to be used to conduct this study it was not possible to maintain this temperature range. Consequently, rates at least 10% higher would have been achieved if the temperature range were 70 to 75°F. Therefore, it is recommended that the temperature range during the field study be between 75 to 80°F.

Results and Discussion

Results obtained from soil sample collected from each bioreactor are illustrated in tables 1-8. Based on the reduction in the concentration of TPHC over the 51-day period there is no doubt that indigenous bacteria present in the soil are capable of degrading the petroleum hydrocarbons in the soil. Increases in the total aerobic counts throughout the study also support the existence of petroleum degrading bacteria in the native soils (see Table A).

The bioremediation of volatile and semi-volatile organics also support active petroleum degrading microorganisms present in the soil. Unfortunately, this laboratory did not analyze some of the compounds of interest such as 1,2,4-trimethylbenzene present in the soil. However, the rate of biodegradation of these compounds should be similar to m/p Xylenes. MTBE can also be biodegraded but requires at least 4 ppm of oxygen and an energy source. Based on the analytical data obtained it is difficult to determine the rate of

biodegradation of Benzene and Toluene. Bacteria will metabolize the simplest organic compounds before biodegrading the more complicated compounds. Biodegradation of the 4-6 ring Polyaromatic hydrocarbons (PHC's) are by far the most difficult to biodegrade. The biodegradation of these compounds also requires good oxygen levels (4-5ppm). Naphthalene and 2-methylnaphthalene will be the easiest PHC to biodegrade.

Based on the analytical results many of the other PHC's were biodegraded. After the lower molecular weights are degraded an energy source such as dextrose and/or yeast extract should be periodically added to the soil. Usually 0.001 percent of each nutrient provides enough energy to allow the bacteria to biodegrade these large molecular weight compounds. An example of the bacteria needing an energy source is reflected in the analytical data obtained after 30 days of bioremediation. The lack of an increase in total counts between 02/13/06 and 02/27/06 also supports the fact that the lower molecular weight, or more readily biodegradable compounds, had been metabolized. On 02/27/06 0.001% of yeast extract and dextrose was added to each Bioreactor. In all bioreactors this lead to an increase in total aerobic count and an increase in biodegradation of some compounds. (Both of these nutrients can be purchased commercially in 50- pound bags.)

As indicated earlier in the report it was very difficult to mix the soil and prepare a homogeneous soil mixture. The soil was very wet and could not be mixed to ensure uniformity. In order to collect a good representive sample to submit to the laboratory and to determine the total bacteria count the soil in each reactor was mixed at least once per week. Some of the analytical data reported supports this problem of soil contaminant heterogeneity. The results however, still indicate that the soil was being bioremediated. There was definitely a reduction in TPHC's and the 2 and 3 ring Polyaromatic Hydrocarbons. Because the low concentration of some of the volatile organics it was more difficult to determine a significant reduction in the concentration of these contaminants. It is well known that once the contamination level becomes less the rate of biodegradation falls dramatically. Therefore, the time to biodegrade volatile organics such as benzene to the state guidance level requires a longer time especially when other more readily metabolizable substrates are available to the bacteria.

Estimated Biodegradation Rates at 75°F

1. TPHC –16-25 ppm/day
2. Benzene –based on previous experience 10ppb/day. Some loss due to flashing
3. Best rate for 2 Ring PAH 0.179ppm/day
4. Best rate for a 3 ring PAH – 0.044 ppm/day
5. Best rate for a 4 ring PAH- 0.058 ppm/day
6. Best rate for a 5 ring PAH -0.024ppm/day

7. Best rate for a 6 ring PAH- 0.019ppm/day

The above estimates are based on experience from prior soil bioremediation projects. The contaminants in soils used in these studies were more homogeneous. The soils were also dryer contained less clay and were easier to aerate. Also the bioremediation systems used in these biotreatability studies were similar to bioslurry reactors.

As stated previously the bioreactor systems used in this study simulated as closely as possible the field conditions that will be used to bioremediate this contaminated soil located at Matt Petroleum. The following estimates of the biodegradation rates for PHC's are based on the analytical data obtained on the soil samples collected and analyzed during the bioremediation of the contaminated soil in this study.

1. Best rate for a 2 ring PAH- 0.074 ppm/day
2. Best rate for a 3 ring PAH-0.05 ppm/day
3. Best rate for a 4 ring PAH –0.088 ppm/day
4. Best rate for a 5 ring PAH –0.04 ppm/day
5. Best rate for a 6 ring PAH-0.019ppm/day

Per discussion w/ Dr. Bruno 1-10 grams per ton soil can be applied

Recommendations

It is recommended that the soil located at Matt Petroleum site be turned 2-3 times per week using the clam-shell earth aerator described. Based on this data and prior experience, soil turning once per week is inadequate.. This soil is very dense and difficult to pass air through it uniformly therefore, soil chunks must be broken up. The excavator described in an important tool to loosen and break apart soils to allow for enhanced aeration.
It is recommended that you add yeast and dextrose every 8 weeks to the soil at a rate of 1 gram per ton. This addition should be made just before the soil is turned over. The ratio of C:N:P of 30:10:1 can be satisfied by using fertilizer at the start. The yeast will also be a good supply of Nitrogen and phosphate. The soil should be kept moist. Water should be sprayed on the soil at least weekly and the soil should be covered to keep the temperature between 75 to 80° F.

Maintenance of an adequate supply of oxygen, moisture, heat, and nutrients to the bacteria are critical to optimization of the bioremediation process. Treatment of 77,000 tons requires that all of these factors remain optimized, especially oxygen availability, throughout to achieve the clean-up objectives in the shortest timeframe. It is possible that the soils can be successfully treated in 12 months if proper conditions can be maintained. However, given the latitude of the site it appears likely that soil treatment would extend

through two summer seasons (May through October X 2) to attain the objectives. Oxygen maintenance for this soil volume poses a problem. Frequent soil turning (the height of the soil pile is also important, the shorter the better), use of oxygen release products, or installation of perforated piping into the soil pile all provide for enhanced oxygen availability to the microbes.

Indigenous bacteria are present in the ground water and are capable of metabolizing petroleum hydrocarbons. The addition of nitrogen and phosphate to flasks containing water from monitoring wells MW-1 and MW-16 produced excellent bacterial growth in the flasks containing nutrients after aeration for 48 hours. In the flask with no added nitrogen or phosphate there was no growth after aeration. Microscopic examination of the groundwater in the flasks containing nutrients also confirmed the presence of rod shaped bacteria. Samples of the biotreated groundwater (nutrients added with aeration) were sent to the laboratory to analyze for volatiles. Results reported however, were all non-detect.

Table #1

TPHC and Volatile Organic Compounds in C-1 soil at time 0 and after Bioremediation (Parts Per Million (ppm). Indigenous Bacteria were used for bioremediation of this soil

	BIOREACTOR				
	Time	Time	Time	Time	**Guidance Value**
	0	17days	30 days	51 days	
Compound	C-1	C-1-I-2	C-1-I-3	C-1-I-4	
1,2,4-Trimethylbenzene	Na				**10**
Benzene	0.043	0.05	0.04	0.15 U	**0.06**
Ethyl Benzene	0.253	0.31	1.2	0.22	**3**
m/p Xylenes	0.539	0.65	0.41	0.39	**1.2**
MTBE	NA				
Naphthalene	2.15		0.7		**13**
n-butylbenzene	NA				**10**
n-propylbenzene	NA				**3.7**
o-Xylene	0.056	0.08	0.17	0.99	**1.2**
4-isopropyltoluene	NA				**10**
Sec-butylbenzene	NA				**10**
Tert-Butylbenzene	NA				
Toluene	.080	0.36	0.4	0.37	**1.5**
TPHC *	1413	1056	1107	622	**1000**
Total VOC's					**10**

U Compound was analyzed but not detected at the minimum attainable detection limits.

* Guidance value based on New Jersey cleanup standard

Table #2

**TPHC and Volatile Organic Compounds in C-1 soil
At time 0 and after Bioremediation (Parts Per Million (ppm)
Both Indigenous and Laboratory Bacteria were used to
bioremediate this soil**

	BIOREACTOR				
	Time	Time	Time	Time	
	0	17days	30 days	51 days	**Guidance Value**
Compound	C-1	C-1-N-2	C-1-N-3	C-1-N-4	
1,2,4-Trimethylbenzene	Na				**10**
Benzene	0.043	0.07	0.04	0.15 U	**0.06**
Ethyl Benzene	0.253	0.48	1.2	0.22	**3**
m/p Xylenes	0.539	0.89	0.41	0.39	**1.2**
MTBE	NA				
Naphthalene	2.15	2.5	0.7		**13**
n-butylbenzene	NA				**10**
n-propylbenzene	NA				**3.7**
o-Xylene	.056	0.16	0.17	0.99	**1.2**
4-isopropyltoluene	NA				**10**
Sec-butylbenzene	NA				**10**
Tert-Butylbenzene	NA				**10**
Toluene	0.080	0.38	0.4	0.37	**1.5**
TPHC	1413	1063	~~1107~~ 1089	992	**1000**

U Compound was analyzed for but not detected U is the minimum attainable limit.

Table # 3

Concentration of Semi-Volatile Compounds in C-1 Soil Before and After Bioremediation data indicted is in Parts per Million (PPM). Only indigenous bacteria used for bioremediation of soil.

	Bioreactor	C-1-I-2	**C-1-I-3**	**C-1-I-4**	
	Time	**Time**	**Time**	**Time**	**Guidance Value**
Compound	**0**	**17 days**	**30days**	**51 days**	
Acenaphthene	1.8	0.95	1.7	0.5	**50**
Anthracene	1.3	0.50	0.8	0.41	**50**
Benzo(a)anthracene	0.99	0.48	0.63	0.5	**0.224**
Benzo(a) pyrene	0.77	0.51	0.5	0.4	**0.61**
Benzo(b)fluoranthene	0.812	0.47	0.48	0.47	**1.1**
Benzo(g,h,i) perylene	0.53	0.48	0.30	0.54	**50**
Benzo(k) fluoranthene	0.70	0.48	1.0	0.45	**1.1**
Chrysene	1.5	0.88	1.2	1.0	**0.40**
Dibenzo(a,h)anthracene	0.42	0.48	1.6	0.6	**0.014**
Fluoranthene	1.98	0.8	3.6	0.87	**50**
Fluorene	1.91	1.1	3.6	0.60	**50**
Indeneno(1,2,3-cd)pyrene	0.54	0.48	3.6	0.4	**3.2**
Naphthalene	2.1	1.5	1.5	0.46	**13**
2-Methylnaphthalene	7.8	5.3	10	3.2	**36.4**
Phenanthrene	3.6	1.9	3.7	1.6	**50**
Pyrene	2.06	1.3	2.3	2.2	**50**
4-Methylphenol	0.41	1.4	0.88	0.66	**na**
Total **SVOC's**	**28.81**	19	37	**14.2**	**500**

Table # 4

Concentration of Semi-Volatile compounds before and after Bioremediation of C-1 soil. Analytical data indicated is in Parts Per Million. Both indigenous and Laboratory developed bacteria used for bioremediation the soil

	Bioreactor	C-1-N-2	**C-1-N-3**	**C-1-N-4**	
	Time	**Time**	**Time**	**Time**	**Guidance Value**
Compound	**0**	**17 days**	**30days**	**51 days**	
Acenaphthene	1.8	1.4	1.4	0.5	**50**
Anthracene	1.3	0.68	0.98	0.41	**50**
Benzo(a)anthracene	0.99	0.73	0.11	0.5	**0.224**
Benzo(a) pyrene	0.77	0.89	0.96	2.9	**0.61**
Benzo(b)fluoranthene	0.812	0. 80	1.0	0.73	**1.1**
Benzo(g,h,i) perylene	0.53	0.11	0.78	0.71	**50**
Benzo(k) fluoranthene	0.70	0.72	0.9	0.6	**1.1**
Chrysene	1.5	~~X~~1.23	1.7	1.4	**0.40**
Dibenzo(a,h)anthracene	0.42	0.51	1.6	0.6	**0.014**
Fluoranthene	1.98	1.1	1.0	1.3	**50**
Fluorene	1.91	1.3	1.7	0.60	**50**
Indeneno(1,2,3-cd)pyrene	0.54	1.0	0.74	0.6	**3.2**
Naphthalene	2.1	2.5	1.3	0.8	**13**
2-Methylnaphthalene	7.8	8.5	6.9	4.5	**36.4**
Phenanthrene	3.6	0.511	3.7	1.8	**50**
Pyrene	2.06	1.5	2.3	2.8	**50**
4-Methylphenol	0.41	0 .51	0.48	0.66	**na**
Total SVOC's	**28.81**	24	27.6	**20.75**	**500**

Table # 5

TPHC and Volatile Organic Compounds in C-2 soil at time 0 and after Bioremediation (Parts Per Million (ppm). Indigenous Bacteria were used for bioremediation of this soil

	BIOREACTOR				
	Time	Time	Time	Time	**Guidance Value**
	0	17days	30 days	51 days	
Compound	C-2	C-2-I-2	C-2-I-3	C-2-I-4	
1,2,4-Trimethylbenzene	Na				**10**
Benzene	0.127	0.10	0.19	0.16 U	**0.06**
Ethyl Benzene	0.159	0.43	0.39	0.22	**5.5**
m/p Xylenes	0.305	1.4	1.7	0.73	**1.2**
MTBE	NA				
Naphthalene	1.6	10.53	0.7		**13**
n-butylbenzene	NA				**10**
n-propylbenzene	NA				**3.7**
o-Xylene	0.063	0.13	0.11	0.08	**1.2**
p-isopropyltoluene	NA				**10**
Sec-butylbenzene	NA				**10**
Tert-Butylbenzene	NA				**10**
Toluene	0.080	0.09	.015	0.27	**1.5**
TPHC	805	657	767	332	**1000**
Total VOC's					**10**

U Compound was analyzed but not detected at the minimum attainable detection limits.

Table #6

TPHC and Volatile Organic Compounds in C-2 soil at time 0 and after Bioremediation (Parts Per Million (ppm). Laboratory Developed and Indigenous Bacteria were used for bioremediation of this soil

	BIOREACTOR				
	Time	Time	Time	Time	**Guidance Value**
	0	17days	30 days	51 days	
Compound	C-2	C-2-N-2	C-2-N-3	C-2-N-4	
1,2,4-Trimethylbenzene					**10**
Benzene	0.127	0.03	0.07	0.16 U	**0.06**
Ethyl Benzene	0.159	0.08	0.17	0.20	**5.5**
m/p Xylenes	0.305	1.86	0.6	0.73	**1.2**
MTBE	NA				
Naphthalene	1.6	1.5	0.89		**13**
n-butylbenzene	NA				**10**
n-propylbenzene	NA				**3.7**
o-Xylene	0.063	0.04	0.046	0.08	**1.2**
4-isopropyltoluene	NA				**10**
Sec-butylbenzene	NA				**10**
Tert-Butylbenzene	NA				**10**
Toluene	0.080	0.05	0.08	0.27	**1.5**
TPHC	805	425	426	289	**1000**

U Compound was analyzed but not detected at the minimum attainable detection limits.

Table # 7

Concentration of Semi-Volatile Compounds in C-2 Soil Before and After Bioremediation data indicted is in Parts per Million (PPM). Only indigenous bacteria used for bioremediation of soil.

	Bioreactor	C-2-I-2	**C-2-I-3**	**C-2-I-4**	
	Time	**Time**	**Time**	**Time**	**Guidance Value**
Compound	**0**	**17 days**	**30days**	**51 days**	
Acenaphthene	0.4	0.93	1.7	1.3	**50**
Anthracene	2.8	0.46	0.8	1.1	**50**
Benzo(a)anthracene	4.9	0.43	0.63	1.0	**0.224**
Benzo(a) pyrene	4.8	0.51	0.5	1.1	**0.061**
Benzo(b)fluoranthene	4.7	0.47	0.48	0.8	**1.1**
Benzo(g,h,i) perylene	2.5	0.48	0.30	1.1	**50**
Benzo(k) fluoranthene	3.2	0.48	0.47	0.7	**1.1**
Chrysene	1.5	0.88	1.0	1.7	**0.40**
Dibenzo(a,h)anthracene	6.7	0.48	0.88	0.6	**0.014**
Fluoranthene	10	0.8	1.2	2.2	**50**
Fluorene	4.4	1.1	1.6	1.7	**50**
Indeneno(1,2,3-cd)pyrene	2.6	0.48	.32	1.2	**3.2**
Naphthalene	1.5	1.4	1.5	0.6	**13**
2-Methylnaphthalene	26.7	5.3	10	12.6	**36.4**
Phenanthrene	10	1.9	3.5	4.4	**50**
Pyrene	3	1.3	1.4	5.5	**50**
4-Methylphenol	0.41	0.48	0.88	0.66	**na**
Total SVOC's	**94**	16	27	**20.75**	**500**

Table # 8

Concentration of Semi-Volatile Compounds in C-2 Soil Before and After Bioremediation data indicted is in Parts per Million (PPM). Both Laboratory developed and indigenous bacteria were used for bioremediation of C-2 soil.

	Bioreactor	C-2-N-2	**C-2-N-3**	**C-2-NI-4**	
	Time	**Time**	**Time**	**Time**	**Guidance Value**
Compound	**0**	**17 days**	**30days**	**51 days**	
Acenaphthene	0.4	1.5	2.3	1.1	**50**
Anthracene	2.8	1.4	4.0	1.6	**50**
Benzo(a)anthracene	4.9	1.2	7.1	0.56	**0.224**
Benzo(a) pyrene	4.8	1.2	5.8	0.56	**0.61**
Benzo(b)fluoranthene	4.7	1.0	5.9	0.54	**1.1**
Benzo(g,h,i) perylene	2.5	0.76	3.4	1.7	**50**
Benzo(k) fluoranthene	3.2	1.0	4.2	0.43	**1.1**
Chrysene	1.5	1.4	9.4	1.6	**0.40**
Dibenzo(a,h)anthracene	6.7	0.46	0.99	0.6	**0.014**
Fluoranthene	10	3.2	1.7	3.9	**50**
Fluorene	4.4	1.1	3.1	1.8	**50**
Indeneno(1,2,3-cd)pyrene	2.6	2.0	3.3	1.7	**3.2**
Naphthalene	1.5	1.5	0.89	0.37	**13**
2-Methylnaphthalene	26.7	12.6	9.3	4.9	**36.4**
Phenanthrene	10	5.4	14.5	7.3	**50**
Pyrene	7.3	3.2	10	4.8	**50**
4-Methylphenol	0.41	0.45	0.88	0.66	**na**
Total SVOC's	**94**	39	87	**32.86**	**500**

Table A

Total Counts of Petroleum Degrading Bacteria in the Soil being bioremediation in the Four Bioreactors. Soil Samplers were collected and submitted to the laboratory on the days indicated in the table.

	Date				
Bioreactor	**01/13/06**	**01/30/06**	**02/13/06**	**02/27/06**	**03/07/06**
C-1-I	$1x10^2$	$1x10^4$	$1x10^5$	$1x10^5$	$1x10^6$
C-1-N	$1x10^4$	$1x10^5$	$1x10^6$	$1x10^6$	$1x10^7$
C-2-I	$1x10^2$	$1x10^4$	$1x10^5$	$1x10^5$	$1x10^6$
C-2-N	$1x10^4$	$1x10^5$	$1x10^6$	$1x10^6$	$1x10^7$

Total counts are based on CFU/gram

C- 1-I: C-1 soil with indigenous bacteria

C-1-N: C-1 soil with indigenous and laboratory bacteria

C-2-I: C-2 soil with indigenous bacteria

C-2-N: C-2 soil with indigenous and laboratory bacteria

Quantex Laboratories
22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Laboratory NJ ID: 12766

January 23, 2006

Quantum Consulting Services
11 Westwood Rd
East Brunswick, NJ 08816

Attn: Dr. C. Bruno

Analytical Report 2060019 Project: Plumley Engineering

This report covers the analysis of two (2) samples submitted to Quantex Laboratories on January 9, 2006. The following analyses were requested:

Total Organic Carbon (2)

Very truly yours,

Angela Menoutis

Angela Menoutis
Manager of Laboratory Services

Quantex
Laboratories

SAMPLE DESIGNATION TABLE

LAB PROJECT ID#: 2060019

Client Sample Identification	Laboratory Sample Identification
PL-C-1	2060019-01
PL-C-2	2060019-02

Quantex
Laboratories

LABORATORY DELIVERABLES CHECK LIST

LAB SDG: *2060019* PROJECT: *Plumley Engineering*

	Check if Complete
1. Cover Page, Title Page listing Laboratory Certification, Facility name and address, and date of the report.	x
2. Table of Contents	x
3. Chain of Custody.	x
4. Methodology .	x
5. Laboratory Chronicle and Holding Time Check which includes cross-referencing of sample field IDs to Lab IDs.	x
6. Conformance/ Non-Conformance Summary	n/a
7. Summary Sheets listing analytical results for all targeted and non-targeted compounds	x
8. Results submitted on a dry weight basis (if applicable)	✓
9. Method Detection Limits	x
10. Document bound, paginated and legible	x
11. Lab certified by NJDEP for parameters or appropriate category or parameters or a member of the USEPA CLP	x

Laboratory Manager

2/1/06
Date

CHAIN OF CUSTODY

Section 1

Quantex Laboratories
22 Distribution Boulevard
Edison, New Jersey 08817
(732) 248-3335 Fax: (732) 248-0912

Quantex Laboratories
CHAIN OF CUSTODY

Form COC-V Rev 2/03

Lab Project No: (FOR LAB USE ONLY) 2006019

CLIENT INFORMATION	BILLING INFORMATION
Company: Quantum Consulting Serv	Company: Same
Address: 11 Westwood Rd	Address:
City: East Brunswick	City:
State: N.J. Zip: 08816	State: Zip:
Contact: Dr. C. Bruno	Attn: PO:
Phone: 732-846-3290 Fax: 732-846-5367	Phone: Fax:
Site/Project Name: Plumley Engineering	
Case #: Mail Petroleum	
Project Manager:	

TURNAROUND TIME

PLEASE CIRCLE

Verbal/Fax: 2 Wk 1Wk* 72Hr* 48Hr* 24Hr* Other:

Conditional/TPHC by Fax: 1Wk 72Hr 48Hr* 24Hr* Other:

Hard Copy: 3 Wk 2Wk* 1Wk* 72Hr* Other:

* Prior laboratory authorization & notification required. YOU MUST NOTIFY THE LABORATORY OF ANY PRIOR AUTHORIZATION BEFORE SAMPLE ARRIVAL.

REPORT DELIVERABLES

- ☐ Results Only
- ☑ Standard
- ☐ Reduced
- ☐ Regulatory (Please Specify)
- ☐ Other

DISK DELIVERABLES

SRP Disk : ☐ .dbf or ☐ .wk1

Other: ☐ Excel ☐ Access

Comments:

ANALYSIS REQUESTED Page ____ of ____

PRESERVATIVES (Circle Number to Left)

1. HCl 2. MeOH
3. HNO_3 4. H_2SO_4
5. NaOH 6. Other

SAMPLE MATRIX: W - Water, G - Groundwater, A - Aqueous, S - Soil, SL - Sludge, SD - Solid, O - Oil, X - Other

Cooler Temp: 4 °C

SAMPLE INFORMATION

Lab ID	Sample ID	Date	Time	Matrix	Sampler	# of Container	Serial #	123 456 TOC	123 456	123 456	123 456	123 456	123 456	123 456	123 456	Comments
	PL-C-1	1/2/06	4:20	S		1		✓								
	PL-C-2	1/9/06	4:30	S		1		✓								

Relinquished By:	Received By:	Date	Time	Relinquished By:	Received By:	Date	Time
C. Bruno	[illegible]	1-9-06	4:20				

P. 4

METHODOLOGY SUMMARY

Section 2

Quantex Laboratories

Methodology Summary

Solids/Soils/Sediments/Liquids/Groundwater/Hazardous Wastes:

Total Organic Carbon -
Modified EPA Method 415.1 – Furnace Technique

Form 15-1 Rev. 12/96

LABORATORY CHRONICLE

Section 3

LABORATORY CHRONICLE

Client: Quantum Consulting Services, Inc.

Report No.: 2060019

Sampling Date: 1/9/2006

Date Received By Laboratory: 1/9/2006

Client ID	Lab Sample ID	Analysis	Prep Date	Preped By	Analysis Date	Analyst
PL-C-1	2060019-01	Total Organic Carbon			1/17/2006	ALI
PL-C-1	2060019-01	Percent Solids			1/10/2006	ALI
PL-C-2	2060019-02	Total Organic Carbon			1/17/2006	ALI
PL-C-2	2060019-02	Percent Solids			1/11/2006	ALI

TABULATED ANALYTICAL RESULTS

Section 4

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Analytical Report

Client Name: Quantum Consulting Services, Inc. **Lab Project:** 2060019
Client Project: Plumley Engineering

Client ID	Lab Sample ID	Analysis	Results	Units	PQL/MDL	Analysis date
PL-C-1	2060019-01					
		Percent Solids	79.3	%	0.1	1/10/2006
		Total Organic Carbon	47900	mg/Kg	126	1/17/2006
PL-C-2	2060019-02					
		Percent Solids	81.7	%	0.1	1/11/2006
		Total Organic Carbon	31700	mg/Kg	122	1/17/2006

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Laboratory NJ ID: 12766

January 31, 2006

Quantum Consulting Services
11 Westwood Rd
East Brunswick, NJ 08816

Attn: Dr. C. Bruno

Analytical Report 2060029 Project: Plumley – Matt Petro

This report covers the analysis of six (6) sample submitted to Quantex Laboratories on January 13, 2006. The following analyses were requested:

Total Petroleum Hydrocarbons (2)
TCL Volatile Organics (2)
TCL Semi-Volatile Organics (2)

Very truly yours,

Angela Menoutis

Angela Menoutis
Manager of Laboratory Services

Quantex
Laboratories

SAMPLE DESIGNATION TABLE

LAB PROJECT ID#: 2060029

Client Sample Identification	Laboratory Sample Identification
PL-C-1-A	2060029-01
PL-C-2-B	2060029-02
PL-C1-C	2060029-03
PL-C2-D	2060029-04
PL-C-1-E	2060029-05
PL-C-2-F	2060029-06

CHAIN OF CUSTODY

Section 1

Quantex Laboratories
22 Distribution Boulevard
Edison, New Jersey 08817
(732) 248-3335 Fax: (732) 248-0912

Quantex Laboratories
CHAIN OF CUSTODY

Form COC rev 2/03

Lab Project No: (FOR LAB USE ONLY) 2060029

CLIENT INFORMATION	BILLING INFORMATION
Company: Quantum Consulting Serv	Company:
Address: 11 Westwood Road	Address:
City: EAST BRUNSWICK	City:
State: NJ Zip: 08816	State: Zip:
Contact: Dr. C. Bruno	Attn: PO:
Phone: 732-846-3990 Fax: 732-846-5307	Phone: Fax:
Site/Project Name: Plumley - Matt Petro	Comments:
Case #	
Project Manager:	

TURNAROUND TIME — PLEASE CIRCLE

- **Verbal/Fax:** 2 Wk 1Wk* 72Hr* 48Hr* 24Hr* Other:
- **Conditional/TPHC by Fax:** 1Wk 72Hr 48Hr* 24Hr* Other:
- **Hard Copy:** 3 Wk 2Wk* 1Wk* 72Hr* Other:

* Prior laboratory authorization & notification required. YOU MUST NOTIFY THE LABORATORY OF ANY PRIOR AUTHORIZATION BEFORE SAMPLE ARRIVAL.

REPORT DELIVERABLES

- ☐ Results Only
- ☐ Standard
- ☐ Reduced
- ☐ Regulatory (Please Specify) _____
- ☐ Other

DISK DELIVERABLES

SRP Disk : ☐ .dbf or ☐ .wk1
Other: ☐ Excel ☐ Access

ANALYSIS REQUESTED Page _____ of____

SAMPLE INFORMATION

SAMPLE MATRIX
W - Water G - Groundwater A- Aqueous
S - Soil SL - Sludge SD - Solid
O - Oil X - Other

Cooler Temp: 4.0°C

Lab ID	Sample ID	Date	Time	Matrix	Sampler	# of Container	Serial #	TPHC (1 2 3 4 5 6)	TCL-VOA (1 2 3 4 5 6)	TCL semivol (1 2 3 4 5 6)	(1 2 3 4 5 6)	(1 2 3 4 5 6)	(1 2 3 4 5 6)	(1 2 3 4 5 6)	(1 2 3 4 5 6)	Comments
	PL-C-1-A	1/13/06		S	CB			✓								
	PL-C-2-B							✓								
	PL-C1-C								✓							
	PL-C2-D								✓							
	PL-C-1-E									✓						
	PL-C-2-F									✓						

PRESERVATIVES (Circle Number to Left)

1. HCl 2. MeOH
3. HNO_3 4. H_2SO_4
5. NaOH 6. Other

Relinquished By:	Received By:	Date	Time	Relinquished By:	Received By:	Date	Time
C. Bruno	[illegible]	1-13-06	1 50				

P. 3

METHODOLOGY SUMMARY

Section 2

Quantex Laboratories

Methodology Summary

Solids/Soils/Sediments/Liquids/Groundwater/Hazardous Wastes:

Volatile Organics:

Sample Prep:

SW 846, Section 1B, 3rd Ed., Method 3585: Waste Dilution for Volatile Organics
SW 846, Section 1B, 3rd Ed., Method 5000: Sample Preparation for Volatile Organic Compounds
SW 846, Section 1B, 3rd Ed., Method 5030B: Purge-and-Trap for Aqueous Samples
SW 846, Section 1B, 3rd Ed., Method 5035: Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Wastes

Analysis:

SW 846, Section 1B, 3rd Ed., 3rd Ed., Method 8260B: Determination of Volatile Organics by Purge and Trap GC/MS.

Semivolatile Organics and PAHs:

Sample Prep:

SW 846, Section 1B, 3rd Ed., Method 3500B: Organic Extraction and Sample Preparation
SW 846, Section 1B, 3rd Ed., Method 3510C: Separatory Funnel Liquid-Liquid Extraction
SW 846, Section 1B, 3rd Ed., Method 3550B: Ultrasonic Extraction
SW 846, Section 1B, 3rd Ed., Method 3580A: Waste Dilution
SW 846, Section 1B, 3rd Ed., Method 3600C: Cleanup
SW 846, Section 1B, 3rd Ed., Method 3610B: Alumina Cleanup
SW 846, Section 1B, 3rd Ed., Method 3611B: Alumina Column Cleanup and Separation of Petroleum Wastes
SW 846, Section 1B, 3rd Ed., Method 3630C: Silica Gel Cleanup
SW 846, Section 1B, 3rd Ed., Method 3650B: Acid-Base Partition Cleanup Analysis:

Analysis:

SW 846, Section 1B, 3rd Ed., Method 8270C: Determination of Semivolatile Organics by Capillary Column GC/MS

Total Petroleum Hydrocarbons:

EPA 600/4-79-020,Revised 3/83, *Methods for Chemical Analysis of Waters and Wastes*,Method 418.1, modified.

LABORATORY CHRONICLE

Section 3

LABORATORY CHRONICLE

Client: Quantum Consulting Services, Inc.

Report No.: 2060029

Sampling Date: 1/13/2006

Date Received By Laboratory: 1/13/2006

Client ID	Lab Sample ID	Analysis	Prep Date	Preped By	Analysis Date	Analyst
PL-C-1-A	2060029-01	Total Petroleum Hydrocarbons	1/16/2006	JS	1/17/2006	JS
PL-C-1-A	2060029-01	Percent Solids	1/16/2006	JS	1/16/2006	JS
PL-C-2-B	2060029-02	Total Petroleum Hydrocarbons	1/16/2006	JS	1/17/2006	JS
PL-C-2-B	2060029-02	Percent Solids	1/16/2006	JS	1/16/2006	JS
PL-C1-C	2060029-03	TCL Volatile Organics in Soil			1/19/2006	AM
PL-C2-D	2060029-04	TCL Volatile Organics in Soil			1/19/2006	AM
PL-C-1-E	2060029-05	Percent Solids	1/16/2006	JS	1/16/2006	JS
PL-C-1-E	2060029-05	TCL Semi-Volatile Organics in So	1/17/2006	SW	1/23/2006	AM
PL-C-2-F	2060029-06	Percent Solids	1/16/2006	JS	1/16/2006	JS
PL-C-2-F	2060029-06	TCL Semi-Volatile Organics in So	1/17/2006	SW	1/23/2006	AM

TABULATED ANALYTICAL RESULTS

Section 4

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Analytical Report

Client Name: Quantum Consulting Services, Inc. **Lab Project:** 2060029
Client Project: Plumley - Matt Petro

Client ID	Lab Sample ID	Analysis	Results	Units	PQL/MDL	Analysis date
PL-C-1-A	2060029-01					
		Percent Solids	79.1	%	0.1	1/16/2006
		Total Petroleum Hydrocarbons	1413	mg/Kg	16.6	1/17/2006
PL-C-2-B	2060029-02					
		Percent Solids	82.8	%	0.1	1/16/2006
		Total Petroleum Hydrocarbons	805	mg/Kg	16.6	1/17/2006
PL-C-1-E	2060029-05					
		Percent Solids	78.2	%	0.1	1/16/2006
PL-C-2-F	2060029-06					
		Percent Solids	81.2	%	0.1	1/16/2006

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060029-03
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	PL-C1-C	**GC/MS ID:**	V11262
Analysis Date:	1/19/2006	**Analysis Time:**	17:16

Compound	Results	Units	PQL
Chloromethane	43.4U	ug/Kg	43.4
Bromomethane	43.4U	ug/Kg	43.4
Vinyl Chloride	43.4U	ug/Kg	43.4
Chloroethane	43.4U	ug/Kg	43.4
Acetone	43.4U	ug/Kg	43.4
Carbon Disulfide	43.4U	ug/Kg	43.4
Methylene Chloride	43.4U	ug/Kg	43.4
1,1 Dichloroethene	43.4U	ug/Kg	43.4
trans 1,2 Dichloroethene	43.4U	ug/Kg	43.4
cis 1,2 Dichloroethene	43.4U	ug/Kg	43.4
2 Butanone	43.4U	ug/Kg	43.4
Vinyl Acetate	43.4U	ug/Kg	43.4
4 Methyl 2 pentanone	43.4U	ug/Kg	43.4
1,1 Dichloroethane	43.4U	ug/Kg	43.4
Chloroform	43.4U	ug/Kg	43.4
1,1,1 Trichloroethane	43.4U	ug/Kg	43.4
Carbon Tetrachloride	43.4U	ug/Kg	43.4
1,2 Dichloroethane	43.4U	ug/Kg	43.4
Bromodichloromethane	43.4U	ug/Kg	43.4
1,2 Dichloropropane	43.4U	ug/Kg	43.4
trans 1,3 Dichloropropene	43.4U	ug/Kg	43.4
cis 1,3 Dichloropropene	43.4U	ug/Kg	43.4
Trichloroethylene	43.4U	ug/Kg	43.4
Dibromochloromethane	43.4U	ug/Kg	43.4
1,1,2 Trichloroethane	43.4U	ug/Kg	43.4
Benzene	43.4U	ug/Kg	43.4
2 Chloroethyl Vinyl Ether	43.4U	ug/Kg	43.4
Bromoform	43.4U	ug/Kg	43.4
Tetrachloroethylene	43.4U	ug/Kg	43.4
1,1,2,2 Tetrachloroethane	43.4U	ug/Kg	43.4
Toluene	80.2	ug/Kg	43.4
Chlorobenzene	43.4U	ug/Kg	43.4
Ethyl Benzene	253	ug/Kg	43.4
M&P Xylenes	539	ug/Kg	43.4
O Xylene	56.3	ug/Kg	43.4
2 Hexanone	43.4U	ug/Kg	43.4
Styrene	43.4U	ug/Kg	43.4

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

Quantex Laboratories
22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060029-04
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	PL-C2-D	**GC/MS ID:**	V11263
Analysis Date:	1/19/2006	**Analysis Time:**	17:57

Compound	Results	Units	PQL
Chloromethane	42.2U	ug/Kg	42.2
Bromomethane	42.2U	ug/Kg	42.2
Vinyl Chloride	42.2U	ug/Kg	42.2
Chloroethane	42.2U	ug/Kg	42.2
Acetone	42.2U	ug/Kg	42.2
Carbon Disulfide	42.2U	ug/Kg	42.2
Methylene Chloride	42.2U	ug/Kg	42.2
1,1 Dichloroethene	42.2U	ug/Kg	42.2
trans 1,2 Dichloroethene	42.2U	ug/Kg	42.2
cis 1,2 Dichloroethene	42.2U	ug/Kg	42.2
2 Butanone	42.2U	ug/Kg	42.2
Vinyl Acetate	42.2U	ug/Kg	42.2
4 Methyl 2 pentanone	42.2U	ug/Kg	42.2
1,1 Dichloroethane	42.2U	ug/Kg	42.2
Chloroform	42.2U	ug/Kg	42.2
1,1,1 Trichloroethane	42.2U	ug/Kg	42.2
Carbon Tetrachloride	42.2U	ug/Kg	42.2
1,2 Dichloroethane	42.2U	ug/Kg	42.2
Bromodichloromethane	42.2U	ug/Kg	42.2
1,2 Dichloropropane	42.2U	ug/Kg	42.2
trans 1,3 Dichloropropene	42.2U	ug/Kg	42.2
cis 1,3 Dichloropropene	42.2U	ug/Kg	42.2
Trichloroethylene	42.2U	ug/Kg	42.2
Dibromochloromethane	42.2U	ug/Kg	42.2
1,1,2 Trichloroethane	42.2U	ug/Kg	42.2
Benzene	127	ug/Kg	42.2
2 Chloroethyl Vinyl Ether	42.2U	ug/Kg	42.2
Bromoform	42.2U	ug/Kg	42.2
Tetrachloroethylene	42.2U	ug/Kg	42.2
1,1,2,2 Tetrachloroethane	42.2U	ug/Kg	42.2
Toluene	48.2	ug/Kg	42.2
Chlorobenzene	42.2U	ug/Kg	42.2
Ethyl Benzene	159	ug/Kg	42.2
M&P Xylenes	305	ug/Kg	42.2
O Xylene	62.9	ug/Kg	42.2
2 Hexanone	42.2U	ug/Kg	42.2
Styrene	42.2U	ug/Kg	42.2

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060029-05
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	PL-C-1-E	**GC/MS ID:**	C01325
Analysis Date:	1/23/2006	**Analysis Time:**	2:23PM

Compound	Results	Units	PQL
Phenol	421U	ug/Kg	421
bis(2-Chloroethyl)ether	421U	ug/Kg	421
2-Chlorophenol	421U	ug/Kg	421
1,3-Dichlorobenzene	421U	ug/Kg	421
1,4-Dichlorobenzene	421U	ug/Kg	421
1,2-Dichlorobenzene	421U	ug/Kg	421
2-Methylphenol	421U	ug/Kg	421
2,2'-oxybis(1-Chloropropane)	421U	ug/Kg	421
4-Methylphenol	421U	ug/Kg	421
N-Nitroso-di-n-propylamine	421U	ug/Kg	421
Hexachloroethane	421U	ug/Kg	421
Nitrobenzene	421U	ug/Kg	421
Isophorone	421U	ug/Kg	421
2-Nitrophenol	421U	ug/Kg	421
2,4-Dimethylphenol	421U	ug/Kg	421
bis(2-Chloroethoxy)methane	421U	ug/Kg	421
2,4-Dichlorophenol	421U	ug/Kg	421
1,2,4-Trichlorobenzene	421U	ug/Kg	421
Naphthalene	2152	ug/Kg	421
4-Chloroaniline	421U	ug/Kg	421
Hexachlorobutadiene	421U	ug/Kg	421
4-Chloro-3-methylphenol	421U	ug/Kg	421
2-Methylnaphthalene	7753	ug/Kg	421
Hexachlorocyclopentadiene	421U	ug/Kg	421
2,4,6-Trichlorophenol	421U	ug/Kg	421
2,4,5-Trichlorophenol	421U	ug/Kg	421
2-Chloronaphthalene	421U	ug/Kg	421
2-Nitroaniline	421U	ug/Kg	421
Dimethylphthalate	421U	ug/Kg	421
Acenaphthylene	421U	ug/Kg	421
2,6-Dinitrotoluene	421U	ug/Kg	421
3-Nitroaniline	421U	ug/Kg	421
Acenaphthene	1842	ug/Kg	421
2,4-Dinitrophenol	421U	ug/Kg	421
4-Nitrophenol	421U	ug/Kg	421
Dibenzofuran	421U	ug/Kg	421
2,4-Dinitrotoluene	421U	ug/Kg	421

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060029-05
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	PL-C-1-E	**GC/MS ID:**	C01325
Analysis Date:	1/23/2006	**Analysis Time:**	2:23PM

Compound	Results	Units	PQL
Diethylphthalate	421U	ug/Kg	421
4-chlorophenyl-phenylether	421U	ug/Kg	421
Fluorene	1912	ug/Kg	421
4-Nitroaniline	421U	ug/Kg	421
4,6-Dinitro-2-methylphenol	421U	ug/Kg	421
N-Nitrosodiphenylamine	421U	ug/Kg	421
4-Bromophenyl-phenylether	421U	ug/Kg	421
Hexachlorobenzene	421U	ug/Kg	421
Pentachlorophenol	421U	ug/Kg	421
Phenanthrene	3617	ug/Kg	421
Anthracene	1287	ug/Kg	421
Carbazole	421U	ug/Kg	421
Di-n-butylphthalate	421U	ug/Kg	421
Fluoranthene	1983	ug/Kg	421
Pyrene	2061	ug/Kg	421
Butylbenzylphthalate	421U	ug/Kg	421
3,3'-Dichlorobenzidine	421U	ug/Kg	421
Benzo(a)anthracene	944	ug/Kg	421
Chrysene	1478	ug/Kg	421
bis(2-Ethylhexyl)phthalate	421U	ug/Kg	421
Di-n-octylphthalate	421U	ug/Kg	421
Benzo(b)fluoranthene	812	ug/Kg	421
Benzo(k)fluoranthene	702	ug/Kg	421
Benzo(a)pyrene	769	ug/Kg	421
Indeno(1,2,3-cd)pyrene	535	ug/Kg	421
Dibenz(a,h)anthracene	421U	ug/Kg	421
Benzo(g,h,i)perylene	659	ug/Kg	421

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

Quantex Laboratories 22 Distribution Boulevard, Edison, New Jersey 08817 (732) 248-3335 FAX (732) 248-0912

Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060029-06
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	PL-C-2-F	**GC/MS ID:**	C01326
Analysis Date:	1/23/2006	**Analysis Time:**	3:15PM

Compound	Results	Units	PQL
Phenol	403U	ug/Kg	403
bis(2-Chloroethyl)ether	403U	ug/Kg	403
2-Chlorophenol	403U	ug/Kg	403
1,3-Dichlorobenzene	403U	ug/Kg	403
1,4-Dichlorobenzene	403U	ug/Kg	403
1,2-Dichlorobenzene	403U	ug/Kg	403
2-Methylphenol	403U	ug/Kg	403
2,2'-oxybis(1-Chloropropane)	403U	ug/Kg	403
4-Methylphenol	403U	ug/Kg	403
N-Nitroso-di-n-propylamine	403U	ug/Kg	403
Hexachloroethane	403U	ug/Kg	403
Nitrobenzene	403U	ug/Kg	403
Isophorone	403U	ug/Kg	403
2-Nitrophenol	403U	ug/Kg	403
2,4-Dimethylphenol	403U	ug/Kg	403
bis(2-Chloroethoxy)methane	403U	ug/Kg	403
2,4-Dichlorophenol	403U	ug/Kg	403
1,2,4-Trichlorobenzene	403U	ug/Kg	403
Naphthalene	1580	ug/Kg	403
4-Chloroaniline	403U	ug/Kg	403
Hexachlorobutadiene	403U	ug/Kg	403
4-Chloro-3-methylphenol	403U	ug/Kg	403
2-Methylnaphthalene	26636E	ug/Kg	403
Hexachlorocyclopentadiene	403U	ug/Kg	403
2,4,6-Trichlorophenol	403U	ug/Kg	403
2,4,5-Trichlorophenol	403U	ug/Kg	403
2-Chloronaphthalene	403U	ug/Kg	403
2-Nitroaniline	403U	ug/Kg	403
Dimethylphthalate	403U	ug/Kg	403
Acenaphthylene	403U	ug/Kg	403
2,6-Dinitrotoluene	403U	ug/Kg	403
3-Nitroaniline	403U	ug/Kg	403
Acenaphthene	403U	ug/Kg	403
2,4-Dinitrophenol	403U	ug/Kg	403
4-Nitrophenol	403U	ug/Kg	403
Dibenzofuran	403U	ug/Kg	403
2,4-Dinitrotoluene	403U	ug/Kg	403

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060029-06
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	PL-C-2-F	**GC/MS ID:**	C01326
Analysis Date:	1/23/2006	**Analysis Time:**	3:15PM

Compound	Results	Units	PQL
Diethylphthalate	403U	ug/Kg	403
4-chlorophenyl-phenylether	403U	ug/Kg	403
Fluorene	4314	ug/Kg	403
4-Nitroaniline	403U	ug/Kg	403
4,6-Dinitro-2-methylphenol	403U	ug/Kg	403
N-Nitrosodiphenylamine	403U	ug/Kg	403
4-Bromophenyl-phenylether	403U	ug/Kg	403
Hexachlorobenzene	403U	ug/Kg	403
Pentachlorophenol	403U	ug/Kg	403
Phenanthrene	10120E	ug/Kg	403
Anthracene	2757	ug/Kg	403
Carbazole	820	ug/Kg	403
Di-n-butylphthalate	403U	ug/Kg	403
Fluoranthene	10039E	ug/Kg	403
Pyrene	7282	ug/Kg	403
Butylbenzylphthalate	403U	ug/Kg	403
3,3'-Dichlorobenzidine	403U	ug/Kg	403
Benzo(a)anthracene	4949	ug/Kg	403
Chrysene	6664	ug/Kg	403
bis(2-Ethylhexyl)phthalate	403U	ug/Kg	403
Di-n-octylphthalate	403U	ug/Kg	403
Benzo(b)fluoranthene	4753	ug/Kg	403
Benzo(k)fluoranthene	3262	ug/Kg	403
Benzo(a)pyrene	4782	ug/Kg	403
Indeno(1,2,3-cd)pyrene	2609	ug/Kg	403
Dibenz(a,h)anthracene	872	ug/Kg	403
Benzo(g,h,i)perylene	2531	ug/Kg	403

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
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Laboratory NJ ID: 12766

February 14, 2006

Quantum Consulting Services
11 Westwood Rd
East Brunswick, NJ 08816

Attn: Dr. C. Bruno

Analytical Report 2060054 Project: Plumley – Matt Petro

This report covers the analysis of eleven (11) samples submitted to Quantex Laboratories on January 30, 2006. The following analyses were requested:

Total Petroleum Hydrocarbons (4)
TCL Volatile Organics + Search (4)
TCL Semi-Volatile Organics + Search (4)
PP Volatile Organics + Search (3)

Very truly yours,

Angela Menoutis
Manager of Laboratory Services

Quantex Laboratories
22 Distrib[illegible] Boulevard
Edison, N[illegible]ersey 08817
(732) 248-3335 Fax: (732) 248-0912

Quantex Laboratories
CHA[illegible] OF CUSTODY

Form [illegible] Rev 2/03

Lab Project No: (FOR LAB USE ONLY)
2060054

CLIENT INFORMATION	BILLING INFORMATION	TURNAROUND TIME	REPORT DELIVERABLES
Company: Quantum Consulting	Company:	PLEASE CIRCLE **Verbal/Fax** 2 Wk 1Wk* 72Hr* 48Hr* 24Hr* Other:	☐ Results Only ☐ Standard ☐ Reduced ☐ Regulatory (Please Specify) _____ ☐ Other
Address: 11 Westwood Rd	Address:	**Conditional/TPHC by Fax** 1Wk 72Hr 48Hr* 24Hr* Other:	**DISK DELIVERABLES** SRP Disk : ☐ .dbf or ☐ .wk1 Other: ☐ Excel ☐ Access
City: East Brunswick	City:	**Hard Copy** 3 Wk 2Wk* 1Wk* 72Hr* Other:	
State: N.J. Zip: 08816	State: Zip:	* Prior laboratory authorization & notification required. YOU MUST NOTIFY THE LABORATORY OF ANY PRIOR AUTHORIZATION BEFORE SAMPLE ARRIVAL.	
Contact: Dr. C. Bruno	Attn: PO:		
Phone: 732-846-3500 Fax: 732-846-5357	Phone: Fax:		

Site/Project Name: Plumley - Hunt Potts

Case #

Project Manager:

Comments:

ANALYSIS REQUESTED Page _____ of _____

SAMPLE MATRIX
W - Water G - Groundwater A- Aqueous
S - Soil SL - Sludge SD - Solid
O - Oil X - Other

Cooler Temp: 4 °C

PRESERVATIVES (Circle Number to Left)
1. HCl 2. MeOH
3. HNO_3 4. H_2SO_4
5. NaOH 6. Other

SAMPLE INFORMATION

Lab ID	Sample ID	Date	Time	Matrix	Sampler	# of Container	Serial #	123 456 TPHC	123 456 Tal Sulf	123 456 TCL-VOST	123 456 VOST	123 456	123 456	123 456	123 456	Comments
1	C-2 I-2	1/3/06	2P	S	CB	1		✓	✓							
2	C-1 N-2							✓	✓							
3	C-2 N-2							✓	✓							
4	C-1 I-2							✓	✓							
5	C-2 I-2									✓						
6	C-2 N-2									✓						
7	C-1 I-2									✓						
8	MW-1-16TN			W		2					✓					
9	MW-1-16C			W		2					✓					
10	MW-1-16TI			W		2					✓					
11	~~MW~~ C-1 N-2			S		1				✓						per Dr. Bruno

Relinquished By:	Received By:	Date	Time	Relinquished By:	Received By:	Date	Time
C. Bruno	[illegible]	1-30-06	330				

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Analytical Report

Client Name: Quantum Consulting Services, Inc. **Lab Project:** 2060054
Client Project: Plumley - Matt Petro

Client ID	Lab Sample ID	Analysis	Results	Units	PQL/MDL	Analysis date
C-2 I2	2060054-01					
		Percent Solids	71.0	%	0.1	2/1/2006
		Total Petroleum Hydrocarbons	657	mg/Kg	16.6	2/1/2006
C-1 N-2	2060054-02					
		Percent Solids	65.2	%	0.1	2/1/2006
		Total Petroleum Hydrocarbons	1063	mg/Kg	16.6	2/1/2006
C-2 N-2	2060054-03					
		Percent Solids	73.1	%	0.1	2/1/2006
		Total Petroleum Hydrocarbons	415	mg/Kg	16.6	2/1/2006
C-1 I-2	2060054-04					
		Percent Solids	68.8	%	0.1	2/1/2006
		Total Petroleum Hydrocarbons	1056	mg/Kg	16.6	2/1/2006
C-2 I-2	2060054-05					
		Percent Solids	72.1	%	0.1	2/1/2006
C-2 N-2	2060054-06					
		Percent Solids	68.1	%	0.1	2/1/2006
C-1 I-2	2060054-07					
		Percent Solids	72.5	%	0.1	2/1/2006
C-1 N-2	2060054-11					
		Percent Solids	67.4	%	0.1	2/1/2006

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-05
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-2 I-2	**GC/MS ID:**	V11292
Analysis Date:	1/31/2006	**Analysis Time:**	19:30

Compound	Results	Units	PQL
Chloromethane	68U	ug/Kg	68
Bromomethane	68U	ug/Kg	68
Vinyl Chloride	68U	ug/Kg	68
Chloroethane	68U	ug/Kg	68
Acetone	68U	ug/Kg	68
Carbon Disulfide	68U	ug/Kg	68
Methylene Chloride	68U	ug/Kg	68
1,1 Dichloroethene	68U	ug/Kg	68
trans 1,2 Dichloroethene	68U	ug/Kg	68
cis 1,2 Dichloroethene	68U	ug/Kg	68
2 Butanone	68U	ug/Kg	68
Vinyl Acetate	68U	ug/Kg	68
4 Methyl 2 pentanone	68U	ug/Kg	68
1,1 Dichloroethane	68U	ug/Kg	68
Chloroform	68U	ug/Kg	68
1,1,1 Trichloroethane	68U	ug/Kg	68
Carbon Tetrachloride	68U	ug/Kg	68
1,2 Dichloroethane	68U	ug/Kg	68
Bromodichloromethane	68U	ug/Kg	68
1,2 Dichloropropane	68U	ug/Kg	68
trans 1,3 Dichloropropene	68U	ug/Kg	68
cis 1,3 Dichloropropene	68U	ug/Kg	68
Trichloroethylene	68U	ug/Kg	68
Dibromochloromethane	68U	ug/Kg	68
1,1,2 Trichloroethane	68U	ug/Kg	68
Benzene	106	ug/Kg	68
2 Chloroethyl Vinyl Ether	68U	ug/Kg	68
Bromoform	68U	ug/Kg	68
Tetrachloroethylene	68U	ug/Kg	68
1,1,2,2 Tetrachloroethane	68U	ug/Kg	68
Toluene	95.5	ug/Kg	68
Chlorobenzene	68U	ug/Kg	68
Ethyl Benzene	428	ug/Kg	68
M&P Xylenes	1423	ug/Kg	68
O Xylene	132	ug/Kg	68
2 Hexanone	68U	ug/Kg	68
Styrene	68U	ug/Kg	68

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E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060054-5

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-5

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11292.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 01/31/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000763-29-1	1-Pentene, 2-methyl-	9.51	4700	JN
2. 000108-87-2	Cyclohexane, methyl-	11.43	5900	JN
3. 000933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	19.67	4100	JN
4. 000527-53-7	Benzene, 1,2,3,5-tetramethyl-	20.30	4100	JN
5. 000767-99-7	Benzene, (1-methyl-1-propenyl)-,	21.04	6900	JN
6. 017301-22-3	Undecane, 2,5-dimethyl-	21.31	4100	JN
7. 017057-82-8	1H-Indene, 2,3-dihydro-1,2-dimet	21.80	3900	JN
8. 006682-71-9	1H-Indene, 2,3-dihydro-4,7-dimet	22.93	4800	JN
9. 000091-57-6	Naphthalene, 2-methyl-	23.75	8900	JN
10. 000090-12-0	Naphthalene, 1-methyl-	24.07	6500	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-06
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-2 N-2	**GC/MS ID:**	V11293
Analysis Date:	1/31/2006	**Analysis Time:**	20:15

Compound	Results	Units	PQL
Chloromethane	52.5U	ug/Kg	52.5
Bromomethane	52.5U	ug/Kg	52.5
Vinyl Chloride	52.5U	ug/Kg	52.5
Chloroethane	52.5U	ug/Kg	52.5
Acetone	52.5U	ug/Kg	52.5
Carbon Disulfide	52.5U	ug/Kg	52.5
Methylene Chloride	52.5U	ug/Kg	52.5
1,1 Dichloroethene	52.5U	ug/Kg	52.5
trans 1,2 Dichloroethene	52.5U	ug/Kg	52.5
cis 1,2 Dichloroethene	52.5U	ug/Kg	52.5
2 Butanone	52.5U	ug/Kg	52.5
Vinyl Acetate	52.5U	ug/Kg	52.5
4 Methyl 2 pentanone	52.5U	ug/Kg	52.5
1,1 Dichloroethane	52.5U	ug/Kg	52.5
Chloroform	52.5U	ug/Kg	52.5
1,1,1 Trichloroethane	52.5U	ug/Kg	52.5
Carbon Tetrachloride	52.5U	ug/Kg	52.5
1,2 Dichloroethane	52.5U	ug/Kg	52.5
Bromodichloromethane	52.5U	ug/Kg	52.5
1,2 Dichloropropane	52.5U	ug/Kg	52.5
trans 1,3 Dichloropropene	52.5U	ug/Kg	52.5
cis 1,3 Dichloropropene	52.5U	ug/Kg	52.5
Trichloroethylene	52.5U	ug/Kg	52.5
Dibromochloromethane	52.5U	ug/Kg	52.5
1,1,2 Trichloroethane	52.5U	ug/Kg	52.5
Benzene	32.6J	ug/Kg	52.5
2 Chloroethyl Vinyl Ether	52.5U	ug/Kg	52.5
Bromoform	52.5U	ug/Kg	52.5
Tetrachloroethylene	52.5U	ug/Kg	52.5
1,1,2,2 Tetrachloroethane	52.5U	ug/Kg	52.5
Toluene	50.5J	ug/Kg	52.5
Chlorobenzene	52.5U	ug/Kg	52.5
Ethyl Benzene	84.2	ug/Kg	52.5
M&P Xylenes	186	ug/Kg	52.5
O Xylene	47.3J	ug/Kg	52.5
2 Hexanone	52.5U	ug/Kg	52.5
Styrene	52.5U	ug/Kg	52.5

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060054-6

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-6

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11293.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 01/31/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000095-93-2	Benzene, 1,2,4,5-tetramethyl-	20.30	840	JN
2. 000767-99-7	Benzene, (1-methyl-1-propenyl)-,	21.04	1900	JN
3. 017301-23-4	Undecane, 2,6-dimethyl-	21.31	1300	JN
4. 062108-25-2	Decane, 2,6,7-trimethyl-	22.22	950	JN
5. 000101-39-3	2-Propenal, 2-methyl-3-phenyl-	22.34	880	JN
6. 017057-82-8	1H-Indene, 2,3-dihydro-1,2-dimet	22.93	1900	JN
7. 000090-12-0	Naphthalene, 1-methyl-	23.75	5300	JN
8. 000091-57-6	Naphthalene, 2-methyl-	24.07	3100	JN
9. 000581-40-8	Naphthalene, 2,3-dimethyl-	25.60	2500	JN
10. 000575-43-9	Naphthalene, 1,6-dimethyl-	25.92	1600	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-07
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-1 I-2	**GC/MS ID:**	V11294
Analysis Date:	1/31/2006	**Analysis Time:**	21:01

Compound	Results	Units	PQL
Chloromethane	49.3U	ug/Kg	49.3
Bromomethane	49.3U	ug/Kg	49.3
Vinyl Chloride	49.3U	ug/Kg	49.3
Chloroethane	49.3U	ug/Kg	49.3
Acetone	49.3U	ug/Kg	49.3
Carbon Disulfide	49.3U	ug/Kg	49.3
Methylene Chloride	49.3U	ug/Kg	49.3
1,1 Dichloroethene	49.3U	ug/Kg	49.3
trans 1,2 Dichloroethene	49.3U	ug/Kg	49.3
cis 1,2 Dichloroethene	49.3U	ug/Kg	49.3
2 Butanone	49.3U	ug/Kg	49.3
Vinyl Acetate	49.3U	ug/Kg	49.3
4 Methyl 2 pentanone	49.3U	ug/Kg	49.3
1,1 Dichloroethane	49.3U	ug/Kg	49.3
Chloroform	49.3U	ug/Kg	49.3
1,1,1 Trichloroethane	49.3U	ug/Kg	49.3
Carbon Tetrachloride	49.3U	ug/Kg	49.3
1,2 Dichloroethane	49.3U	ug/Kg	49.3
Bromodichloromethane	49.3U	ug/Kg	49.3
1,2 Dichloropropane	49.3U	ug/Kg	49.3
trans 1,3 Dichloropropene	49.3U	ug/Kg	49.3
cis 1,3 Dichloropropene	49.3U	ug/Kg	49.3
Trichloroethylene	49.3U	ug/Kg	49.3
Dibromochloromethane	49.3U	ug/Kg	49.3
1,1,2 Trichloroethane	49.3U	ug/Kg	49.3
Benzene	49.3U	ug/Kg	49.3
2 Chloroethyl Vinyl Ether	49.3U	ug/Kg	49.3
Bromoform	49.3U	ug/Kg	49.3
Tetrachloroethylene	49.3U	ug/Kg	49.3
1,1,2,2 Tetrachloroethane	49.3U	ug/Kg	49.3
Toluene	386	ug/Kg	49.3
Chlorobenzene	49.3U	ug/Kg	49.3
Ethyl Benzene	309	ug/Kg	49.3
M&P Xylenes	645	ug/Kg	49.3
O Xylene	85.4	ug/Kg	49.3
2 Hexanone	49.3U	ug/Kg	49.3
Styrene	49.3U	ug/Kg	49.3

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J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060054-7

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-7

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11294.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 01/31/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000096-14-0	Pentane, 3-methyl-	7.24	4400	JN
2. 000096-37-7	Cyclopentane, methyl-	8.37	2400	JN
3. 000110-82-7	Cyclohexane	9.55	2900	JN
4. 000108-87-2	Cyclohexane, methyl-	11.43	2400	JN
5. 000111-65-9	Octane	13.34	2400	JN
6. 004923-77-7	Cyclohexane, 1-ethyl-2-methyl-,	15.59	1800	JN
7. 000620-14-4	Benzene, 1-ethyl-3-methyl-	18.07	1800	JN
8. 000934-80-5	Benzene, 4-ethyl-1,2-dimethyl-	19.15	1700	JN
9. 001587-04-8	Benzene, 1-methyl-2-(2-propenyl	21.06	2200	JN
10. 000091-57-6	Naphthalene, 2-methyl-	23.77	1900	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-11
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-1 N-2	**GC/MS ID:**	V11295
Analysis Date:	1/31/2006	**Analysis Time:**	21:47

Compound	Results	Units	PQL
Chloromethane	74.9U	ug/Kg	74.9
Bromomethane	74.9U	ug/Kg	74.9
Vinyl Chloride	74.9U	ug/Kg	74.9
Chloroethane	74.9U	ug/Kg	74.9
Acetone	74.9U	ug/Kg	74.9
Carbon Disulfide	74.9U	ug/Kg	74.9
Methylene Chloride	74.9U	ug/Kg	74.9
1,1 Dichloroethene	74.9U	ug/Kg	74.9
trans 1,2 Dichloroethene	74.9U	ug/Kg	74.9
cis 1,2 Dichloroethene	74.9U	ug/Kg	74.9
2 Butanone	74.9U	ug/Kg	74.9
Vinyl Acetate	74.9U	ug/Kg	74.9
4 Methyl 2 pentanone	74.9U	ug/Kg	74.9
1,1 Dichloroethane	74.9U	ug/Kg	74.9
Chloroform	74.9U	ug/Kg	74.9
1,1,1 Trichloroethane	74.9U	ug/Kg	74.9
Carbon Tetrachloride	74.9U	ug/Kg	74.9
1,2 Dichloroethane	74.9U	ug/Kg	74.9
Bromodichloromethane	74.9U	ug/Kg	74.9
1,2 Dichloropropane	74.9U	ug/Kg	74.9
trans 1,3 Dichloropropene	74.9U	ug/Kg	74.9
cis 1,3 Dichloropropene	74.9U	ug/Kg	74.9
Trichloroethylene	74.9U	ug/Kg	74.9
Dibromochloromethane	74.9U	ug/Kg	74.9
1,1,2 Trichloroethane	74.9U	ug/Kg	74.9
Benzene	74.9U	ug/Kg	74.9
2 Chloroethyl Vinyl Ether	74.9U	ug/Kg	74.9
Bromoform	74.9U	ug/Kg	74.9
Tetrachloroethylene	74.9U	ug/Kg	74.9
1,1,2,2 Tetrachloroethane	74.9U	ug/Kg	74.9
Toluene	110	ug/Kg	74.9
Chlorobenzene	74.9U	ug/Kg	74.9
Ethyl Benzene	484	ug/Kg	74.9
M&P Xylenes	887	ug/Kg	74.9
O Xylene	159	ug/Kg	74.9
2 Hexanone	74.9U	ug/Kg	74.9
Styrene	74.9U	ug/Kg	74.9

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J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060054-11

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-11

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11295.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 01/31/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000110-54-3	Hexane	7.22	4800	JN
2. 000111-65-9	Octane	13.34	5500	JN
3. 004926-78-7	Cyclohexane, 1-ethyl-4-methyl-,	15.57	4900	JN
4. 000095-36-3	1,2,4-Trimethylbenzene	18.07	7800	JN
5. 000527-84-4	Benzene, 1-methyl-2-(1-methylet	19.15	7300	JN
6. 000934-80-5	Benzene, 4-ethyl-1,2-dimethyl-	19.69	5900	JN
7. 000768-49-0	Benzene, (2-methyl-1-propenyl)-	19.88	4900	JN
8. 000488-23-3	Benzene, 1,2,3,4-tetramethyl-	20.32	5200	JN
9. 000874-35-1	1H-Indene, 2,3-dihydro-5-methyl-	21.06	8200	JN
10. 000091-57-6	Naphthalene, 2-methyl-	23.78	6800	JN

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Tabulated Analytical Report For Priority Pollutant Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-08
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	MW-1-16TN	**GC/MS ID:**	V11283
Analysis Date:	1/31/2006	**Analysis Time:**	00:57

Compound	Results	Units	PQL
Chloromethane	1U	ug/L	1
Bromomethane	1U	ug/L	1
Vinyl Chloride	1U	ug/L	1
Chloroethane	1U	ug/L	1
Methylene Chloride	1U	ug/L	1
1,1-Dichloroethene	1U	ug/L	1
1,1-Dichloroethane	1U	ug/L	1
cis-1,2-Dichloroethene	1U	ug/L	1
trans-1,2- Dichloroethene	1U	ug/L	1
Chloroform	1U	ug/L	1
1,2-Dichloroethane	1U	ug/L	1
1,1,1-Trichloroethane	1U	ug/L	1
Carbon Tetrachloride	1U	ug/L	1
Bromodichloromethane	1U	ug/L	1
1,2-Dichloropropane	1U	ug/L	1
trans-1,3-Dichloropropene	1U	ug/L	1
Trichloroethylene	1U	ug/L	1
Dibromochloromethane	1U	ug/L	1
1,1,2-Trichloroethane	1U	ug/L	1
Benzene	1U	ug/L	1
cis-1,3-Dichloropropene	1U	ug/L	1
2-Chloroethyl Vinyl Ether	1U	ug/L	1
Bromoform	1U	ug/L	1
Tetrachloroethylene	1U	ug/L	1
1,1,2,2-Tetrachloroethane	1U	ug/L	1
Toluene	1U	ug/L	1
Chlorobenzene	1U	ug/L	1
Ethyl Benzene	1U	ug/L	1
Total Xylenes	1U	ug/L	1
1, 3-Dichlorobenzene	1U	ug/L	1
1, 4-Dichlorobenzene	1U	ug/L	1
1, 2-Dichlorobenzene	1U	ug/L	1

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060054-8

Lab Name: QUANTEX LABS Contract: _____

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

Matrix: (soil/water) WATER Lab Sample ID: 2060054-8

Sample wt/vol: 1.0 (g/ml) ML Lab File ID: V11283.D

Level: (low/med) LOW Date Received: _____

% Moisture: not dec. _____ Date Analyzed: 01/31/06

GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q

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Tabulated Analytical Report For Priority Pollutant Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-09
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	MW-1-16C	**GC/MS ID:**	V11284
Analysis Date:	1/31/2006	**Analysis Time:**	1:39

Compound	Results	Units	PQL
Chloromethane	1U	ug/L	1
Bromomethane	1U	ug/L	1
Vinyl Chloride	1U	ug/L	1
Chloroethane	1U	ug/L	1
Methylene Chloride	1U	ug/L	1
1,1-Dichloroethene	1U	ug/L	1
1,1-Dichloroethane	1U	ug/L	1
cis-1,2-Dichloroethene	1U	ug/L	1
trans-1,2- Dichloroethene	1U	ug/L	1
Chloroform	1U	ug/L	1
1,2-Dichloroethane	1U	ug/L	1
1,1,1-Trichloroethane	1U	ug/L	1
Carbon Tetrachloride	1U	ug/L	1
Bromodichloromethane	1U	ug/L	1
1,2-Dichloropropane	1U	ug/L	1
trans-1,3-Dichloropropene	1U	ug/L	1
Trichloroethylene	1U	ug/L	1
Dibromochloromethane	1U	ug/L	1
1,1,2-Trichloroethane	1U	ug/L	1
Benzene	1U	ug/L	1
cis-1,3-Dichloropropene	1U	ug/L	1
2-Chloroethyl Vinyl Ether	1U	ug/L	1
Bromoform	1U	ug/L	1
Tetrachloroethylene	1U	ug/L	1
1,1,2,2-Tetrachloroethane	1U	ug/L	1
Toluene	1U	ug/L	1
Chlorobenzene	1U	ug/L	1
Ethyl Benzene	1U	ug/L	1
Total Xylenes	1U	ug/L	1
1, 3-Dichlorobenzene	1U	ug/L	1
1, 4-Dichlorobenzene	1U	ug/L	1
1, 2-Dichlorobenzene	1U	ug/L	1

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060054-9

Lab Name: QUANTEX LABS Contract: _____

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

Matrix: (soil/water) WATER Lab Sample ID: 2060054-9

Sample wt/vol: 1.0 (g/ml) ML Lab File ID: V11284.D

Level: (low/med) LOW Date Received: _____

% Moisture: not dec. _____ Date Analyzed: 01/31/06

GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 5

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000624-92-0	Disulfide, dimethyl	12.57	3	JN
2. 054833-23-7	Eicosane, 10-methyl-	22.23	1	JN
3. 017312-81-1	Undecane, 3,5-dimethyl-	22.63	3	JN
4. 062016-34-6	Octane, 2,3,7-trimethyl-	23.85	1	JN
5. 001560-89-0	Heptadecane, 2-methyl-	24.16	3	JN

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Tabulated Analytical Report For Priority Pollutant Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-10
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	MW-1-16TI	**GC/MS ID:**	V11285
Analysis Date:	1/31/2006	**Analysis Time:**	2:21

Compound	Results	Units	PQL
Chloromethane	1U	ug/L	1
Bromomethane	1U	ug/L	1
Vinyl Chloride	1U	ug/L	1
Chloroethane	1U	ug/L	1
Methylene Chloride	1U	ug/L	1
1,1-Dichloroethene	1U	ug/L	1
1,1-Dichloroethane	1U	ug/L	1
cis-1,2-Dichloroethene	1U	ug/L	1
trans-1,2- Dichloroethene	1U	ug/L	1
Chloroform	1U	ug/L	1
1,2-Dichloroethane	1U	ug/L	1
1,1,1-Trichloroethane	1U	ug/L	1
Carbon Tetrachloride	1U	ug/L	1
Bromodichloromethane	1U	ug/L	1
1,2-Dichloropropane	1U	ug/L	1
trans-1,3-Dichloropropene	1U	ug/L	1
Trichloroethylene	1U	ug/L	1
Dibromochloromethane	1U	ug/L	1
1,1,2-Trichloroethane	1U	ug/L	1
Benzene	1U	ug/L	1
cis-1,3-Dichloropropene	1U	ug/L	1
2-Chloroethyl Vinyl Ether	1U	ug/L	1
Bromoform	1U	ug/L	1
Tetrachloroethylene	1U	ug/L	1
1,1,2,2-Tetrachloroethane	1U	ug/L	1
Toluene	1U	ug/L	1
Chlorobenzene	1U	ug/L	1
Ethyl Benzene	1U	ug/L	1
Total Xylenes	1U	ug/L	1
1, 3-Dichlorobenzene	1U	ug/L	1
1, 4-Dichlorobenzene	1U	ug/L	1
1, 2-Dichlorobenzene	1U	ug/L	1

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060054-10

Lab Name: QUANTEX LABS Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 2060054-10

Sample wt/vol: 1.0 (g/ml) ML Lab File ID: V11285.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. Date Analyzed: 01/31/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000108-67-8	Benzene, 1,3,5-trimethyl-	18.02	62	JN
2. 000300-57-2	Benzene, 2-propenyl-	18.96	67	JN
3. 000934-74-7	Benzene, 1-ethyl-3,5-dimethyl-	19.53	44	JN
4. 002870-04-4	Benzene, 2-ethyl-1,3-dimethyl-	19.70	49	JN
5. 027133-93-3	2,3-Dihydro-1-methylindene	19.87	46	JN
6. 000095-93-2	Benzene, 1,2,4,5-tetramethyl-	20.39	47	JN
7. 002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	21.04	150	JN
8. 056253-64-6	Benzene, (2-methyl-1-butenyl)-	22.95	41	JN
9. 000090-12-0	Naphthalene, 1-methyl-	23.75	59	JN
10. 000091-57-6	Naphthalene, 2-methyl-	24.06	52	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-01
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-2 I2	**GC/MS ID:**	C01355
Analysis Date:	2/9/2006	**Analysis Time:**	3:06PM

Compound	Results	Units	PQL
Phenol	469U	ug/Kg	469
bis(2-Chloroethyl)ether	469U	ug/Kg	469
2-Chlorophenol	469U	ug/Kg	469
1,3-Dichlorobenzene	469U	ug/Kg	469
1,4-Dichlorobenzene	469U	ug/Kg	469
1,2-Dichlorobenzene	469U	ug/Kg	469
2-Methylphenol	469U	ug/Kg	469
2,2'-oxybis(1-Chloropropane)	469U	ug/Kg	469
4-Methylphenol	1418	ug/Kg	469
N-Nitroso-di-n-propylamine	469U	ug/Kg	469
Hexachloroethane	469U	ug/Kg	469
Nitrobenzene	469U	ug/Kg	469
Isophorone	469U	ug/Kg	469
2-Nitrophenol	469U	ug/Kg	469
2,4-Dimethylphenol	469U	ug/Kg	469
bis(2-Chloroethoxy)methane	469U	ug/Kg	469
2,4-Dichlorophenol	469U	ug/Kg	469
1,2,4-Trichlorobenzene	469U	ug/Kg	469
Naphthalene	10309	ug/Kg	469
4-Chloroaniline	469U	ug/Kg	469
Hexachlorobutadiene	469U	ug/Kg	469
4-Chloro-3-methylphenol	469U	ug/Kg	469
2-Methylnaphthalene	23335	ug/Kg	469
Hexachlorocyclopentadiene	469U	ug/Kg	469
2,4,6-Trichlorophenol	469U	ug/Kg	469
2,4,5-Trichlorophenol	469U	ug/Kg	469
2-Chloronaphthalene	469U	ug/Kg	469
2-Nitroaniline	469U	ug/Kg	469
Dimethylphthalate	469U	ug/Kg	469
Acenaphthylene	469U	ug/Kg	469
2,6-Dinitrotoluene	469U	ug/Kg	469
3-Nitroaniline	469U	ug/Kg	469
Acenaphthene	12451	ug/Kg	469
2,4-Dinitrophenol	469U	ug/Kg	469
4-Nitrophenol	469U	ug/Kg	469
Dibenzofuran	469U	ug/Kg	469
2,4-Dinitrotoluene	469U	ug/Kg	469

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-01
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-2 I2	**GC/MS ID:**	C01355
Analysis Date:	2/9/2006	**Analysis Time:**	3:06PM

Compound	Results	Units	PQL
Diethylphthalate	469U	ug/Kg	469
4-chlorophenyl-phenylether	469U	ug/Kg	469
Fluorene	16687	ug/Kg	469
4-Nitroaniline	469U	ug/Kg	469
4,6-Dinitro-2-methylphenol	469U	ug/Kg	469
N-Nitrosodiphenylamine	469U	ug/Kg	469
4-Bromophenyl-phenylether	469U	ug/Kg	469
Hexachlorobenzene	469U	ug/Kg	469
Pentachlorophenol	469U	ug/Kg	469
Phenanthrene	129505E	ug/Kg	469
Anthracene	469U	ug/Kg	469
Carbazole	18989	ug/Kg	469
Di-n-butylphthalate	469U	ug/Kg	469
Fluoranthene	98400	ug/Kg	469
Pyrene	45646	ug/Kg	469
Butylbenzylphthalate	469U	ug/Kg	469
3,3'-Dichlorobenzidine	469U	ug/Kg	469
Benzo(a)anthracene	39916	ug/Kg	469
Chrysene	36271	ug/Kg	469
bis(2-Ethylhexyl)phthalate	1952	ug/Kg	469
Di-n-octylphthalate	469U	ug/Kg	469
Benzo(b)fluoranthene	40113	ug/Kg	469
Benzo(k)fluoranthene	469U	ug/Kg	469
Benzo(a)pyrene	26604	ug/Kg	469
Indeno(1,2,3-cd)pyrene	13720	ug/Kg	469
Dibenz(a,h)anthracene	4320	ug/Kg	469
Benzo(g,h,i)perylene	15182	ug/Kg	469

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060054-1

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-1

Sample wt/vol: 1 (g/ml) G Lab File ID: C01355.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 30 (ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	002207-04-7	Cyclohexane, 1,4-dimethyl-, tran	5.04	2000	JN
2.	000111-65-9	Octane	5.46	2100	JN
3.	001072-05-5	Heptane, 2,6-dimethyl-	6.05	1100	JN
4.	001678-91-7	Cyclohexane, ethyl-	6.19	2300	JN
5.	016789-46-1	Hexane, 3-ethyl-2-methyl-	6.64	1200	JN
6.	000100-41-4	Ethylbenzene	6.82	3300	JN
7.	000106-42-3	p-Xylene	6.99	7600	JN
8.	006236-88-0	Cyclohexane, 1-ethyl-4-methyl-, t	7.32	1700	JN
9.	000589-43-5	Hexane, 2,4-dimethyl-	7.90	1800	JN
10.	001124-63-6	Cyclohexanepropanol-	7.99	1800	JN
11.	001678-92-8	Cyclohexane, propyl-	8.20	1900	JN
12.	015869-94-0	Octane, 3,6-dimethyl-	8.24	3800	JN
13.	052896-87-4	Heptane, 4-(1-methylethyl)-	8.39	3900	JN
14.	013151-35-4	Decane, 5-methyl-	8.67	2300	JN
15.	006783-92-2	Cyclohexane, 1,1,2,3-tetramethyl	8.73	1600	JN
16.	017301-94-9	Nonane, 4-methyl-	8.80	2400	JN
17.	000611-14-3	Benzene, 1-ethyl-2-methyl-	8.86	2500	JN
18.	005911-04-6	Nonane, 3-methyl-	8.98	2300	JN
19.	004291-79-6	Cyclohexane, 1-methyl-2-propyl-	9.26	3200	JN
20.	006069-98-3	Cyclohexane, 1-methyl-4-(1-met	9.32	2400	JN
21.	000526-73-8	Benzene, 1,2,3-trimethyl-	9.51	4800	JN
22.	002847-72-5	Decane, 4-methyl-	9.98	4900	JN
23.	017302-32-8	Nonane, 3,7-dimethyl-	10.07	3200	JN
24.	001678-98-4	Cyclohexane, (2-methylpropyl)-	10.21	3900	JN
25.	000493-02-7	Naphthalene, decahydro-, trans-	10.69	9000	JN
26.	000205-82-3	Benzo[j]fluoranthene	31.40	1600	JN
27.	000205-99-2	Benz[e]acephenanthrylene	31.93	2800	JN
28.	000192-97-2	Benzo[e]pyrene	32.32	1900	JN
29.	000592-27-8	Heptane, 2-methyl-	4.79	1700	JN
30.	000589-81-1	Heptane, 3-methyl-	4.93	1200	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-02
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-1 N-2	**GC/MS ID:**	C01356
Analysis Date:	2/9/2006	**Analysis Time:**	3:58PM

Compound	Results	Units	PQL
Phenol	511U	ug/Kg	511
bis(2-Chloroethyl)ether	511U	ug/Kg	511
2-Chlorophenol	511U	ug/Kg	511
1,3-Dichlorobenzene	511U	ug/Kg	511
1,4-Dichlorobenzene	511U	ug/Kg	511
1,2-Dichlorobenzene	511U	ug/Kg	511
2-Methylphenol	511U	ug/Kg	511
2,2'-oxybis(1-Chloropropane)	511U	ug/Kg	511
4-Methylphenol	511U	ug/Kg	511
N-Nitroso-di-n-propylamine	511U	ug/Kg	511
Hexachloroethane	511U	ug/Kg	511
Nitrobenzene	511U	ug/Kg	511
Isophorone	511U	ug/Kg	511
2-Nitrophenol	511U	ug/Kg	511
2,4-Dimethylphenol	511U	ug/Kg	511
bis(2-Chloroethoxy)methane	511U	ug/Kg	511
2,4-Dichlorophenol	511U	ug/Kg	511
1,2,4-Trichlorobenzene	511U	ug/Kg	511
Naphthalene	2513	ug/Kg	511
4-Chloroaniline	511U	ug/Kg	511
Hexachlorobutadiene	511U	ug/Kg	511
4-Chloro-3-methylphenol	511U	ug/Kg	511
2-Methylnaphthalene	8538	ug/Kg	511
Hexachlorocyclopentadiene	511U	ug/Kg	511
2,4,6-Trichlorophenol	511U	ug/Kg	511
2,4,5-Trichlorophenol	511U	ug/Kg	511
2-Chloronaphthalene	511U	ug/Kg	511
2-Nitroaniline	511U	ug/Kg	511
Dimethylphthalate	511U	ug/Kg	511
Acenaphthylene	511U	ug/Kg	511
2,6-Dinitrotoluene	511U	ug/Kg	511
3-Nitroaniline	511U	ug/Kg	511
Acenaphthene	1387	ug/Kg	511
2,4-Dinitrophenol	511U	ug/Kg	511
4-Nitrophenol	511U	ug/Kg	511
Dibenzofuran	511U	ug/Kg	511
2,4-Dinitrotoluene	511U	ug/Kg	511

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-02
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-1 N-2	**GC/MS ID:**	C01356
Analysis Date:	2/9/2006	**Analysis Time:**	3:58PM

Compound	Results	Units	PQL
Diethylphthalate	511U	ug/Kg	511
4-chlorophenyl-phenylether	511U	ug/Kg	511
Fluorene	1329	ug/Kg	511
4-Nitroaniline	511U	ug/Kg	511
4,6-Dinitro-2-methylphenol	511U	ug/Kg	511
N-Nitrosodiphenylamine	511U	ug/Kg	511
4-Bromophenyl-phenylether	511U	ug/Kg	511
Hexachlorobenzene	511U	ug/Kg	511
Pentachlorophenol	511U	ug/Kg	511
Phenanthrene	2441	ug/Kg	511
Anthracene	684	ug/Kg	511
Carbazole	511U	ug/Kg	511
Di-n-butylphthalate	511U	ug/Kg	511
Fluoranthene	1140	ug/Kg	511
Pyrene	1478	ug/Kg	511
Butylbenzylphthalate	511U	ug/Kg	511
3,3'-Dichlorobenzidine	511U	ug/Kg	511
Benzo(a)anthracene	730	ug/Kg	511
Chrysene	1230	ug/Kg	511
bis(2-Ethylhexyl)phthalate	511U	ug/Kg	511
Di-n-octylphthalate	511U	ug/Kg	511
Benzo(b)fluoranthene	796	ug/Kg	511
Benzo(k)fluoranthene	720	ug/Kg	511
Benzo(a)pyrene	891	ug/Kg	511
Indeno(1,2,3-cd)pyrene	1046	ug/Kg	511
Dibenz(a,h)anthracene	511U	ug/Kg	511
Benzo(g,h,i)perylene	1107	ug/Kg	511

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060054-2

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-2

Sample wt/vol: 1 (g/ml) G Lab File ID: C01356.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 30 (ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	000111-65-9	Octane	5.46	520	JN
2.	003073-66-3	Cyclohexane, 1,1,3-trimethyl-	6.25	620	JN
3.	002216-34-4	Octane, 4-methyl-	6.81	1000	JN
4.	002216-33-3	Octane, 3-methyl-	6.96	1500	JN
5.	015869-94-0	Octane, 3,6-dimethyl-	8.25	820	JN
6.	024524-56-9	Ether, tert-butyl isopropylidenecy	8.40	590	JN
7.	017301-94-9	Nonane, 4-methyl-	8.80	700	JN
8.	000871-83-0	Nonane, 2-methyl-	8.86	1300	JN
9.	000095-63-6	Benzene, 1,2,4-trimethyl-	9.02	3100	JN
10.	000620-14-4	Benzene, 1-ethyl-3-methyl-	9.27	2100	JN
11.	000526-73-8	Benzene, 1,2,3-trimethyl-	9.53	3200	JN
12.	002847-72-5	Decane, 4-methyl-	9.98	800	JN
13.	000108-67-8	Benzene, 1,3,5-trimethyl-	10.09	1000	JN
14.	025340-17-4	Benzene, diethyl-	10.62	2000	JN
15.	000104-51-8	Benzene, butyl-	10.69	1700	JN
16.	000099-87-6	Benzene, 1-methyl-4-(1-methylet	10.74	2800	JN
17.	000934-74-7	Benzene, 1-ethyl-3,5-dimethyl-	11.12	3700	JN
18.	001758-88-9	Benzene, 2-ethyl-1,4-dimethyl-	11.88	1000	JN
19.	001587-04-8	Benzene, 1-methyl-2-(2-propenyl	12.27	1300	JN
20.	002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	12.45	1400	JN
21.	017301-28-9	Undecane, 3,6-dimethyl-	13.32	1800	JN
22.	004292-75-5	Cyclohexane, hexyl-	13.82	980	JN
23.	054105-67-8	Heptadecane, 2,6-dimethyl-	14.25	1400	JN
24.	000091-57-6	Naphthalene, 2-methyl-	15.13	1800	JN
25.	004292-92-6	Cyclohexane, pentyl-	15.42	810	JN
26.	017453-94-0	Undecane, 5-ethyl-	19.39	2100	JN
27.	001921-70-6	Pentadecane, 2,6,10,14-tetramet	20.09	2400	JN
28.	000613-33-2	4,4'-Dimethylbiphenyl	20.50	950	JN
29.	000629-59-4	Tetradecane	21.25	2100	JN
30.	026429-11-8	Heptadecane, 4-methyl-	22.14	570	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-03
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-2 N-2	**GC/MS ID:**	C01357
Analysis Date:	2/9/2006	**Analysis Time:**	4:49PM

Compound	Results	Units	PQL
Phenol	456U	ug/Kg	456
bis(2-Chloroethyl)ether	456U	ug/Kg	456
2-Chlorophenol	456U	ug/Kg	456
1,3-Dichlorobenzene	456U	ug/Kg	456
1,4-Dichlorobenzene	456U	ug/Kg	456
1,2-Dichlorobenzene	456U	ug/Kg	456
2-Methylphenol	456U	ug/Kg	456
2,2'-oxybis(1-Chloropropane)	456U	ug/Kg	456
4-Methylphenol	804	ug/Kg	456
N-Nitroso-di-n-propylamine	456U	ug/Kg	456
Hexachloroethane	456U	ug/Kg	456
Nitrobenzene	456U	ug/Kg	456
Isophorone	456U	ug/Kg	456
2-Nitrophenol	456U	ug/Kg	456
2,4-Dimethylphenol	456U	ug/Kg	456
bis(2-Chloroethoxy)methane	456U	ug/Kg	456
2,4-Dichlorophenol	456U	ug/Kg	456
1,2,4-Trichlorobenzene	456U	ug/Kg	456
Naphthalene	1504	ug/Kg	456
4-Chloroaniline	456U	ug/Kg	456
Hexachlorobutadiene	456U	ug/Kg	456
4-Chloro-3-methylphenol	456U	ug/Kg	456
2-Methylnaphthalene	12558	ug/Kg	456
Hexachlorocyclopentadiene	456U	ug/Kg	456
2,4,6-Trichlorophenol	456U	ug/Kg	456
2,4,5-Trichlorophenol	456U	ug/Kg	456
2-Chloronaphthalene	456U	ug/Kg	456
2-Nitroaniline	456U	ug/Kg	456
Dimethylphthalate	456U	ug/Kg	456
Acenaphthylene	456U	ug/Kg	456
2,6-Dinitrotoluene	456U	ug/Kg	456
3-Nitroaniline	456U	ug/Kg	456
Acenaphthene	1475	ug/Kg	456
2,4-Dinitrophenol	456U	ug/Kg	456
4-Nitrophenol	456U	ug/Kg	456
Dibenzofuran	456U	ug/Kg	456
2,4-Dinitrotoluene	456U	ug/Kg	456

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-03
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-2 N-2	**GC/MS ID:**	C01357
Analysis Date:	2/9/2006	**Analysis Time:**	4:49PM

Compound	Results	Units	PQL
Diethylphthalate	456U	ug/Kg	456
4-chlorophenyl-phenylether	456U	ug/Kg	456
Fluorene	1996	ug/Kg	456
4-Nitroaniline	456U	ug/Kg	456
4,6-Dinitro-2-methylphenol	456U	ug/Kg	456
N-Nitrosodiphenylamine	456U	ug/Kg	456
4-Bromophenyl-phenylether	456U	ug/Kg	456
Hexachlorobenzene	456U	ug/Kg	456
Pentachlorophenol	456U	ug/Kg	456
Phenanthrene	5441	ug/Kg	456
Anthracene	1445	ug/Kg	456
Carbazole	530	ug/Kg	456
Di-n-butylphthalate	456U	ug/Kg	456
Fluoranthene	3164	ug/Kg	456
Pyrene	3233	ug/Kg	456
Butylbenzylphthalate	456U	ug/Kg	456
3,3'-Dichlorobenzidine	456U	ug/Kg	456
Benzo(a)anthracene	1421	ug/Kg	456
Chrysene	1860	ug/Kg	456
bis(2-Ethylhexyl)phthalate	597	ug/Kg	456
Di-n-octylphthalate	456U	ug/Kg	456
Benzo(b)fluoranthene	1030	ug/Kg	456
Benzo(k)fluoranthene	1020	ug/Kg	456
Benzo(a)pyrene	1193	ug/Kg	456
Indeno(1,2,3-cd)pyrene	651	ug/Kg	456
Dibenz(a,h)anthracene	456U	ug/Kg	456
Benzo(g,h,i)perylene	759	ug/Kg	456

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060054-3

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-3

Sample wt/vol: 1 (g/ml) G Lab File ID: C01357.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

Number TICs found: 30 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	000638-04-0	Cyclohexane, 1,3-dimethyl-, cis-	5.07	630	JN
2.	000111-65-9	Octane	5.49	520	JN
3.	001795-27-3	Cyclohexane, 1,3,5-trimethyl-, (1.	6.26	580	JN
4.	002216-34-4	Octane, 4-methyl-	6.82	740	JN
5.	000108-38-3	Benzene, 1,3-dimethyl-	7.00	1400	JN
6.	015869-94-0	Octane, 3,6-dimethyl-	8.25	940	JN
7.	052896-87-4	Heptane, 4-(1-methylethyl)-	8.40	840	JN
8.	062108-23-0	Decane, 2,5,6-trimethyl-	8.67	590	JN
9.	005911-04-6	Nonane, 3-methyl-	8.99	630	JN
10.	004926-90-3	Cyclohexane, 1-ethyl-1-methyl-	9.26	910	JN
11.	000095-63-6	Benzene, 1,2,4-trimethyl-	9.52	1000	JN
12.	002847-72-5	Decane, 4-methyl-	9.97	1400	JN
13.	000620-14-4	Benzene, 1-ethyl-3-methyl-	10.08	850	JN
14.	001678-93-9	Cyclohexane, butyl-	10.20	1100	JN
15.	000300-57-2	Benzene, 2-propenyl-	10.35	880	JN
16.	000141-93-5	Benzene, 1,3-diethyl-	10.56	630	JN
17.	000493-02-7	Naphthalene, decahydro-, trans-	10.70	2200	JN
18.	013151-34-3	Decane, 3-methyl-	10.85	1200	JN
19.	000934-74-7	Benzene, 1-ethyl-3,5-dimethyl-	11.23	800	JN
20.	002958-76-1	Naphthalene, decahydro-2-methy	11.70	960	JN
21.	062185-53-9	Nonane, 5-(2-methylpropyl)-	11.85	610	JN
22.	002958-76-1	Naphthalene, decahydro-2-methy	12.00	560	JN
23.	000767-58-8	Indan, 1-methyl-	12.44	1800	JN
24.	000638-36-8	Hexadecane, 2,6,10,14-tetramet	21.29	1800	JN
25.	000610-48-0	Anthracene, 1-methyl-	23.03	640	JN
26.	000103-23-1	Hexanedioic acid, bis(2-ethylhex	26.97	760	JN
27.	056554-86-0	17-Octadecenal	30.55	1800	JN
28.	010152-69-9	Cyclopropanenonanoic acid, 2-[(	30.67	850	JN
29.	002432-90-8	Didodecyl phthalate	30.79	1100	JN
30.	000629-78-7	Heptadecane	33.14	910	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-04
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-1 I-2	**GC/MS ID:**	C01358
Analysis Date:	2/9/2006	**Analysis Time:**	5:40PM

Compound	Results	Units	PQL
Phenol	484U	ug/Kg	484
bis(2-Chloroethyl)ether	484U	ug/Kg	484
2-Chlorophenol	484U	ug/Kg	484
1,3-Dichlorobenzene	484U	ug/Kg	484
1,4-Dichlorobenzene	484U	ug/Kg	484
1,2-Dichlorobenzene	484U	ug/Kg	484
2-Methylphenol	484U	ug/Kg	484
2,2'-oxybis(1-Chloropropane)	484U	ug/Kg	484
4-Methylphenol	1398	ug/Kg	484
N-Nitroso-di-n-propylamine	484U	ug/Kg	484
Hexachloroethane	484U	ug/Kg	484
Nitrobenzene	484U	ug/Kg	484
Isophorone	484U	ug/Kg	484
2-Nitrophenol	484U	ug/Kg	484
2,4-Dimethylphenol	484U	ug/Kg	484
bis(2-Chloroethoxy)methane	484U	ug/Kg	484
2,4-Dichlorophenol	484U	ug/Kg	484
1,2,4-Trichlorobenzene	484U	ug/Kg	484
Naphthalene	1474	ug/Kg	484
4-Chloroaniline	484U	ug/Kg	484
Hexachlorobutadiene	484U	ug/Kg	484
4-Chloro-3-methylphenol	484U	ug/Kg	484
2-Methylnaphthalene	5246	ug/Kg	484
Hexachlorocyclopentadiene	484U	ug/Kg	484
2,4,6-Trichlorophenol	484U	ug/Kg	484
2,4,5-Trichlorophenol	484U	ug/Kg	484
2-Chloronaphthalene	484U	ug/Kg	484
2-Nitroaniline	484U	ug/Kg	484
Dimethylphthalate	484U	ug/Kg	484
Acenaphthylene	484U	ug/Kg	484
2,6-Dinitrotoluene	484U	ug/Kg	484
3-Nitroaniline	484U	ug/Kg	484
Acenaphthene	925	ug/Kg	484
2,4-Dinitrophenol	484U	ug/Kg	484
4-Nitrophenol	484U	ug/Kg	484
Dibenzofuran	484U	ug/Kg	484
2,4-Dinitrotoluene	484U	ug/Kg	484

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060054-04
Client Project:	Plumley - Matt Petro	**Analyst:**	AM
Client Sample ID:	C-1 I-2	**GC/MS ID:**	C01358
Analysis Date:	2/9/2006	**Analysis Time:**	5:40PM

Compound	Results	Units	PQL
Diethylphthalate	484U	ug/Kg	484
4-chlorophenyl-phenylether	484U	ug/Kg	484
Fluorene	1116	ug/Kg	484
4-Nitroaniline	484U	ug/Kg	484
4,6-Dinitro-2-methylphenol	484U	ug/Kg	484
N-Nitrosodiphenylamine	484U	ug/Kg	484
4-Bromophenyl-phenylether	484U	ug/Kg	484
Hexachlorobenzene	484U	ug/Kg	484
Pentachlorophenol	484U	ug/Kg	484
Phenanthrene	1874	ug/Kg	484
Anthracene	468J	ug/Kg	484
Carbazole	484U	ug/Kg	484
Di-n-butylphthalate	484U	ug/Kg	484
Fluoranthene	818	ug/Kg	484
Pyrene	1310	ug/Kg	484
Butylbenzylphthalate	484U	ug/Kg	484
3,3'-Dichlorobenzidine	484U	ug/Kg	484
Benzo(a)anthracene	483	ug/Kg	484
Chrysene	879	ug/Kg	484
bis(2-Ethylhexyl)phthalate	484U	ug/Kg	484
Di-n-octylphthalate	484U	ug/Kg	484
Benzo(b)fluoranthene	471	ug/Kg	484
Benzo(k)fluoranthene	484	ug/Kg	484
Benzo(a)pyrene	515	ug/Kg	484
Indeno(1,2,3-cd)pyrene	484U	ug/Kg	484
Dibenz(a,h)anthracene	484U	ug/Kg	484
Benzo(g,h,i)perylene	484U	ug/Kg	484

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060054-4

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060054-4

Sample wt/vol: 1 (g/ml) G Lab File ID: C01358.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

Number TICs found: 30

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	003073-66-3	Cyclohexane, 1,1,3-trimethyl-	6.24	730	JN
2.	002216-34-4	Octane, 4-methyl-	6.82	820	JN
3.	000108-38-3	Benzene, 1,3-dimethyl-	6.99	1600	JN
4.	005911-04-6	Nonane, 3-methyl-	8.24	1200	JN
5.	000611-14-3	Benzene, 1-ethyl-2-methyl-	8.86	990	JN
6.	000095-63-6	Benzene, 1,2,4-trimethyl-	9.01	2500	JN
7.	000624-29-3	Cyclohexane, 1,4-dimethyl-, cis-	9.27	1100	JN
8.	000526-73-8	Benzene, 1,2,3-trimethyl-	9.51	2400	JN
9.	002847-72-5	Decane, 4-methyl-	9.98	1100	JN
10.	000108-67-8	Benzene, 1,3,5-trimethyl-	10.09	1100	JN
11.	001678-98-4	Cyclohexane, (2-methylpropyl)-	10.21	730	JN
12.	000611-15-4	Benzene, 1-ethenyl-2-methyl-	10.35	710	JN
13.	013151-35-4	Decane, 5-methyl-	10.62	1300	JN
14.	000491-01-0	Cyclohexanol, 5-methyl-2-(1-met	10.68	730	JN
15.	013151-34-3	Decane, 3-methyl-	10.86	1200	JN
16.	000488-23-3	Benzene, 1,2,3,4-tetramethyl-	11.86	1000	JN
17.	001758-85-6	Benzene, 2,4-diethyl-1-methyl-	12.26	1600	JN
18.	002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	12.44	2100	JN
19.	006682-71-9	1H-Indene, 2,3-dihydro-4,7-dimet	12.94	1100	JN
20.	006044-71-9	Dodecane, 6-methyl-	13.30	1400	JN
21.	061142-20-9	Cyclohexane, (4-methylpentyl)-	13.81	1500	JN
22.	026730-14-3	Tridecane, 7-methyl-	14.25	3100	JN
23.	000090-12-0	Naphthalene, 1-methyl-	15.11	2400	JN
24.	000575-41-7	Naphthalene, 1,3-dimethyl-	17.00	2000	JN
25.	055045-11-9	Tridecane, 5-propyl-	19.39	1800	JN
26.	054105-67-8	Heptadecane, 2,6-dimethyl-	20.09	2300	JN
27.	055045-07-3	Dodecane, 2-methyl-8-propyl-	21.27	2000	JN
28.	054833-48-6	Heptadecane, 2,6,10,15-tetramet	34.48	2000	JN
29.	000646-31-1	Tetracosane	36.03	2000	JN
30.	000630-06-8	Hexatriacontane	37.89	2100	JN

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Laboratory NJ ID: 12766

March 1, 2006

Quantum Consulting Services
11 Westwood Rd
East Brunswick, NJ 08816

Attn: Dr. C. Bruno

Analytical Report 2060084 Project: Plumley – Matt Petro

This report covers the analysis of four (4) samples submitted to Quantex Laboratories on February 13, 2006. The following analyses were requested:

Total Petroleum Hydrocarbons (4)
TCL Volatile Organics + Search (4)
TCL Semi-Volatile Organics + Search (4)

Very truly yours,

Angela Menoutis

Angela Menoutis
Manager of Laboratory Services

Quantex Laboratories
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Edison, Ne[illegible]rsey 08817
(732) 248-3335 Fax: (732) 248-0912

Quantex Laboratories
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Lab Project No: (FOR LAB USE ONLY) 2060084

CLIENT INFORMATION	BILLING INFORMATION	TURNAROUND TIME	REPORT DELIVERABLES
Company: Quantum Consulting	Company:	PLEASE CIRCLE **Verbal/Fax** 2 Wk 1Wk* 72Hr* 48Hr* 24Hr* Other: **Conditional/TPHC** by Fax 1Wk 72Hr 48Hr* 24Hr* Other: **Hard Copy** 3 Wk 2Wk* 1Wk* 72Hr* Other: * Prior laboratory authorization & notification required. YOU MUST NOTIFY THE LABORATORY OF ANY PRIOR AUTHORIZATION BEFORE SAMPLE ARRIVAL.	☐ Results Only ☐ Standard ☐ Reduced ☐ Regulatory (Please Specify) ☐ Other
Address: 11 Westwood Rd	Address:		**DISK DELIVERABLES** SRP Disk : ☐ .dbf or ☐ .wk1 Other: ☐ Excel ☐ Access
City: East Brunswick	City:		
State: N.J. Zip: 08816	State: Zip:		
Contact: Dr C. Bruno	Attn: PO:		
Phone: 732-846-5988 Fax: 732-846-5307	Phone: Fax:		

Site/Project Name: Plumley - Mill Pond

Case #

Project Manager:

Comments:

ANALYSIS REQUESTED Page ____ of ____

SAMPLE MATRIX
W - Water G - Groundwater A- Aqueous
S - Soil SL - Sludge SD - Solid
O - Oil X - Other

Cooler Temp 4 °C

SAMPLE INFORMATION

Lab ID	Sample ID	Date	Time	Matrix	Sampler	# of Container	Serial #	123 456 TPHC	123 456 TCL SVOA	123 456 TCL-VOA	123 456	123 456	123 456	123 456	123 456
1	C-2-N-3			S				✓							
1	C-2-N-3			S					✓	✓					
1	C-2-N-3			S						✓					
2	C-2-I-3			S				✓	✓						
2	C-2-I-3			S					✓						
2	C-2-I-3			S						✓					
3	C-1-I-3			S				✓							
3	C-1-I-3			S					✓						
3	C-1-I-3			S						✓					
4	C-1-N-3			S				✓							
4	C-1-N-3			S					✓						
4	C-1-N-3			S						✓					

PRESERVATIVES (Circle Number to Left)
1. HCl 2. MeOH
3. HNO_3 4. H_2SO_4
5. NaOH 6. Other

Comments

Relinquished By:	Received By:	Date	Time	Relinquished By:	Received By:	Date	Time
C. Bruno	A Menutti	2/13/06	11:30				

P. 1

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Analytical Report

Client Name: Quantum Consulting Services, Inc. **Lab Project:** 2060084
Client Project: Plumly

Client ID	Lab Sample ID	Analysis	Results	Units	PQL/MDL	Analysis date
C-2-N-3	2060084-01					
		Percent Solids	67.3	%	0.1	2/13/2006
		Total Petroleum Hydroc	426	mg/Kg	16.6	2/14/2006
C-2-I-3	2060084-02					
		Percent Solids	67.0	%	0.1	2/13/2006
		Total Petroleum Hydroc	767	mg/Kg	16.6	2/14/2006
C-1-I-3	2060084-03					
		Percent Solids	75.7	%	0.1	2/13/2006
		Total Petroleum Hydroc	1107	mg/Kg	16.6	2/14/2006
C-1-N-3	2060084-04					
		Percent Solids	63.7	%	0.1	2/13/2006
		Total Petroleum Hydroc	1089	mg/Kg	16.6	2/14/2006

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-01
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-2-N-3	**GC/MS ID:**	V11328
Analysis Date:	2/13/2006	**Analysis Time:**	18:48

Compound	Results	Units	PQL
Chloromethane	45.3U	ug/Kg	45.3
Bromomethane	45.3U	ug/Kg	45.3
Vinyl Chloride	45.3U	ug/Kg	45.3
Chloroethane	45.3U	ug/Kg	45.3
Acetone	45.3U	ug/Kg	45.3
Carbon Disulfide	45.3U	ug/Kg	45.3
Methylene Chloride	45.3U	ug/Kg	45.3
1,1 Dichloroethene	45.3U	ug/Kg	45.3
trans 1,2 Dichloroethene	45.3U	ug/Kg	45.3
cis 1,2 Dichloroethene	45.3U	ug/Kg	45.3
2 Butanone	45.3U	ug/Kg	45.3
Vinyl Acetate	45.3U	ug/Kg	45.3
4 Methyl 2 pentanone	45.3U	ug/Kg	45.3
1,1 Dichloroethane	45.3U	ug/Kg	45.3
Chloroform	45.3U	ug/Kg	45.3
1,1,1 Trichloroethane	45.3U	ug/Kg	45.3
Carbon Tetrachloride	45.3U	ug/Kg	45.3
1,2 Dichloroethane	45.3U	ug/Kg	45.3
Bromodichloromethane	45.3U	ug/Kg	45.3
1,2 Dichloropropane	45.3U	ug/Kg	45.3
trans 1,3 Dichloropropene	45.3U	ug/Kg	45.3
cis 1,3 Dichloropropene	45.3U	ug/Kg	45.3
Trichloroethylene	45.3U	ug/Kg	45.3
Dibromochloromethane	45.3U	ug/Kg	45.3
1,1,2 Trichloroethane	45.3U	ug/Kg	45.3
Benzene	76.2	ug/Kg	45.3
2 Chloroethyl Vinyl Ether	45.3U	ug/Kg	45.3
Bromoform	45.3U	ug/Kg	45.3
Tetrachloroethylene	45.3U	ug/Kg	45.3
1,1,2,2 Tetrachloroethane	45.3U	ug/Kg	45.3
Toluene	87.9	ug/Kg	45.3
Chlorobenzene	45.3U	ug/Kg	45.3
Ethyl Benzene	172	ug/Kg	45.3
M&P Xylenes	606	ug/Kg	45.3
O Xylene	46.4	ug/Kg	45.3
2 Hexanone	45.3U	ug/Kg	45.3
Styrene	45.3U	ug/Kg	45.3

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060084-1

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-1

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11328.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 02/13/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 015918-08-8	Heptane, 4-methylene-	8.38	1500	JN
2. 000110-82-7	Cyclohexane	9.50	2100	JN
3. 000108-87-2	Cyclohexane, methyl-	11.31	2700	JN
4. 000934-80-5	Benzene, 4-ethyl-1,2-dimethyl-	19.64	1500	JN
5. 000767-99-7	Benzene, (1-methyl-1-propenyl)-,	21.01	3400	JN
6. 004706-90-5	Benzene, 1,3-dimethyl-5-(1-meth	21.62	1500	JN
7. 006682-71-9	1H-Indene, 2,3-dihydro-4,7-dimet	21.79	2100	JN
8. 001559-81-5	Naphthalene, 1,2,3,4-tetrahydro-	22.93	2100	JN
9. 000091-57-6	Naphthalene, 2-methyl-	23.77	3900	JN
10. 000090-12-0	Naphthalene, 1-methyl-	24.06	2700	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-02
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-2-I-3	**GC/MS ID:**	V11329
Analysis Date:	2/13/2006	**Analysis Time:**	19:16

Compound	Results	Units	PQL
Chloromethane	73.2U	ug/Kg	73.2
Bromomethane	73.2U	ug/Kg	73.2
Vinyl Chloride	73.2U	ug/Kg	73.2
Chloroethane	73.2U	ug/Kg	73.2
Acetone	73.2U	ug/Kg	73.2
Carbon Disulfide	73.2U	ug/Kg	73.2
Methylene Chloride	73.2U	ug/Kg	73.2
1,1 Dichloroethene	73.2U	ug/Kg	73.2
trans 1,2 Dichloroethene	73.2U	ug/Kg	73.2
cis 1,2 Dichloroethene	73.2U	ug/Kg	73.2
2 Butanone	73.2U	ug/Kg	73.2
Vinyl Acetate	73.2U	ug/Kg	73.2
4 Methyl 2 pentanone	73.2U	ug/Kg	73.2
1,1 Dichloroethane	73.2U	ug/Kg	73.2
Chloroform	73.2U	ug/Kg	73.2
1,1,1 Trichloroethane	73.2U	ug/Kg	73.2
Carbon Tetrachloride	73.2U	ug/Kg	73.2
1,2 Dichloroethane	73.2U	ug/Kg	73.2
Bromodichloromethane	73.2U	ug/Kg	73.2
1,2 Dichloropropane	73.2U	ug/Kg	73.2
trans 1,3 Dichloropropene	73.2U	ug/Kg	73.2
cis 1,3 Dichloropropene	73.2U	ug/Kg	73.2
Trichloroethylene	73.2U	ug/Kg	73.2
Dibromochloromethane	73.2U	ug/Kg	73.2
1,1,2 Trichloroethane	73.2U	ug/Kg	73.2
Benzene	191	ug/Kg	73.2
2 Chloroethyl Vinyl Ether	73.2U	ug/Kg	73.2
Bromoform	73.2U	ug/Kg	73.2
Tetrachloroethylene	73.2U	ug/Kg	73.2
1,1,2,2 Tetrachloroethane	73.2U	ug/Kg	73.2
Toluene	151	ug/Kg	73.2
Chlorobenzene	73.2U	ug/Kg	73.2
Ethyl Benzene	391	ug/Kg	73.2
M&P Xylenes	1735	ug/Kg	73.2
O Xylene	112	ug/Kg	73.2
2 Hexanone	73.2U	ug/Kg	73.2
Styrene	73.2U	ug/Kg	73.2

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060084-2

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-2

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11329.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 02/13/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000096-37-7	Cyclopentane, methyl-	8.36	3700	JN
2. 000110-82-7	Cyclohexane	9.50	5500	JN
3. 000108-87-2	Cyclohexane, methyl-	11.39	5900	JN
4. 000527-84-4	Benzene, 1-methyl-2-(1-methylet	19.66	4100	JN
5. 000934-80-5	Benzene, 4-ethyl-1,2-dimethyl-	20.27	4000	JN
6. 000824-22-6	1H-Indene, 2,3-dihydro-4-methyl-	21.03	10000	JN
7. 006682-71-9	1H-Indene, 2,3-dihydro-4,7-dimet	21.81	4900	JN
8. 017057-82-8	1H-Indene, 2,3-dihydro-1,2-dimet	22.93	5200	JN
9. 000090-12-0	Naphthalene, 1-methyl-	23.77	9300	JN
10. 000091-57-6	Naphthalene, 2-methyl-	24.09	7000	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-03
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-1-I-3	**GC/MS ID:**	V11330
Analysis Date:	2/13/2006	**Analysis Time:**	19:55

Compound	Results	Units	PQL
Chloromethane	43.5U	ug/Kg	43.5
Bromomethane	43.5U	ug/Kg	43.5
Vinyl Chloride	43.5U	ug/Kg	43.5
Chloroethane	43.5U	ug/Kg	43.5
Acetone	43.5U	ug/Kg	43.5
Carbon Disulfide	43.5U	ug/Kg	43.5
Methylene Chloride	43.5U	ug/Kg	43.5
1,1 Dichloroethene	43.5U	ug/Kg	43.5
trans 1,2 Dichloroethene	43.5U	ug/Kg	43.5
cis 1,2 Dichloroethene	43.5U	ug/Kg	43.5
2 Butanone	43.5U	ug/Kg	43.5
Vinyl Acetate	43.5U	ug/Kg	43.5
4 Methyl 2 pentanone	43.5U	ug/Kg	43.5
1,1 Dichloroethane	43.5U	ug/Kg	43.5
Chloroform	43.5U	ug/Kg	43.5
1,1,1 Trichloroethane	43.5U	ug/Kg	43.5
Carbon Tetrachloride	43.5U	ug/Kg	43.5
1,2 Dichloroethane	43.5U	ug/Kg	43.5
Bromodichloromethane	43.5U	ug/Kg	43.5
1,2 Dichloropropane	43.5U	ug/Kg	43.5
trans 1,3 Dichloropropene	43.5U	ug/Kg	43.5
cis 1,3 Dichloropropene	43.5U	ug/Kg	43.5
Trichloroethylene	43.5U	ug/Kg	43.5
Dibromochloromethane	43.5U	ug/Kg	43.5
1,1,2 Trichloroethane	43.5U	ug/Kg	43.5
Benzene	43.5U	ug/Kg	43.5
2 Chloroethyl Vinyl Ether	43.5U	ug/Kg	43.5
Bromoform	43.5U	ug/Kg	43.5
Tetrachloroethylene	43.5U	ug/Kg	43.5
1,1,2,2 Tetrachloroethane	43.5U	ug/Kg	43.5
Toluene	407	ug/Kg	43.5
Chlorobenzene	43.5U	ug/Kg	43.5
Ethyl Benzene	1285	ug/Kg	43.5
M&P Xylenes	4076	ug/Kg	43.5
O Xylene	170	ug/Kg	43.5
2 Hexanone	43.5U	ug/Kg	43.5
Styrene	43.5U	ug/Kg	43.5

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060084-3

Lab Name: Quantex Labs Contract:
Lab Code: Case No.: SAS No.: SDG No.:
Matrix: (soil/water) SOIL Lab Sample ID: 2060084-3
Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11330.D
Level: (low/med) LOW Date Received:
% Moisture: not dec. 0.00001 Date Analyzed: 02/13/06
GC Column: ID: (mm) Dilution Factor: 1.0
Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000096-14-0	Pentane, 3-methyl-	6.72	5100	JN
2. 000763-32-6	3-Buten-1-ol, 3-methyl-	7.31	14000	JN
3. 003638-35-5	Cyclopropane, (1-methylethyl)-	8.42	12000	JN
4. 000110-82-7	Cyclohexane	9.56	13000	JN
5. 000108-87-2	Cyclohexane, methyl-	11.37	3900	JN
6. 000111-65-9	Octane	13.22	4400	JN
7. 001678-91-7	Cyclohexane, ethyl-	14.25	2400	JN
8. 019489-10-2	cis-1-Ethyl-3-methyl-cyclohexane	15.45	2700	JN
9. 000098-82-8	Benzene, (1-methylethyl)-	17.26	3000	JN
10. 000095-36-3	1,2,4-Trimethylbenzene	17.96	3800	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-04
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-1-N-3	**GC/MS ID:**	V11331
Analysis Date:	2/13/2006	**Analysis Time:**	20:30

Compound	Results	Units	PQL
Chloromethane	44.9U	ug/Kg	44.9
Bromomethane	44.9U	ug/Kg	44.9
Vinyl Chloride	44.9U	ug/Kg	44.9
Chloroethane	44.9U	ug/Kg	44.9
Acetone	44.9U	ug/Kg	44.9
Carbon Disulfide	44.9U	ug/Kg	44.9
Methylene Chloride	44.9U	ug/Kg	44.9
1,1 Dichloroethene	44.9U	ug/Kg	44.9
trans 1,2 Dichloroethene	44.9U	ug/Kg	44.9
cis 1,2 Dichloroethene	44.9U	ug/Kg	44.9
2 Butanone	44.9U	ug/Kg	44.9
Vinyl Acetate	44.9U	ug/Kg	44.9
4 Methyl 2 pentanone	44.9U	ug/Kg	44.9
1,1 Dichloroethane	44.9U	ug/Kg	44.9
Chloroform	44.9U	ug/Kg	44.9
1,1,1 Trichloroethane	44.9U	ug/Kg	44.9
Carbon Tetrachloride	44.9U	ug/Kg	44.9
1,2 Dichloroethane	44.9U	ug/Kg	44.9
Bromodichloromethane	44.9U	ug/Kg	44.9
1,2 Dichloropropane	44.9U	ug/Kg	44.9
trans 1,3 Dichloropropene	44.9U	ug/Kg	44.9
cis 1,3 Dichloropropene	44.9U	ug/Kg	44.9
Trichloroethylene	44.9U	ug/Kg	44.9
Dibromochloromethane	44.9U	ug/Kg	44.9
1,1,2 Trichloroethane	44.9U	ug/Kg	44.9
Benzene	44.9U	ug/Kg	44.9
2 Chloroethyl Vinyl Ether	44.9U	ug/Kg	44.9
Bromoform	44.9U	ug/Kg	44.9
Tetrachloroethylene	44.9U	ug/Kg	44.9
1,1,2,2 Tetrachloroethane	44.9U	ug/Kg	44.9
Toluene	76.2	ug/Kg	44.9
Chlorobenzene	44.9U	ug/Kg	44.9
Ethyl Benzene	226	ug/Kg	44.9
M&P Xylenes	584	ug/Kg	44.9
O Xylene	88.5	ug/Kg	44.9
2 Hexanone	44.9U	ug/Kg	44.9
Styrene	44.9U	ug/Kg	44.9

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060084-4

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-4

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11331.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 02/13/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000110-54-3	Hexane	7.20	2100	JN
2. 002415-72-7	Cyclopropane, propyl-	8.34	1700	JN
3. 000763-29-1	1-Pentene, 2-methyl-	9.47	2200	JN
4. 000108-87-2	Cyclohexane, methyl-	11.31	2800	JN
5. 000611-14-3	Benzene, 1-ethyl-2-methyl-	17.94	3100	JN
6. 000934-74-7	Benzene, 1-ethyl-3,5-dimethyl-	19.05	3500	JN
7. 000099-87-6	Benzene, 1-methyl-4-(1-methylet	19.52	2000	JN
8. 000933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	19.64	2600	JN
9. 000767-99-7	Benzene, (1-methyl-1-propenyl)-,	19.81	1900	JN
10. 002039-90-9	Benzene, 2-ethenyl-1,3-dimethyl-	21.01	3600	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-01
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-2-N-3	**GC/MS ID:**	C01377
Analysis Date:	2/17/2006	**Analysis Time:**	6:39PM

Compound	Results	Units	PQL
Phenol	495U	ug/Kg	495
bis(2-Chloroethyl)ether	495U	ug/Kg	495
2-Chlorophenol	495U	ug/Kg	495
1,3-Dichlorobenzene	495U	ug/Kg	495
1,4-Dichlorobenzene	495U	ug/Kg	495
1,2-Dichlorobenzene	495U	ug/Kg	495
2-Methylphenol	495U	ug/Kg	495
2,2'-oxybis(1-Chloropropane)	495U	ug/Kg	495
4-Methylphenol	230J	ug/Kg	495
N-Nitroso-di-n-propylamine	495U	ug/Kg	495
Hexachloroethane	495U	ug/Kg	495
Nitrobenzene	495U	ug/Kg	495
Isophorone	495U	ug/Kg	495
2-Nitrophenol	495U	ug/Kg	495
2,4-Dimethylphenol	495U	ug/Kg	495
bis(2-Chloroethoxy)methane	495U	ug/Kg	495
2,4-Dichlorophenol	495U	ug/Kg	495
1,2,4-Trichlorobenzene	495U	ug/Kg	495
Naphthalene	893	ug/Kg	495
4-Chloroaniline	495U	ug/Kg	495
Hexachlorobutadiene	495U	ug/Kg	495
4-Chloro-3-methylphenol	495U	ug/Kg	495
2-Methylnaphthalene	9274	ug/Kg	495
Hexachlorocyclopentadiene	495U	ug/Kg	495
2,4,6-Trichlorophenol	495U	ug/Kg	495
2,4,5-Trichlorophenol	495U	ug/Kg	495
2-Chloronaphthalene	495U	ug/Kg	495
2-Nitroaniline	495U	ug/Kg	495
Dimethylphthalate	495U	ug/Kg	495
Acenaphthylene	495U	ug/Kg	495
2,6-Dinitrotoluene	495U	ug/Kg	495
3-Nitroaniline	495U	ug/Kg	495
Acenaphthene	2296	ug/Kg	495
2,4-Dinitrophenol	495U	ug/Kg	495
4-Nitrophenol	495U	ug/Kg	495
Dibenzofuran	495U	ug/Kg	495
2,4-Dinitrotoluene	495U	ug/Kg	495

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-01
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-2-N-3	**GC/MS ID:**	C01377
Analysis Date:	2/17/2006	**Analysis Time:**	6:39PM

Compound	Results	Units	PQL
Diethylphthalate	495U	ug/Kg	495
4-chlorophenyl-phenylether	495U	ug/Kg	495
Fluorene	3195	ug/Kg	495
4-Nitroaniline	495U	ug/Kg	495
4,6-Dinitro-2-methylphenol	495U	ug/Kg	495
N-Nitrosodiphenylamine	495U	ug/Kg	495
4-Bromophenyl-phenylether	495U	ug/Kg	495
Hexachlorobenzene	495U	ug/Kg	495
Pentachlorophenol	495U	ug/Kg	495
Phenanthrene	14856	ug/Kg	495
Anthracene	4054	ug/Kg	495
Carbazole	1420	ug/Kg	495
Di-n-butylphthalate	495U	ug/Kg	495
Fluoranthene	16766	ug/Kg	495
Pyrene	10002	ug/Kg	495
Butylbenzylphthalate	495U	ug/Kg	495
3,3'-Dichlorobenzidine	495U	ug/Kg	495
Benzo(a)anthracene	7146	ug/Kg	495
Chrysene	9424	ug/Kg	495
bis(2-Ethylhexyl)phthalate	544	ug/Kg	495
Di-n-octylphthalate	495U	ug/Kg	495
Benzo(b)fluoranthene	5969	ug/Kg	495
Benzo(k)fluoranthene	4206	ug/Kg	495
Benzo(a)pyrene	5800	ug/Kg	495
Indeno(1,2,3-cd)pyrene	3297	ug/Kg	495
Dibenz(a,h)anthracene	991	ug/Kg	495
Benzo(g,h,i)perylene	3377	ug/Kg	495

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060084-1

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-1

Sample wt/vol: 1 (g/ml) G Lab File ID: C01377.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/17/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 30 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 000108-38-3	Benzene, 1,3-dimethyl-	6.99	1100	JN
2. 002051-30-1	Octane, 2,6-dimethyl-	8.24	670	JN
3. 003178-29-8	Heptane, 4-propyl-	8.39	700	JN
4. 000095-63-6	Benzene, 1,2,4-trimethyl-	9.51	950	JN
5. 002847-72-5	Decane, 4-methyl-	9.98	1100	JN
6. 000108-67-8	Benzene, 1,3,5-trimethyl-	10.08	770	JN
7. 001678-93-9	Cyclohexane, butyl-	10.20	950	JN
8. 000300-57-2	Benzene, 2-propenyl-	10.34	760	JN
9. 000493-02-7	Naphthalene, decahydro-, trans-	10.69	1900	JN
10. 013151-34-3	Decane, 3-methyl-	10.84	1000	JN
11. 061142-70-9	Cyclohexane, 2,4-diethyl-1-meth	11.05	690	JN
12. 000089-82-7	Pulegone	11.70	2000	JN
13. 000874-41-9	Benzene, 1-ethyl-2,4-dimethyl-	11.78	990	JN
14. 062185-53-9	Nonane, 5-(2-methylpropyl)-	11.85	1300	JN
15. 002958-76-1	Naphthalene, decahydro-2-methy	12.01	1100	JN
16. 000767-58-8	Indan, 1-methyl-	12.43	3300	JN
17. 017301-23-4	Undecane, 2,6-dimethyl-	13.31	2000	JN
18. 000120-29-6	Tropine	13.84	3700	JN
19. 026730-14-3	Tridecane, 7-methyl-	14.33	11000	JN
20. 000090-12-0	Naphthalene, 1-methyl-	15.19	8400	JN
21. 000638-36-8	Hexadecane, 2,6,10,14-tetramet	21.29	2000	JN
22. 000000-00-0	Tridecanol, 2-ethyl-2-methyl-	22.16	980	JN
23. 000613-12-7	Anthracene, 2-methyl-	22.74	1100	JN
24. 000832-71-3	Phenanthrene, 3-methyl-	22.81	1100	JN
25. 000610-48-0	Anthracene, 1-methyl-	23.04	3000	JN
26. 001576-69-8	Phenanthrene, 2,7-dimethyl-	24.01	1100	JN
27. 000243-17-4	11H-Benzo[b]fluorene	25.98	1100	JN
28. 028553-12-0	1,2-Benzenedicarboxylic acid, dii	30.67	2400	JN
29. 025724-58-7	1,2-Benzenedicarboxylic acid, de	30.81	3500	JN
30. 000205-82-3	Benzo[j]fluoranthene	31.76	5500	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-02
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-2-I-3	**GC/MS ID:**	C01378
Analysis Date:	2/17/2006	**Analysis Time:**	7:30PM

Compound	Results	Units	PQL
Phenol	498U	ug/Kg	498
bis(2-Chloroethyl)ether	498U	ug/Kg	498
2-Chlorophenol	498U	ug/Kg	498
1,3-Dichlorobenzene	498U	ug/Kg	498
1,4-Dichlorobenzene	498U	ug/Kg	498
1,2-Dichlorobenzene	498U	ug/Kg	498
2-Methylphenol	498U	ug/Kg	498
2,2'-oxybis(1-Chloropropane)	498U	ug/Kg	498
4-Methylphenol	579	ug/Kg	498
N-Nitroso-di-n-propylamine	498U	ug/Kg	498
Hexachloroethane	498U	ug/Kg	498
Nitrobenzene	498U	ug/Kg	498
Isophorone	498U	ug/Kg	498
2-Nitrophenol	498U	ug/Kg	498
2,4-Dimethylphenol	498U	ug/Kg	498
bis(2-Chloroethoxy)methane	498U	ug/Kg	498
2,4-Dichlorophenol	498U	ug/Kg	498
1,2,4-Trichlorobenzene	498U	ug/Kg	498
Naphthalene	709	ug/Kg	498
4-Chloroaniline	498U	ug/Kg	498
Hexachlorobutadiene	498U	ug/Kg	498
4-Chloro-3-methylphenol	498U	ug/Kg	498
2-Methylnaphthalene	7915	ug/Kg	498
Hexachlorocyclopentadiene	498U	ug/Kg	498
2,4,6-Trichlorophenol	498U	ug/Kg	498
2,4,5-Trichlorophenol	498U	ug/Kg	498
2-Chloronaphthalene	498U	ug/Kg	498
2-Nitroaniline	498U	ug/Kg	498
Dimethylphthalate	498U	ug/Kg	498
Acenaphthylene	498U	ug/Kg	498
2,6-Dinitrotoluene	498U	ug/Kg	498
3-Nitroaniline	498U	ug/Kg	498
Acenaphthene	1801	ug/Kg	498
2,4-Dinitrophenol	498U	ug/Kg	498
4-Nitrophenol	498U	ug/Kg	498
Dibenzofuran	498U	ug/Kg	498
2,4-Dinitrotoluene	498U	ug/Kg	498

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-02
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-2-I-3	**GC/MS ID:**	C01378
Analysis Date:	2/17/2006	**Analysis Time:**	7:30PM

Compound	Results	Units	PQL
Diethylphthalate	498U	ug/Kg	498
4-chlorophenyl-phenylether	498U	ug/Kg	498
Fluorene	2117	ug/Kg	498
4-Nitroaniline	498U	ug/Kg	498
4,6-Dinitro-2-methylphenol	498U	ug/Kg	498
N-Nitrosodiphenylamine	498U	ug/Kg	498
4-Bromophenyl-phenylether	498U	ug/Kg	498
Hexachlorobenzene	498U	ug/Kg	498
Pentachlorophenol	498U	ug/Kg	498
Phenanthrene	8055	ug/Kg	498
Anthracene	2339	ug/Kg	498
Carbazole	800	ug/Kg	498
Di-n-butylphthalate	498U	ug/Kg	498
Fluoranthene	9210	ug/Kg	498
Pyrene	6052	ug/Kg	498
Butylbenzylphthalate	498U	ug/Kg	498
3,3'-Dichlorobenzidine	498U	ug/Kg	498
Benzo(a)anthracene	3878	ug/Kg	498
Chrysene	5166	ug/Kg	498
bis(2-Ethylhexyl)phthalate	1266	ug/Kg	498
Di-n-octylphthalate	498U	ug/Kg	498
Benzo(b)fluoranthene	2837	ug/Kg	498
Benzo(k)fluoranthene	2884	ug/Kg	498
Benzo(a)pyrene	3363	ug/Kg	498
Indeno(1,2,3-cd)pyrene	1978	ug/Kg	498
Dibenz(a,h)anthracene	585	ug/Kg	498
Benzo(g,h,i)perylene	2006	ug/Kg	498

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060084-2

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-2

Sample wt/vol: 1 (g/ml) G Lab File ID: C01378.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/17/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 31 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 001072-05-5	Heptane, 2,6-dimethyl-	6.82	470	JN
2. 000108-38-3	Benzene, 1,3-dimethyl-	6.98	810	JN
3. 005911-04-6	Nonane, 3-methyl-	8.24	690	JN
4. 017301-94-9	Nonane, 4-methyl-	8.79	480	JN
5. 010544-96-4	Octadecane, 6-methyl-	8.85	580	JN
6. 000099-82-1	1-Methyl-4-(1-methylethyl)-cyclo	9.06	780	JN
7. 000108-67-8	Benzene, 1,3,5-trimethyl-	9.51	760	JN
8. 002847-72-5	Decane, 4-methyl-	9.97	780	JN
9. 000526-73-8	Benzene, 1,2,3-trimethyl-	10.07	500	JN
10. 001678-93-9	Cyclohexane, butyl-	10.19	690	JN
11. 000091-17-8	Naphthalene, decahydro-	10.68	1600	JN
12. 013151-34-3	Decane, 3-methyl-	10.84	600	JN
13. 002958-76-1	Naphthalene, decahydro-2-methy	11.69	1100	JN
14. 031081-18-2	Nonane, 3-methyl-5-propyl-	11.84	940	JN
15. 000089-82-7	Pulegone	12.00	940	JN
16. 000767-58-8	Indan, 1-methyl-	12.42	1800	JN
17. 006682-71-9	1H-Indene, 2,3-dihydro-4,7-dimet	12.94	2000	JN
18. 017301-23-4	Undecane, 2,6-dimethyl-	13.30	2300	JN
19. 061142-20-9	Cyclohexane, (4-methylpentyl)-	13.83	1800	JN
20. 026730-14-3	Tridecane, 7-methyl-	14.26	2100	JN
21. 000629-59-4	Tetradecane	21.28	2000	JN
22. 001795-17-1	Dodecylcyclohexane	21.95	710	JN
23. 000613-12-7	Anthracene, 2-methyl-	22.70	880	JN
24. 000610-48-0	Anthracene, 1-methyl-	23.01	2400	JN
25. 000243-17-4	11H-Benzo[b]fluorene	25.96	700	JN
26. 000238-84-6	11H-Benzo[a]fluorene	26.12	670	JN
27. 003442-78-2	Pyrene, 2-methyl-	26.22	650	JN
28. 000123-79-5	Hexanedioic acid, dioctyl ester	26.96	610	JN
29. 001330-96-7	1,2-Benzenedicarboxylic acid, iso	30.66	1600	JN
30. 028553-12-0	1,2-Benzenedicarboxylic acid, dii	30.79	2100	JN
31. 000205-82-3	Benzo[j]fluoranthene	31.74	3200	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-03
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-1-I-3	**GC/MS ID:**	C01379
Analysis Date:	2/17/2006	**Analysis Time:**	8:21PM

Compound	Results	Units	PQL
Phenol	881U	ug/Kg	881
bis(2-Chloroethyl)ether	881U	ug/Kg	881
2-Chlorophenol	881U	ug/Kg	881
1,3-Dichlorobenzene	881U	ug/Kg	881
1,4-Dichlorobenzene	881U	ug/Kg	881
1,2-Dichlorobenzene	881U	ug/Kg	881
2-Methylphenol	881U	ug/Kg	881
2,2'-oxybis(1-Chloropropane)	881U	ug/Kg	881
4-Methylphenol	528J	ug/Kg	881
N-Nitroso-di-n-propylamine	881U	ug/Kg	881
Hexachloroethane	881U	ug/Kg	881
Nitrobenzene	881U	ug/Kg	881
Isophorone	881U	ug/Kg	881
2-Nitrophenol	881U	ug/Kg	881
2,4-Dimethylphenol	881U	ug/Kg	881
bis(2-Chloroethoxy)methane	881U	ug/Kg	881
2,4-Dichlorophenol	881U	ug/Kg	881
1,2,4-Trichlorobenzene	881U	ug/Kg	881
Naphthalene	1539	ug/Kg	881
4-Chloroaniline	881U	ug/Kg	881
Hexachlorobutadiene	881U	ug/Kg	881
4-Chloro-3-methylphenol	881U	ug/Kg	881
2-Methylnaphthalene	10215	ug/Kg	881
Hexachlorocyclopentadiene	881U	ug/Kg	881
2,4,6-Trichlorophenol	881U	ug/Kg	881
2,4,5-Trichlorophenol	881U	ug/Kg	881
2-Chloronaphthalene	881U	ug/Kg	881
2-Nitroaniline	881U	ug/Kg	881
Dimethylphthalate	881U	ug/Kg	881
Acenaphthylene	881U	ug/Kg	881
2,6-Dinitrotoluene	881U	ug/Kg	881
3-Nitroaniline	881U	ug/Kg	881
Acenaphthene	1748	ug/Kg	881
2,4-Dinitrophenol	881U	ug/Kg	881
4-Nitrophenol	881U	ug/Kg	881
Dibenzofuran	881U	ug/Kg	881
2,4-Dinitrotoluene	881U	ug/Kg	881

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-03
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-1-I-3	**GC/MS ID:**	C01379
Analysis Date:	2/17/2006	**Analysis Time:**	8:21PM

Compound	Results	Units	PQL
Diethylphthalate	881U	ug/Kg	881
4-chlorophenyl-phenylether	881U	ug/Kg	881
Fluorene	1644	ug/Kg	881
4-Nitroaniline	881U	ug/Kg	881
4,6-Dinitro-2-methylphenol	881U	ug/Kg	881
N-Nitrosodiphenylamine	881U	ug/Kg	881
4-Bromophenyl-phenylether	881U	ug/Kg	881
Hexachlorobenzene	881U	ug/Kg	881
Pentachlorophenol	881U	ug/Kg	881
Phenanthrene	3515	ug/Kg	881
Anthracene	814J	ug/Kg	881
Carbazole	881U	ug/Kg	881
Di-n-butylphthalate	881U	ug/Kg	881
Fluoranthene	1197	ug/Kg	881
Pyrene	1424	ug/Kg	881
Butylbenzylphthalate	881U	ug/Kg	881
3,3'-Dichlorobenzidine	881U	ug/Kg	881
Benzo(a)anthracene	627	ug/Kg	881
Chrysene	1051	ug/Kg	881
bis(2-Ethylhexyl)phthalate	881U	ug/Kg	881
Di-n-octylphthalate	881U	ug/Kg	881
Benzo(b)fluoranthene	484J	ug/Kg	881
Benzo(k)fluoranthene	473J	ug/Kg	881
Benzo(a)pyrene	557J	ug/Kg	881
Indeno(1,2,3-cd)pyrene	362J	ug/Kg	881
Dibenz(a,h)anthracene	881U	ug/Kg	881
Benzo(g,h,i)perylene	306J	ug/Kg	881

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060084-3

Lab Name: Quantex Laboratories, Inc. Contract: _____

Lab Code: 12766 Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-3

Sample wt/vol: 1 (g/ml) G Lab File ID: C01379.D

Level: (low/med) LOW Date Received: _____

% Moisture: 1 decanted: (Y/N) N Date Extracted: _____

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/17/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

Number TICs found: 31 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 000624-29-3	Cyclohexane, 1,4-dimethyl-, cis-	5.03	750	JN
2. 000111-65-9	Octane	5.46	1300	JN
3. 001678-91-7	Cyclohexane, ethyl-	6.18	890	JN
4. 001839-63-0	Cyclohexane, 1,3,5-trimethyl-	6.24	1300	JN
5. 003221-61-2	Octane, 2-methyl-	6.81	1100	JN
6. 000108-38-3	Benzene, 1,3-dimethyl-	6.97	1800	JN
7. 003728-55-0	1-Ethyl-3-methylcyclohexane (c,t	7.30	710	JN
8. 005911-04-6	Nonane, 3-methyl-	8.23	1500	JN
9. 014676-29-0	Heptane, 3-ethyl-2-methyl-	8.38	1200	JN
10. 003074-71-3	Heptane, 2,3-dimethyl-	8.67	790	JN
11. 000108-67-8	Benzene, 1,3,5-trimethyl-	9.00	1000	JN
12. 000526-73-8	Benzene, 1,2,3-trimethyl-	9.50	3300	JN
13. 002847-72-5	Decane, 4-methyl-	9.97	1900	JN
14. 000620-14-4	Benzene, 1-ethyl-3-methyl-	10.07	1500	JN
15. 001678-93-9	Cyclohexane, butyl-	10.20	1300	JN
16. 017302-32-8	Nonane, 3,7-dimethyl-	10.27	710	JN
17. 000611-15-4	Benzene, 1-ethenyl-2-methyl-	10.33	1200	JN
18. 007094-26-0	Cyclohexane, 1,1,2-trimethyl-	10.45	840	JN
19. 000491-02-1	Cyclohexanol, 5-methyl-2-(1-met	10.66	1800	JN
20. 002958-76-1	Naphthalene, decahydro-2-methy	11.70	1100	JN
21. 000874-41-9	Benzene, 1-ethyl-2,4-dimethyl-	11.85	1600	JN
22. 002050-24-0	Benzene, 1,3-diethyl-5-methyl-	12.23	1200	JN
23. 002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	12.42	2900	JN
24. 006682-71-9	1H-Indene, 2,3-dihydro-4,7-dimet	12.92	2100	JN
25. 006044-71-9	Dodecane, 6-methyl-	13.29	2100	JN
26. 061142-20-9	Cyclohexane, (4-methylpentyl)-	13.81	2300	JN
27. 061141-72-8	Dodecane, 4,6-dimethyl-	14.23	5500	JN
28. 000090-12-0	Naphthalene, 1-methyl-	15.10	5200	JN
29. 000575-41-7	Naphthalene, 1,3-dimethyl-	17.00	3600	JN
30. 021164-95-4	Hexadecane, 7,9-dimethyl-	19.39	3500	JN
31. 000638-36-8	Hexadecane, 2,6,10,14-tetramet	21.25	3600	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-04
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-1-N-3	**GC/MS ID:**	C01380
Analysis Date:	2/17/2006	**Analysis Time:**	9:12PM

Compound	Results	Units	PQL
Phenol	1046U	ug/Kg	1046
bis(2-Chloroethyl)ether	1046U	ug/Kg	1046
2-Chlorophenol	1046U	ug/Kg	1046
1,3-Dichlorobenzene	1046U	ug/Kg	1046
1,4-Dichlorobenzene	1046U	ug/Kg	1046
1,2-Dichlorobenzene	1046U	ug/Kg	1046
2-Methylphenol	1046U	ug/Kg	1046
2,2'-oxybis(1-Chloropropane)	1046U	ug/Kg	1046
4-Methylphenol	480J	ug/Kg	1046
N-Nitroso-di-n-propylamine	1046U	ug/Kg	1046
Hexachloroethane	1046U	ug/Kg	1046
Nitrobenzene	1046U	ug/Kg	1046
Isophorone	1046U	ug/Kg	1046
2-Nitrophenol	1046U	ug/Kg	1046
2,4-Dimethylphenol	1046U	ug/Kg	1046
bis(2-Chloroethoxy)methane	1046U	ug/Kg	1046
2,4-Dichlorophenol	1046U	ug/Kg	1046
1,2,4-Trichlorobenzene	1046U	ug/Kg	1046
Naphthalene	1340	ug/Kg	1046
4-Chloroaniline	1046U	ug/Kg	1046
Hexachlorobutadiene	1046U	ug/Kg	1046
4-Chloro-3-methylphenol	1046U	ug/Kg	1046
2-Methylnaphthalene	6971	ug/Kg	1046
Hexachlorocyclopentadiene	1046U	ug/Kg	1046
2,4,6-Trichlorophenol	1046U	ug/Kg	1046
2,4,5-Trichlorophenol	1046U	ug/Kg	1046
2-Chloronaphthalene	1046U	ug/Kg	1046
2-Nitroaniline	1046U	ug/Kg	1046
Dimethylphthalate	1046U	ug/Kg	1046
Acenaphthylene	1046U	ug/Kg	1046
2,6-Dinitrotoluene	1046U	ug/Kg	1046
3-Nitroaniline	1046U	ug/Kg	1046
Acenaphthene	1428	ug/Kg	1046
2,4-Dinitrophenol	1046U	ug/Kg	1046
4-Nitrophenol	1046U	ug/Kg	1046
Dibenzofuran	1046U	ug/Kg	1046
2,4-Dinitrotoluene	1046U	ug/Kg	1046

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060084-04
Client Project:	Plumly	**Analyst:**	AM
Client Sample ID:	C-1-N-3	**GC/MS ID:**	C01380
Analysis Date:	2/17/2006	**Analysis Time:**	9:12PM

Compound	Results	Units	PQL
Diethylphthalate	1046U	ug/Kg	1046
4-chlorophenyl-phenylether	1046U	ug/Kg	1046
Fluorene	1717	ug/Kg	1046
4-Nitroaniline	1046U	ug/Kg	1046
4,6-Dinitro-2-methylphenol	1046U	ug/Kg	1046
N-Nitrosodiphenylamine	1046U	ug/Kg	1046
4-Bromophenyl-phenylether	1046U	ug/Kg	1046
Hexachlorobenzene	1046U	ug/Kg	1046
Pentachlorophenol	1046U	ug/Kg	1046
Phenanthrene	3691	ug/Kg	1046
Anthracene	985	ug/Kg	1046
Carbazole	1046U	ug/Kg	1046
Di-n-butylphthalate	1046U	ug/Kg	1046
Fluoranthene	2812	ug/Kg	1046
Pyrene	2266	ug/Kg	1046
Butylbenzylphthalate	1046U	ug/Kg	1046
3,3'-Dichlorobenzidine	1046U	ug/Kg	1046
Benzo(a)anthracene	1122	ug/Kg	1046
Chrysene	1727	ug/Kg	1046
bis(2-Ethylhexyl)phthalate	548J	ug/Kg	1046
Di-n-octylphthalate	1046U	ug/Kg	1046
Benzo(b)fluoranthene	1067	ug/Kg	1046
Benzo(k)fluoranthene	930J	ug/Kg	1046
Benzo(a)pyrene	967J	ug/Kg	1046
Indeno(1,2,3-cd)pyrene	738J	ug/Kg	1046
Dibenz(a,h)anthracene	1046U	ug/Kg	1046
Benzo(g,h,i)perylene	779J	ug/Kg	1046

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060084-4

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060084-4

Sample wt/vol: 1 (g/ml) G Lab File ID: C01380.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 02/17/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 31 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 003221-61-2	Octane, 2-methyl-	6.81	1600	JN
2. 002216-33-3	Octane, 3-methyl-	6.96	1800	JN
3. 000871-83-0	Nonane, 2-methyl-	8.83	1500	JN
4. 000526-73-8	Benzene, 1,2,3-trimethyl-	9.50	3200	JN
5. 017302-28-2	Nonane, 2,6-dimethyl-	9.96	2000	JN
6. 000622-96-8	Benzene, 1-ethyl-4-methyl-	10.06	1500	JN
7. 001678-93-9	Cyclohexane, butyl-	10.18	1600	JN
8. 000493-02-7	Naphthalene, decahydro-, trans-	10.67	2300	JN
9. 000874-41-9	Benzene, 1-ethyl-2,4-dimethyl-	10.71	2900	JN
10. 000099-87-6	Benzene, 1-methyl-4-(1-methylet	11.09	3000	JN
11. 000933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	11.85	2000	JN
12. 000089-74-7	Ethanone, 1-(2,4-dimethylphenyl)	12.23	2400	JN
13. 002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	12.41	3500	JN
14. 054411-00-6	Cyclohexane, 1-methyl-4-(1-met	12.90	3200	JN
15. 017301-23-4	Undecane, 2,6-dimethyl-	13.28	2400	JN
16. 054965-53-6	1-Propanone, 2-chloro-1-(2,4-dim	13.58	3800	JN
17. 001795-16-0	Cyclohexane, decyl-	13.76	3100	JN
18. 026730-20-1	Hexadecane, 7-methyl-	14.20	6500	JN
19. 000090-12-0	Naphthalene, 1-methyl-	15.08	4800	JN
20. 004292-92-6	Cyclohexane, pentyl-	15.36	2400	JN
21. 031295-56-4	Dodecane, 2,6,11-trimethyl-	15.75	2700	JN
22. 000571-61-9	Naphthalene, 1,5-dimethyl-	16.45	3700	JN
23. 000575-37-1	Naphthalene, 1,7-dimethyl-	16.74	8800	JN
24. 017312-62-8	Decane, 5-propyl-	16.95	7700	JN
25. 055045-11-9	Tridecane, 5-propyl-	19.36	6900	JN
26. 001921-70-6	Pentadecane, 2,6,10,14-tetramet	20.06	20000	JN
27. 000613-33-2	4,4'-Dimethylbiphenyl	20.47	9000	JN
28. 000629-59-4	Tetradecane	21.22	16000	JN
29. 000544-76-3	Hexadecane	22.11	4600	JN
30. 000610-48-0	Anthracene, 1-methyl-	22.66	2200	JN
31. 000779-02-2	Anthracene, 9-methyl-	22.96	3600	JN

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Laboratory NJ ID: 12766

March 13, 2006

Quantum Consulting Services
11 Westwood Rd
East Brunswick, NJ 08816

Attn: Dr. C. Bruno

Analytical Report 2060131 Project: Plumley – Matt Petro

This report covers the analysis of four (4) samples submitted to Quantex Laboratories on March 7, 2006. The following analyses were requested:

Total Petroleum Hydrocarbons (4)
TCL Volatile Organics + Search (4)
TCL Semi-Volatile Organics + Search (4)

Very truly yours,

Angela Menoutis

Angela Menoutis
Manager of Laboratory Services

Quantex Laboratories
22 Distributio[illegible]levard
Edison, New J[illegible]ey 08817
(732) 248-3335 Fax: (732) 248-0912

Quantex Laboratories
CHAIN[illegible] CUSTODY

Form COCE[illegible] 2/03

Lab Project No: (FOR LAB USE ONLY) 20608131

CLIENT INFORMATION	BILLING INFORMATION
Company: Quantum Consulting	Company:
Address: 11 Westwood Rd	Address:
City: EAST BRUNSWICK	City:
State: N.J. Zip: 08816	State: Zip:
Contact: Dr. C. Bruno	Attn: PO:
Phone: 732-846-5990 Fax: 732-846-5307	Phone: Fax:

TURNAROUND TIME — PLEASE CIRCLE

Verbal/Fax
2 Wk 1Wk* 72Hr* 48Hr* 24Hr* Other:

Conditional/TPHC by Fax
1Wk 72Hr 48Hr* 24Hr* Other:

Hard Copy
3 Wk 2Wk* 1Wk* 72Hr* Other:

* Prior laboratory authorization & notification required. YOU MUST NOTIFY THE LABORATORY OF ANY PRIOR AUTHORIZATION BEFORE SAMPLE ARRIVAL.

REPORT DELIVERABLES
- ☐ Results Only
- ☐ Standard
- ☐ Reduced
- ☐ Regulatory (Please Specify) _____
- ☐ Other

DISK DELIVERABLES
SRP Disk : ☐ .dbf or ☐ .wk1
Other: ☐ Excel ☐ Access

Site/Project Name: Plumley - Mart Petro
Case #
Project Manager:

Comments:

ANALYSIS REQUESTED Page _____ of____

SAMPLE MATRIX
W - Water G - Groundwater A- Aqueous
S - Soil SL - Sludge SD - Solid
O - Oil X - Other

Cooler Temp 4 °C

SAMPLE INFORMATION

Lab ID	Sample ID	Date	Time	Matrix	Sampler	# of Container	Serial #	TPHC (123 456)	TCL Semivol + (123 456)	TCL-VOA + (123 456)	123 456	123 456	123 456	123 456	123 456	Comments
1	C-2-N-4	3-6-06		S				✓								
1	C-2-N-4			S					✓							
1	C-2-N-4			S						✓						
2	C-2-I-4			S				✓								
2	C-2-I-4			S					✓							
2	C-2-I-4			S						✓						
3	C-1-I-4			S				✓								
3	C-1-I-4			S					✓							
3	C-1-I-4			S						✓						
4	C-1-N-4			S				✓								
4	C-1-N-4			S					✓							
4	C-1-N-4			S						✓						

1. HCl 2. MeOH
3. HNO_3 4. H_2SO_4
5. NaOH 6. Other

Relinquished By:	Received By:	Date	Time	Relinquished By:	Received By:	Date	Time
C. Bruno	[illegible]	3/7/06	900				

P. 1

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Analytical Report

Client Name: Quantum Consulting Services, Inc. **Lab Project:** 2060131
Client Project: Plumley

Client ID	Lab Sample ID	Analysis	Results	Units	PQL/MDL	Analysis date
C-2-N-4	2060131-01					
		Percent Solids	76.4	%	0.1	3/7/2006
		Total Petroleum Hydrocarbons	289	mg/Kg	16.6	3/9/2006
C-2-I-4	2060131-02					
		Percent Solids	76.6	%	0.1	3/7/2006
		Total Petroleum Hydrocarbons	332	mg/Kg	16.6	3/9/2006
C-1-I-4	2060131-03					
		Percent Solids	66.4	%	0.1	3/7/2006
		Total Petroleum Hydrocarbons	622	mg/Kg	16.6	3/9/2006
C-1-N-4	2060131-04					
		Percent Solids	70.0	%	0.1	3/7/2006
		Total Petroleum Hydrocarbons	992	mg/Kg	16.6	3/9/2006

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-01
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-2-N-4	**GC/MS ID:**	V11399
Analysis Date:	3/7/2006	**Analysis Time:**	12:10

Compound	Results	Units	PQL
Chloromethane	168U	ug/Kg	168
Bromomethane	168U	ug/Kg	168
Vinyl Chloride	168U	ug/Kg	168
Chloroethane	168U	ug/Kg	168
Acetone	168U	ug/Kg	168
Carbon Disulfide	168U	ug/Kg	168
Methylene Chloride	168U	ug/Kg	168
1,1 Dichloroethene	168U	ug/Kg	168
trans 1,2 Dichloroethene	168U	ug/Kg	168
cis 1,2 Dichloroethene	168U	ug/Kg	168
2 Butanone	168U	ug/Kg	168
Vinyl Acetate	168U	ug/Kg	168
4 Methyl 2 pentanone	168U	ug/Kg	168
1,1 Dichloroethane	168U	ug/Kg	168
Chloroform	168U	ug/Kg	168
1,1,1 Trichloroethane	168U	ug/Kg	168
Carbon Tetrachloride	168U	ug/Kg	168
1,2 Dichloroethane	168U	ug/Kg	168
Bromodichloromethane	168U	ug/Kg	168
1,2 Dichloropropane	168U	ug/Kg	168
trans 1,3 Dichloropropene	168U	ug/Kg	168
cis 1,3 Dichloropropene	168U	ug/Kg	168
Trichloroethylene	168U	ug/Kg	168
Dibromochloromethane	168U	ug/Kg	168
1,1,2 Trichloroethane	168U	ug/Kg	168
Benzene	168U	ug/Kg	168
2 Chloroethyl Vinyl Ether	168U	ug/Kg	168
Bromoform	168U	ug/Kg	168
Tetrachloroethylene	168U	ug/Kg	168
1,1,2,2 Tetrachloroethane	168U	ug/Kg	168
Toluene	270	ug/Kg	168
Chlorobenzene	168U	ug/Kg	168
Ethyl Benzene	201	ug/Kg	168
M&P Xylenes	732	ug/Kg	168
O Xylene	83.6J	ug/Kg	168
2 Hexanone	168U	ug/Kg	168
Styrene	168U	ug/Kg	168

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060131-1

Lab Name: Quantex Labs Contract: _____

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

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-1

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11399.D

Level: (low/med) LOW Date Received: _____

% Moisture: not dec. 0.00001 Date Analyzed: 03/07/06

GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000110-54-3	Hexane	7.34	32000	JN
2. 000110-82-7	Cyclohexane	9.61	7200	JN
3. 001071-31-4	2,2,7,7-Tetramethyloctane	10.35	50000	JN
4. 000108-87-2	Cyclohexane, methyl-	11.47	6900	JN
5. 000933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	20.32	7500	JN
6. 000095-93-2	Benzene, 1,2,4,5-tetramethyl-	21.08	6900	JN
7. 017301-28-9	Undecane, 3,6-dimethyl-	21.33	9400	JN
8. 017057-82-8	1H-Indene, 2,3-dihydro-1,2-dimet	22.99	8400	JN
9. 000090-12-0	Naphthalene, 1-methyl-	23.81	15000	JN
10. 000091-57-6	Naphthalene, 2-methyl-	24.13	10000	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-02
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-2-I-4	**GC/MS ID:**	V11400
Analysis Date:	3/7/2006	**Analysis Time:**	12:52

Compound	Results	Units	PQL
Chloromethane	155U	ug/Kg	155
Bromomethane	155U	ug/Kg	155
Vinyl Chloride	155U	ug/Kg	155
Chloroethane	155U	ug/Kg	155
Acetone	155U	ug/Kg	155
Carbon Disulfide	155U	ug/Kg	155
Methylene Chloride	155U	ug/Kg	155
1,1 Dichloroethene	155U	ug/Kg	155
trans 1,2 Dichloroethene	155U	ug/Kg	155
cis 1,2 Dichloroethene	155U	ug/Kg	155
2 Butanone	155U	ug/Kg	155
Vinyl Acetate	155U	ug/Kg	155
4 Methyl 2 pentanone	155U	ug/Kg	155
1,1 Dichloroethane	155U	ug/Kg	155
Chloroform	155U	ug/Kg	155
1,1,1 Trichloroethane	155U	ug/Kg	155
Carbon Tetrachloride	155U	ug/Kg	155
1,2 Dichloroethane	155U	ug/Kg	155
Bromodichloromethane	155U	ug/Kg	155
1,2 Dichloropropane	155U	ug/Kg	155
trans 1,3 Dichloropropene	155U	ug/Kg	155
cis 1,3 Dichloropropene	155U	ug/Kg	155
Trichloroethylene	155U	ug/Kg	155
Dibromochloromethane	155U	ug/Kg	155
1,1,2 Trichloroethane	155U	ug/Kg	155
Benzene	155U	ug/Kg	155
2 Chloroethyl Vinyl Ether	155U	ug/Kg	155
Bromoform	155U	ug/Kg	155
Tetrachloroethylene	155U	ug/Kg	155
1,1,2,2 Tetrachloroethane	155U	ug/Kg	155
Toluene	282	ug/Kg	155
Chlorobenzene	155U	ug/Kg	155
Ethyl Benzene	251	ug/Kg	155
M&P Xylenes	1209	ug/Kg	155
O Xylene	118J	ug/Kg	155
2 Hexanone	155U	ug/Kg	155
Styrene	155U	ug/Kg	155

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

2060131-2

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-2

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11400.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 03/07/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000096-14-0	Pentane, 3-methyl-	7.36	31000	JN
2. 000110-82-7	Cyclohexane	9.59	10000	JN
3. 001067-20-5	Pentane, 3,3-diethyl-	10.29	23000	JN
4. 000624-83-9	Methane, isocyanato-	10.33	15000	JN
5. 000095-93-2	Benzene, 1,2,4,5-tetramethyl-	20.36	8500	JN
6. 000105-05-5	Benzene, 1,4-diethyl-	21.10	9500	JN
7. 017301-23-4	Undecane, 2,6-dimethyl-	21.37	10000	JN
8. 005911-04-6	Nonane, 3-methyl-	22.30	8600	JN
9. 004489-84-3	Benzene, (3-methyl-2-butenyl)-	22.99	10000	JN
10. 000090-12-0	Naphthalene, 1-methyl-	23.81	14000	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-03
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-1-I-4	**GC/MS ID:**	V11401
Analysis Date:	3/7/2006	**Analysis Time:**	13:33

Compound	Results	Units	PQL
Chloromethane	154U	ug/Kg	154
Bromomethane	154U	ug/Kg	154
Vinyl Chloride	154U	ug/Kg	154
Chloroethane	154U	ug/Kg	154
Acetone	154U	ug/Kg	154
Carbon Disulfide	154U	ug/Kg	154
Methylene Chloride	154U	ug/Kg	154
1,1 Dichloroethene	154U	ug/Kg	154
trans 1,2 Dichloroethene	154U	ug/Kg	154
cis 1,2 Dichloroethene	154U	ug/Kg	154
2 Butanone	154U	ug/Kg	154
Vinyl Acetate	154U	ug/Kg	154
4 Methyl 2 pentanone	154U	ug/Kg	154
1,1 Dichloroethane	154U	ug/Kg	154
Chloroform	154U	ug/Kg	154
1,1,1 Trichloroethane	154U	ug/Kg	154
Carbon Tetrachloride	154U	ug/Kg	154
1,2 Dichloroethane	154U	ug/Kg	154
Bromodichloromethane	154U	ug/Kg	154
1,2 Dichloropropane	154U	ug/Kg	154
trans 1,3 Dichloropropene	154U	ug/Kg	154
cis 1,3 Dichloropropene	154U	ug/Kg	154
Trichloroethylene	154U	ug/Kg	154
Dibromochloromethane	154U	ug/Kg	154
1,1,2 Trichloroethane	154U	ug/Kg	154
Benzene	154U	ug/Kg	154
2 Chloroethyl Vinyl Ether	154U	ug/Kg	154
Bromoform	154U	ug/Kg	154
Tetrachloroethylene	154U	ug/Kg	154
1,1,2,2 Tetrachloroethane	154U	ug/Kg	154
Toluene	369	ug/Kg	154
Chlorobenzene	154U	ug/Kg	154
Ethyl Benzene	228	ug/Kg	154
M&P Xylenes	764	ug/Kg	154
O Xylene	128J	ug/Kg	154
2 Hexanone	154U	ug/Kg	154
Styrene	154U	ug/Kg	154

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060131-3

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-3

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11401.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 03/07/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000096-14-0	Pentane, 3-methyl-	7.32	27000	JN
2. 000110-82-7	Cyclohexane	9.59	5300	JN
3. 015877-57-3	Pentanal, 3-methyl-	10.25	20000	JN
4. 000108-87-2	Cyclohexane, methyl-	11.40	5600	JN
5. 000589-81-1	Heptane, 3-methyl-	13.25	4800	JN
6. 000108-87-2	Cyclohexane, methyl-	16.43	4400	JN
7. 062338-57-2	1,4-Cyclohexadiene, 3-ethenyl-1,	19.10	4600	JN
8. 000527-84-4	Benzene, 1-methyl-2-(1-methylet	21.08	6800	JN
9. 000090-12-0	Naphthalene, 1-methyl-	23.79	4700	JN
10. 000091-57-6	Naphthalene, 2-methyl-	24.11	4600	JN

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Tabulated Analytical Report For TCL Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-04
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-1-N-4	**GC/MS ID:**	V11402
Analysis Date:	3/7/2006	**Analysis Time:**	14:14

Compound	Results	Units	PQL
Chloromethane	143U	ug/Kg	143
Bromomethane	143U	ug/Kg	143
Vinyl Chloride	143U	ug/Kg	143
Chloroethane	143U	ug/Kg	143
Acetone	143U	ug/Kg	143
Carbon Disulfide	143U	ug/Kg	143
Methylene Chloride	143U	ug/Kg	143
1,1 Dichloroethene	143U	ug/Kg	143
trans 1,2 Dichloroethene	143U	ug/Kg	143
cis 1,2 Dichloroethene	143U	ug/Kg	143
2 Butanone	143U	ug/Kg	143
Vinyl Acetate	143U	ug/Kg	143
4 Methyl 2 pentanone	143U	ug/Kg	143
1,1 Dichloroethane	143U	ug/Kg	143
Chloroform	143U	ug/Kg	143
1,1,1 Trichloroethane	143U	ug/Kg	143
Carbon Tetrachloride	143U	ug/Kg	143
1,2 Dichloroethane	143U	ug/Kg	143
Bromodichloromethane	143U	ug/Kg	143
1,2 Dichloropropane	143U	ug/Kg	143
trans 1,3 Dichloropropene	143U	ug/Kg	143
cis 1,3 Dichloropropene	143U	ug/Kg	143
Trichloroethylene	143U	ug/Kg	143
Dibromochloromethane	143U	ug/Kg	143
1,1,2 Trichloroethane	143U	ug/Kg	143
Benzene	143U	ug/Kg	143
2 Chloroethyl Vinyl Ether	143U	ug/Kg	143
Bromoform	143U	ug/Kg	143
Tetrachloroethylene	143U	ug/Kg	143
1,1,2,2 Tetrachloroethane	143U	ug/Kg	143
Toluene	202	ug/Kg	143
Chlorobenzene	143U	ug/Kg	143
Ethyl Benzene	187	ug/Kg	143
M&P Xylenes	394	ug/Kg	143
O Xylene	97.9J	ug/Kg	143
2 Hexanone	143U	ug/Kg	143
Styrene	143U	ug/Kg	143

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
2060131-4

Lab Name: Quantex Labs Contract:

Lab Code: Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-4

Sample wt/vol: 1.0 (g/ml) G Lab File ID: V11402.D

Level: (low/med) LOW Date Received:

% Moisture: not dec. 0.00001 Date Analyzed: 03/07/06

GC Column: ID: (mm) Dilution Factor: 1.0

Soil Extract Volume: 1 (uL) Soil Aliquot Volume: 1 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 10

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000110-54-3	Hexane	7.34	23000	JN
2. 000110-82-7	Cyclohexane	9.61	4400	JN
3. 000111-36-4	Butane, 1-isocyanato-	10.31	26000	JN
4. 000624-83-9	Methane, isocyanato-	10.37	13000	JN
5. 074752-93-5	Cyclopropane, 1,1,2,3-tetramethy	11.49	4300	JN
6. 000111-65-9	Octane	13.32	3700	JN
7. 003728-54-9	Cyclohexane, 1-ethyl-2-methyl-	15.55	3200	JN
8. 001795-15-9	Cyclohexane, octyl-	16.47	3300	JN
9. 002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	21.08	4800	JN
10. 000090-12-0	Naphthalene, 1-methyl-	23.81	3100	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-01
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-2-N-4	**GC/MS ID:**	C01416
Analysis Date:	3/9/2006	**Analysis Time:**	12:19PM

Compound	Results	Units	PQL
Phenol	149	ug/Kg	662
bis(2-Chloroethyl)ether	662U	ug/Kg	662
2-Chlorophenol	662U	ug/Kg	662
1,3-Dichlorobenzene	662U	ug/Kg	662
1,4-Dichlorobenzene	662U	ug/Kg	662
1,2-Dichlorobenzene	662U	ug/Kg	662
2-Methylphenol	453J	ug/Kg	662
2,2'-oxybis(1-Chloropropane)	662U	ug/Kg	662
4-Methylphenol	662U	ug/Kg	662
N-Nitroso-di-n-propylamine	662U	ug/Kg	662
Hexachloroethane	662U	ug/Kg	662
Nitrobenzene	662U	ug/Kg	662
Isophorone	662U	ug/Kg	662
2-Nitrophenol	662U	ug/Kg	662
2,4-Dimethylphenol	662U	ug/Kg	662
bis(2-Chloroethoxy)methane	662U	ug/Kg	662
2,4-Dichlorophenol	662U	ug/Kg	662
1,2,4-Trichlorobenzene	662U	ug/Kg	662
Naphthalene	378J	ug/Kg	662
4-Chloroaniline	662U	ug/Kg	662
Hexachlorobutadiene	662U	ug/Kg	662
4-Chloro-3-methylphenol	662U	ug/Kg	662
2-Methylnaphthalene	4855	ug/Kg	662
Hexachlorocyclopentadiene	662U	ug/Kg	662
2,4,6-Trichlorophenol	662U	ug/Kg	662
2,4,5-Trichlorophenol	662U	ug/Kg	662
2-Chloronaphthalene	662U	ug/Kg	662
2-Nitroaniline	662U	ug/Kg	662
Dimethylphthalate	662U	ug/Kg	662
Acenaphthylene	662U	ug/Kg	662
2,6-Dinitrotoluene	662U	ug/Kg	662
3-Nitroaniline	662U	ug/Kg	662
Acenaphthene	1121	ug/Kg	662
2,4-Dinitrophenol	662U	ug/Kg	662
4-Nitrophenol	662U	ug/Kg	662
Dibenzofuran	662U	ug/Kg	662
2,4-Dinitrotoluene	662U	ug/Kg	662

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-01
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-2-N-4	**GC/MS ID:**	C01416
Analysis Date:	3/9/2006	**Analysis Time:**	12:19PM

Compound	Results	Units	PQL
Diethylphthalate	662U	ug/Kg	662
4-chlorophenyl-phenylether	662U	ug/Kg	662
Fluorene	1816	ug/Kg	662
4-Nitroaniline	662U	ug/Kg	662
4,6-Dinitro-2-methylphenol	662U	ug/Kg	662
N-Nitrosodiphenylamine	662U	ug/Kg	662
4-Bromophenyl-phenylether	662U	ug/Kg	662
Hexachlorobenzene	662U	ug/Kg	662
Pentachlorophenol	662U	ug/Kg	662
Phenanthrene	7330	ug/Kg	662
Anthracene	1614	ug/Kg	662
Carbazole	662U	ug/Kg	662
Di-n-butylphthalate	662U	ug/Kg	662
Fluoranthene	3950	ug/Kg	662
Pyrene	4873	ug/Kg	662
Butylbenzylphthalate	662U	ug/Kg	662
3,3'-Dichlorobenzidine	662U	ug/Kg	662
Benzo(a)anthracene	568J	ug/Kg	662
Chrysene	1558	ug/Kg	662
bis(2-Ethylhexyl)phthalate	662U	ug/Kg	662
Di-n-octylphthalate	662U	ug/Kg	662
Benzo(b)fluoranthene	554J	ug/Kg	662
Benzo(k)fluoranthene	429J	ug/Kg	662
Benzo(a)pyrene	568J	ug/Kg	662
Indeno(1,2,3-cd)pyrene	1713	ug/Kg	662
Dibenz(a,h)anthracene	662U	ug/Kg	662
Benzo(g,h,i)perylene	1706	ug/Kg	662

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060131-1

Lab Name: Quantex Laboratories, Inc. Contract: _____

Lab Code: 12766 Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-1

Sample wt/vol: 1 (g/ml) G Lab File ID: C01416.D

Level: (low/med) LOW Date Received: _____

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 03/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

Number TICs found: 30 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 000581-42-0	Naphthalene, 2,6-dimethyl-	16.40	3200	JN
2. 000575-43-9	Naphthalene, 1,6-dimethyl-	16.63	4400	JN
3. 000582-16-1	Naphthalene, 2,7-dimethyl-	16.68	4500	JN
4. 001795-15-9	Cyclohexane, octyl-	16.80	1100	JN
5. 006117-97-1	Dodecane, 4-methyl-	16.91	4600	JN
6. 000000-00-0	Decahydro-4,4,8,9,10-pentameth	17.20	1800	JN
7. 000829-26-5	Naphthalene, 2,3,6-trimethyl-	18.06	1700	JN
8. 002131-42-2	Naphthalene, 1,4,6-trimethyl-	18.12	1900	JN
9. 002245-38-7	Naphthalene, 1,6,7-trimethyl-	18.35	1100	JN
10. 002131-41-1	Naphthalene, 1,4,5-trimethyl-	18.38	1600	JN
11.	unknown substituted naphthalene	18.57	1900	J
12. 000629-50-5	Tridecane	19.28	2600	JN
13. 000529-05-5	Azulene, 7-ethyl-1,4-dimethyl-	19.89	2000	JN
14. 001921-70-6	Pentadecane, 2,6,10,14-tetramet	19.97	7200	JN
15. 000272-30-0	Benzo[b]selenophene	20.40	2300	JN
16. 001795-17-1	Dodecylcyclohexane	20.70	1300	JN
17. 000629-59-4	Tetradecane	21.14	2900	JN
18. 002039-89-6	Benzene, 2-ethenyl-1,4-dimethyl-	12.42	1400	JN
19. 004413-21-2	Cyclopentane, 1,1'-ethylidenebis-	12.91	1300	JN
20. 017301-23-4	Undecane, 2,6-dimethyl-	13.27	2500	JN
21. 061142-20-9	Cyclohexane, (4-methylpentyl)-	13.76	1600	JN
22. 000629-92-5	Nonadecane	13.90	1600	JN
23. 026730-14-3	Tridecane, 7-methyl-	14.18	3900	JN
24. 033641-78-0	Phenol, p-(2-methylallyl)-	14.50	1700	JN
25. 021693-54-9	Naphthalene, 1,2,3,4-tetrahydro-	14.70	1300	JN
26. 021564-91-0	Naphthalene, 1,2,3,4-tetrahydro-	14.85	2200	JN
27. 000090-12-0	Naphthalene, 1-methyl-	15.07	3900	JN
28. 001678-93-9	Cyclohexane, butyl-	15.32	1200	JN
29. 003891-98-3	Dodecane, 2,6,10-trimethyl-	15.72	2400	JN
30. 000000-00-0	Decahydro-4,4,8,9,10-pentameth	15.90	1600	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-02
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-2-I-4	**GC/MS ID:**	C01417
Analysis Date:	3/9/2006	**Analysis Time:**	1:10PM

Compound	Results	Units	PQL
Phenol	661U	ug/Kg	661
bis(2-Chloroethyl)ether	661U	ug/Kg	661
2-Chlorophenol	661U	ug/Kg	661
1,3-Dichlorobenzene	661U	ug/Kg	661
1,4-Dichlorobenzene	661U	ug/Kg	661
1,2-Dichlorobenzene	661U	ug/Kg	661
2-Methylphenol	340J	ug/Kg	661
2,2'-oxybis(1-Chloropropane)	661U	ug/Kg	661
4-Methylphenol	661U	ug/Kg	661
N-Nitroso-di-n-propylamine	661U	ug/Kg	661
Hexachloroethane	661U	ug/Kg	661
Nitrobenzene	661U	ug/Kg	661
Isophorone	661U	ug/Kg	661
2-Nitrophenol	661U	ug/Kg	661
2,4-Dimethylphenol	661U	ug/Kg	661
bis(2-Chloroethoxy)methane	661U	ug/Kg	661
2,4-Dichlorophenol	661U	ug/Kg	661
1,2,4-Trichlorobenzene	661U	ug/Kg	661
Naphthalene	620J	ug/Kg	661
4-Chloroaniline	661U	ug/Kg	661
Hexachlorobutadiene	661U	ug/Kg	661
4-Chloro-3-methylphenol	661U	ug/Kg	661
2-Methylnaphthalene	12569	ug/Kg	661
Hexachlorocyclopentadiene	661U	ug/Kg	661
2,4,6-Trichlorophenol	661U	ug/Kg	661
2,4,5-Trichlorophenol	661U	ug/Kg	661
2-Chloronaphthalene	661U	ug/Kg	661
2-Nitroaniline	661U	ug/Kg	661
Dimethylphthalate	661U	ug/Kg	661
Acenaphthylene	661U	ug/Kg	661
2,6-Dinitrotoluene	661U	ug/Kg	661
3-Nitroaniline	661U	ug/Kg	661
Acenaphthene	1291	ug/Kg	661
2,4-Dinitrophenol	661U	ug/Kg	661
4-Nitrophenol	661U	ug/Kg	661
Dibenzofuran	661U	ug/Kg	661
2,4-Dinitrotoluene	661U	ug/Kg	661

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-02
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-2-I-4	**GC/MS ID:**	C01417
Analysis Date:	3/9/2006	**Analysis Time:**	1:10PM

Compound	Results	Units	PQL
Diethylphthalate	661U	ug/Kg	661
4-chlorophenyl-phenylether	661U	ug/Kg	661
Fluorene	1666	ug/Kg	661
4-Nitroaniline	661U	ug/Kg	661
4,6-Dinitro-2-methylphenol	661U	ug/Kg	661
N-Nitrosodiphenylamine	661U	ug/Kg	661
4-Bromophenyl-phenylether	661U	ug/Kg	661
Hexachlorobenzene	661U	ug/Kg	661
Pentachlorophenol	661U	ug/Kg	661
Phenanthrene	4447	ug/Kg	661
Anthracene	1114	ug/Kg	661
Carbazole	661U	ug/Kg	661
Di-n-butylphthalate	661U	ug/Kg	661
Fluoranthene	2185	ug/Kg	661
Pyrene	5507	ug/Kg	661
Butylbenzylphthalate	661U	ug/Kg	661
3,3'-Dichlorobenzidine	661U	ug/Kg	661
Benzo(a)anthracene	1036	ug/Kg	661
Chrysene	1728	ug/Kg	661
bis(2-Ethylhexyl)phthalate	661U	ug/Kg	661
Di-n-octylphthalate	661U	ug/Kg	661
Benzo(b)fluoranthene	861	ug/Kg	661
Benzo(k)fluoranthene	739	ug/Kg	661
Benzo(a)pyrene	1141	ug/Kg	661
Indeno(1,2,3-cd)pyrene	1195	ug/Kg	661
Dibenz(a,h)anthracene	661U	ug/Kg	661
Benzo(g,h,i)perylene	1156	ug/Kg	661

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060131-2

Lab Name: Quantex Laboratories, Inc. Contract: _____

Lab Code: 12766 Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-2

Sample wt/vol: 1 (g/ml) G Lab File ID: C01417.D

Level: (low/med) LOW Date Received: _____

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 03/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

Number TICs found: 29 (ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	000563-16-6	Hexane, 3,3-dimethyl-	11.90	3500	JN
2.	000095-93-2	Benzene, 1,2,4,5-tetramethyl-	12.46	5000	JN
3.	054411-09-5	1H-Pyrazole-1-carboxaldehyde, 4	12.93	8700	JN
4.	017301-23-4	Undecane, 2,6-dimethyl-	13.31	9600	JN
5.	021293-02-7	3,5-Octadiene, 4,5-diethyl-, (E,Z)	13.63	3800	JN
6.	004292-75-5	Cyclohexane, hexyl-	13.78	6300	JN
7.	054823-95-9	Cyclohexane, 1-(cyclohexylmeth	13.94	6100	JN
8.	026730-14-3	Tridecane, 7-methyl-	14.23	16000	JN
9.	000700-12-9	Benzene, pentamethyl-	14.53	7300	JN
10.	006682-06-0	1H-Indene, 2,3-dihydro-4,5,7-trim	14.74	5100	JN
11.	000629-92-5	Nonadecane	14.89	9000	JN
12.	000090-12-0	Naphthalene, 1-methyl-	15.09	16000	JN
13.	003891-98-3	Dodecane, 2,6,10-trimethyl-	15.76	6200	JN
14.	000000-00-0	Decahydro-4,4,8,9,10-pentameth	15.94	4200	JN
15.	000581-42-0	Naphthalene, 2,6-dimethyl-	16.46	11000	JN
16.	000613-13-8	2-Anthracenamine	16.75	14000	JN
17.	004292-19-7	Dodecane, 1-iodo-	16.95	11000	JN
18.	000000-00-0	Decahydro-4,4,8,9,10-pentameth	17.24	5600	JN
19.	002245-38-7	Naphthalene, 1,6,7-trimethyl-	18.11	5700	JN
20.	002131-42-2	Naphthalene, 1,4,6-trimethyl-	18.18	7000	JN
21.	000829-26-5	Naphthalene, 2,3,6-trimethyl-	18.44	5200	JN
22.	002131-41-1	Naphthalene, 1,4,5-trimethyl-	18.61	4900	JN
23.	000112-95-8	Eicosane	19.31	5600	JN
24.	000529-05-5	Azulene, 7-ethyl-1,4-dimethyl-	19.94	3500	JN
25.	001921-70-6	Pentadecane, 2,6,10,14-tetramet	20.02	15000	JN
26.	000613-33-2	4,4'-Dimethylbiphenyl	20.44	5900	JN
27.	000529-05-5	Azulene, 7-ethyl-1,4-dimethyl-	20.75	3800	JN
28.	000613-33-2	4,4'-Dimethylbiphenyl	21.04	4700	JN
29.	000629-59-4	Tetradecane	21.19	8000	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-03
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-1-I-4	**GC/MS ID:**	C01418
Analysis Date:	3/9/2006	**Analysis Time:**	2:01PM

Compound	Results	Units	PQL
Phenol	600U	ug/Kg	600
bis(2-Chloroethyl)ether	600U	ug/Kg	600
2-Chlorophenol	600U	ug/Kg	600
1,3-Dichlorobenzene	600U	ug/Kg	600
1,4-Dichlorobenzene	600U	ug/Kg	600
1,2-Dichlorobenzene	600U	ug/Kg	600
2-Methylphenol	1198	ug/Kg	600
2,2'-oxybis(1-Chloropropane)	600U	ug/Kg	600
4-Methylphenol	600U	ug/Kg	600
N-Nitroso-di-n-propylamine	600U	ug/Kg	600
Hexachloroethane	600U	ug/Kg	600
Nitrobenzene	600U	ug/Kg	600
Isophorone	600U	ug/Kg	600
2-Nitrophenol	600U	ug/Kg	600
2,4-Dimethylphenol	600U	ug/Kg	600
bis(2-Chloroethoxy)methane	600U	ug/Kg	600
2,4-Dichlorophenol	600U	ug/Kg	600
1,2,4-Trichlorobenzene	600U	ug/Kg	600
Naphthalene	462J	ug/Kg	600
4-Chloroaniline	600U	ug/Kg	600
Hexachlorobutadiene	600U	ug/Kg	600
4-Chloro-3-methylphenol	600U	ug/Kg	600
2-Methylnaphthalene	3190	ug/Kg	600
Hexachlorocyclopentadiene	600U	ug/Kg	600
2,4,6-Trichlorophenol	600U	ug/Kg	600
2,4,5-Trichlorophenol	600U	ug/Kg	600
2-Chloronaphthalene	600U	ug/Kg	600
2-Nitroaniline	600U	ug/Kg	600
Dimethylphthalate	600U	ug/Kg	600
Acenaphthylene	600U	ug/Kg	600
2,6-Dinitrotoluene	600U	ug/Kg	600
3-Nitroaniline	600U	ug/Kg	600
Acenaphthene	503J	ug/Kg	600
2,4-Dinitrophenol	600U	ug/Kg	600
4-Nitrophenol	600U	ug/Kg	600
Dibenzofuran	600U	ug/Kg	600
2,4-Dinitrotoluene	600U	ug/Kg	600

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-03
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-1-I-4	**GC/MS ID:**	C01418
Analysis Date:	3/9/2006	**Analysis Time:**	2:01PM

Compound	Results	Units	PQL
Diethylphthalate	600U	ug/Kg	600
4-chlorophenyl-phenylether	600U	ug/Kg	600
Fluorene	606	ug/Kg	600
4-Nitroaniline	600U	ug/Kg	600
4,6-Dinitro-2-methylphenol	600U	ug/Kg	600
N-Nitrosodiphenylamine	600U	ug/Kg	600
4-Bromophenyl-phenylether	600U	ug/Kg	600
Hexachlorobenzene	600U	ug/Kg	600
Pentachlorophenol	600U	ug/Kg	600
Phenanthrene	1662	ug/Kg	600
Anthracene	410J	ug/Kg	600
Carbazole	600U	ug/Kg	600
Di-n-butylphthalate	600U	ug/Kg	600
Fluoranthene	877	ug/Kg	600
Pyrene	2189	ug/Kg	600
Butylbenzylphthalate	600U	ug/Kg	600
3,3'-Dichlorobenzidine	600U	ug/Kg	600
Benzo(a)anthracene	521J	ug/Kg	600
Chrysene	1004	ug/Kg	600
bis(2-Ethylhexyl)phthalate	600U	ug/Kg	600
Di-n-octylphthalate	600U	ug/Kg	600
Benzo(b)fluoranthene	473J	ug/Kg	600
Benzo(k)fluoranthene	453J	ug/Kg	600
Benzo(a)pyrene	462J	ug/Kg	600
Indeno(1,2,3-cd)pyrene	415J	ug/Kg	600
Dibenz(a,h)anthracene	600U	ug/Kg	600
Benzo(g,h,i)perylene	546J	ug/Kg	600

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected. but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060131-3

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-3

Sample wt/vol: 1 (g/ml) G Lab File ID: C01418.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 03/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 30 (ug/L or ug/Kg) UG/KG

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 000768-00-3	Benzene, (1-methyl-1-propenyl)-,	12.45	1400	JN
2. 004926-90-3	Cyclohexane, 1-ethyl-1-methyl-	12.94	1000	JN
3. 017301-23-4	Undecane, 2,6-dimethyl-	13.29	1400	JN
4. 061142-20-9	Cyclohexane, (4-methylpentyl)-	13.78	1100	JN
5. 062108-25-2	Decane, 2,6,7-trimethyl-	14.20	2700	JN
6. 020294-32-0	6-Methyl-4-indanol	14.52	1100	JN
7. 056292-65-0	Dodecane, 2,5-dimethyl-	14.89	1000	JN
8. 000090-12-0	Naphthalene, 1-methyl-	15.08	2600	JN
9. 003891-98-3	Dodecane, 2,6,10-trimethyl-	15.75	1600	JN
10. 000295-17-0	Cyclotetradecane	15.95	1200	JN
11. 000582-16-1	Naphthalene, 2,7-dimethyl-	16.44	2800	JN
12. 000573-98-8	Naphthalene, 1,2-dimethyl-	16.67	2700	JN
13. 054832-83-6	1H-Indene, octahydro-2,2,4,4,7,7	16.71	3400	JN
14. 000544-76-3	Hexadecane	16.94	3200	JN
15. 000000-00-0	Decahydro-4,4,8,9,10-pentameth	17.23	1200	JN
16. 002131-42-2	Naphthalene, 1,4,6-trimethyl-	17.80	1800	JN
17. 002245-38-7	Naphthalene, 1,6,7-trimethyl-	18.10	1800	JN
18. 000829-26-5	Naphthalene, 2,3,6-trimethyl-	18.18	2600	JN
19.	unknown trimethyl naphthalene	18.39	1000	J
20.	unknown trimethyl naphthalene	18.44	1800	J
21.	unknown trimethyl naphthalene	18.62	2500	J
22. 000490-65-3	Naphthalene, 1-methyl-7-(1-meth	19.15	1300	JN
23. 000529-05-5	Azulene, 7-ethyl-1,4-dimethyl-	19.25	1100	JN
24. 000112-40-3	Dodecane	19.32	3100	JN
25. 001921-70-6	Pentadecane, 2,6,10,14-tetramet	20.03	5200	JN
26. 000613-33-2	4,4'-Dimethylbiphenyl	20.45	3200	JN
27. 000638-36-8	Hexadecane, 2,6,10,14-tetramet	21.20	3800	JN
28. 001961-96-2	1H-Indene, 1-phenyl-	22.72	1100	JN
29. 000613-12-7	Anthracene, 2-methyl-	22.95	1300	JN
30. 000603-11-2	1,2-Benzenedicarboxylic acid, 3-	28.31	2000	JN

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-04
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-1-N-4	**GC/MS ID:**	C01419
Analysis Date:	3/9/2006	**Analysis Time:**	2:52PM

Compound	Results	Units	PQL
Phenol	652U	ug/Kg	652
bis(2-Chloroethyl)ether	652U	ug/Kg	652
2-Chlorophenol	652U	ug/Kg	652
1,3-Dichlorobenzene	652U	ug/Kg	652
1,4-Dichlorobenzene	652U	ug/Kg	652
1,2-Dichlorobenzene	652U	ug/Kg	652
2-Methylphenol	345J	ug/Kg	652
2,2'-oxybis(1-Chloropropane)	652U	ug/Kg	652
4-Methylphenol	652U	ug/Kg	652
N-Nitroso-di-n-propylamine	652U	ug/Kg	652
Hexachloroethane	652U	ug/Kg	652
Nitrobenzene	652U	ug/Kg	652
Isophorone	652U	ug/Kg	652
2-Nitrophenol	652U	ug/Kg	652
2,4-Dimethylphenol	652U	ug/Kg	652
bis(2-Chloroethoxy)methane	652U	ug/Kg	652
2,4-Dichlorophenol	652U	ug/Kg	652
1,2,4-Trichlorobenzene	652U	ug/Kg	652
Naphthalene	802	ug/Kg	652
4-Chloroaniline	652U	ug/Kg	652
Hexachlorobutadiene	652U	ug/Kg	652
4-Chloro-3-methylphenol	652U	ug/Kg	652
2-Methylnaphthalene	4579	ug/Kg	652
Hexachlorocyclopentadiene	652U	ug/Kg	652
2,4,6-Trichlorophenol	652U	ug/Kg	652
2,4,5-Trichlorophenol	652U	ug/Kg	652
2-Chloronaphthalene	652U	ug/Kg	652
2-Nitroaniline	652U	ug/Kg	652
Dimethylphthalate	652U	ug/Kg	652
Acenaphthylene	652U	ug/Kg	652
2,6-Dinitrotoluene	652U	ug/Kg	652
3-Nitroaniline	652U	ug/Kg	652
Acenaphthene	530J	ug/Kg	652
2,4-Dinitrophenol	652U	ug/Kg	652
4-Nitrophenol	652U	ug/Kg	652
Dibenzofuran	652U	ug/Kg	652
2,4-Dinitrotoluene	652U	ug/Kg	652

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th

J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.

E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

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Tabulated Analytical Report For TCL Semi-Volatile Organics

Client Name:	Quantum Consulting Services, Inc.	**Lab Sample ID:**	2060131-04
Client Project:	Plumley	**Analyst:**	AM
Client Sample ID:	C-1-N-4	**GC/MS ID:**	C01419
Analysis Date:	3/9/2006	**Analysis Time:**	2:52PM

Compound	Results	Units	PQL
Diethylphthalate	652U	ug/Kg	652
4-chlorophenyl-phenylether	652U	ug/Kg	652
Fluorene	603J	ug/Kg	652
4-Nitroaniline	652U	ug/Kg	652
4,6-Dinitro-2-methylphenol	652U	ug/Kg	652
N-Nitrosodiphenylamine	652U	ug/Kg	652
4-Bromophenyl-phenylether	652U	ug/Kg	652
Hexachlorobenzene	652U	ug/Kg	652
Pentachlorophenol	652U	ug/Kg	652
Phenanthrene	1778	ug/Kg	652
Anthracene	494J	ug/Kg	652
Carbazole	652U	ug/Kg	652
Di-n-butylphthalate	652U	ug/Kg	652
Fluoranthene	1312	ug/Kg	652
Pyrene	2894	ug/Kg	652
Butylbenzylphthalate	652U	ug/Kg	652
3,3'-Dichlorobenzidine	652U	ug/Kg	652
Benzo(a)anthracene	859	ug/Kg	652
Chrysene	1462	ug/Kg	652
bis(2-Ethylhexyl)phthalate	652U	ug/Kg	652
Di-n-octylphthalate	652U	ug/Kg	652
Benzo(b)fluoranthene	763	ug/Kg	652
Benzo(k)fluoranthene	607J	ug/Kg	652
Benzo(a)pyrene	703	ug/Kg	652
Indeno(1,2,3-cd)pyrene	594J	ug/Kg	652
Dibenz(a,h)anthracene	652U	ug/Kg	652
Benzo(g,h,i)perylene	714	ug/Kg	652

U Compound was analyzed for but not detected. The number proceeding the analytical flag "U" is the minimum attainable detection limit for th
J Compound was detected, but it is below the Method Detection Limit/Practical Quantitation Limit. Quantitation is approximate.
E Compound concentration exceeded the method calibration curve. Results are reported as an estimated value.

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

TENTATIVELY IDENTIFIED COMPOUNDS

2060131-4

Lab Name: Quantex Laboratories, Inc. Contract:

Lab Code: 12766 Case No.: SAS No.: SDG No.:

Matrix: (soil/water) SOIL Lab Sample ID: 2060131-4

Sample wt/vol: 1 (g/ml) G Lab File ID: C01419.D

Level: (low/med) LOW Date Received:

% Moisture: 1 decanted: (Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 03/09/06

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

Number TICs found: 30 (ug/L or ug/Kg) UG/KG

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	002980-69-0	Undecane, 4-methyl-	11.87	1400	JN
2.	000767-99-7	Benzene, (1-methyl-1-propenyl)-,	12.44	1500	JN
3.	017301-23-4	Undecane, 2,6-dimethyl-	13.29	2300	JN
4.	061142-20-9	Cyclohexane, (4-methylpentyl)-	13.78	1600	JN
5.	006069-98-3	Cyclohexane, 1-methyl-4-(1-met	13.93	1800	JN
6.	005911-04-6	Nonane, 3-methyl-	14.22	3900	JN
7.	020294-32-0	6-Methyl-4-indanol	14.52	1600	JN
8.	013287-24-6	Nonadecane, 9-methyl-	14.89	1500	JN
9.	000090-12-0	Naphthalene, 1-methyl-	15.08	3700	JN
10.	000638-36-8	Hexadecane, 2,6,10,14-tetramet	15.75	2000	JN
11.	016205-96-2	Acrylophenone, 2,2',5'-trimethyl-	15.94	1300	JN
12.	000581-42-0	Naphthalene, 2,6-dimethyl-	16.44	3000	JN
13.	000573-98-8	Naphthalene, 1,2-dimethyl-	16.67	3200	JN
14.	000575-43-9	Naphthalene, 1,6-dimethyl-	16.73	2600	JN
15.	000544-76-3	Hexadecane	16.94	3300	JN
16.	002027-17-0	Naphthalene, 2-(1-methylethyl)-	17.80	2200	JN
17.	002131-42-2	Naphthalene, 1,4,6-trimethyl-	18.10	3100	JN
18.	002245-38-7	Naphthalene, 1,6,7-trimethyl-	18.18	2700	JN
19.	000829-26-5	Naphthalene, 2,3,6-trimethyl-	18.39	1500	JN
20.		unknown trimethyl naphthalene	18.62	1500	J
21.	000490-65-3	Naphthalene, 1-methyl-7-(1-meth	19.15	1300	JN
22.	001921-70-6	Pentadecane, 2,6,10,14-tetramet	19.32	2900	JN
23.	000613-33-2	4,4'-Dimethylbiphenyl	19.58	1800	JN
24.	000529-05-5	Azulene, 7-ethyl-1,4-dimethyl-	19.95	1400	JN
25.	001921-70-6	Pentadecane, 2,6,10,14-tetramet	20.03	5000	JN
26.	000613-33-2	4,4'-Dimethylbiphenyl	20.45	3100	JN
27.	028239-47-6	2,4,6(1H,3H,5H)-Pyrimidinetrione	20.78	1600	JN
28.	000638-36-8	Hexadecane, 2,6,10,14-tetramet	21.20	3700	JN
29.	000613-12-7	Anthracene, 2-methyl-	22.95	1400	JN
30.	003674-73-5	Phenanthrene, 2,3,5-trimethyl-	25.28	2600	JN

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Quantum Consulting Services, Inc.
11 Westwood Road
East Brunswick, New Jersey 08816
Attention Dr Charles Bruno

Sample date January 30, 2006
Sample by KM
Report date February 6, 2006

Project Matt Petroleum
Assay N0. 013006C

Sample Identification	**Contamination degraders** (per gram)
C-1- I- 2	$1x10^4$
C-1-N-2	$1x10^5$
C-2- I-2	$1x10^4$
C-2-N-2	$1x10^5$

Each soil sample was added to a flasks containing sterile water and placed on a rotary shaker. After 5 minutes of agitation one milliliter of the washed soil was removed from each flasks and diluted further using sterile water. Following the serial dilution method one milliliter of the soil washings was streaked on special agar containing hydrocarbons as the only source of carbon. The streaked plates were incubated at 25° C. After 72 hours of incubation the plates were read to determine the number of colony forming units.

R. Mehta

Dr. Raj Mehta
Chief Microbiologist

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11 Westwood Road
East Brunswick, New Jersey 08816
Attention Dr Charles Bruno

Sample date January 13, 2006
Sample by KM
Report date January 20, 2006

Project Matt Petroleum
Assay N0. 011306B

Sample Identification	**Contamination degraders** (per gram)
C-1- I	$1x10^2$
C-1-N	$1x10^4$
C-2- I	$1x10^2$
C-2-N	$1x10^4$

Each soil sample was added to a flasks containing sterile water and placed on a rotary shaker. After 5 minutes of agitation one milliliter of the washed soil was removed from each flasks and diluted further using sterile water. Following the serial dilution method one milliliter of the soil washings was streaked on special agar containing hydrocarbons as the only source of carbon. The streaked plates were incubated at 25° C. After 72 hours of incubation the plates were read to determine the number of colony forming units.

R. Mehta

Dr. Raj Mehta
Chief Microbiologist

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Quantum Consulting Services, Inc.
11 Westwood Road
East Brunswick, New Jersey 08816
Attention Dr Charles Bruno

Sample date February 13, 2006
Sample by KM
Report date February 21, 2006

Project Matt Petroleum
Assay N0. 021306D

Sample Identification	**Contamination degraders** (per gram)
C-1-I -3	$1x10^5$
C-1-N-3	$1x10^6$
C-2-I- 3	$1x10^5$
C-2-N-3	$1x10^6$

Each soil sample was placed in a flasks containing sterile water and placed on a rotary shaker. After 5 minutes of agitation one milliliter of the washed soil was removed from each flasks and diluted further using sterile water. Following the serial dilution method one milliliter of the soil washings was streaked on special agar containing hydrocarbons as the only source of carbon. The streaked plates were incubated at 25° C. After 72 hours of incubation the plates were read to determine the number of colony forming units.

R. Mehta

Dr. Raj Mehta
Chief Microbiologist

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Quantum Consulting Services, Inc.
11 Westwood Road
East Brunswick, New Jersey 08816
Attention Dr Charles Bruno

Sample date February 27, 2006
Sample by KM
Report date March 7, 2006

Project Matt Petroleum
Assay N0022706E

Sample Identification	**Contamination degraders** (per gram)
C-1- I- 4	$1x10^5$
C-1-N-4	$1x10^6$
C-2- I-4	$1x10^5$
C-2-N-4	$1x10^6$

Each soil sample was added to a flasks containing sterile water and placed on a rotary shaker. After 5 minutes of agitation one milliliter of the washed soil was removed from each flasks and diluted further using sterile water. Following the serial dilution method one milliliter of the soil washings was streaked on special agar containing hydrocarbons as the only source of carbon. The streaked plates were incubated at 25° C. After 72 hours of incubation the plates were read to determine the number of colony forming units.

R. Mehta

Dr. Raj Mehta
Chief Microbiologist

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Quantum Consulting Services, Inc.
11 Westwood Road
East Brunswick, New Jersey 08816
Attention Dr Charles Bruno

Sample date March 7, 2006
Sample by KM
Report date March 15, 2006

Project Matt Petroleum
Assay N0. 030706F

Sample Identification	**Contamination degraders** (per gram)
C-1- I- 5	$1x10^6$
C-1-N-5	$1x10^7$
C-2- I-5	$1x10^6$
C-2-N-5	$1x10^7$

Each soil sample was added to a flasks containing sterile water and placed on a rotary shaker. After 5 minutes of agitation one milliliter of the washed soil was removed from each flasks and diluted further using sterile water. Following the serial dilution method one milliliter of the soil washings was streaked on special agar containing hydrocarbons as the only source of carbon. The streaked plates were incubated at 25° C. After 72 hours of incubation the plates were read to determine the number of colony forming units.

R Mehta

Dr. Raj Mehta
Chief Microbiologist

PAH Biodegradation Field Study

LABORATORY SCALE

PARTS PER BILLION (ug/kg)

Parameter	# Rings	Control	8 Weeks
Naphthalene	2	15467	5390
2-Methylnaphthalene	2	13288	ND
Acenaphthylene	2	432	96
Acenaphthene	2	603	87
Dibenzofuran	2	720	ND
Fluorene	2	912	147
Phenanthrene	3	3220	719
Anthracene	3	983	143
Fluoranthene	3	289	609
Pyrene	4	3765	494
Benzo(a)anthracene	4	1860	305
Chrysene	4	2255	230
Benzo(b)fluoranthene	4	2952	494
Benzo(k)fluoranthene	4	946	232
Benzo(a)pyrene	5	1794	447
Indeno(1,2,3-cd)pyrene	5	994	475
Dibenz(a,h)anthracene	5	414	660
Benzo(g,h)perylene	6	1531	419
Total ug/kg		52431	10947

Laboratory design was an in situ bioremediation system in conjunction with a unipolar magnetic field.

APPENDIX B

PETROLEUM CONTAMINANT DEGRADATION WITH PERSULFATE-BASED OXIDATION PROCESSES

Bench-Scale Study of Petroleum Contaminant Degradation with Persulfate-Based Oxidation Processes for Matt Petroleum, Oneida County, New York

Submitted to:
Plumley Engineering, P.C.
8232 Loop Rd., Baldwinsville, NY 13027

By

KCH EnviroTech, LLC
165 River Rd., Suite 1D, Willington, CT 06279
Tel.: 860-3711200

March 20, 2006

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1. Introduction

The treatability study implemented herein by KCH EnviroTech LLC (retained by Plumley Engineering, P.C.) is to investigate the chemical oxidation technology using sodium persulfate (SP) as an alternative remedy for a site primarily contaminated by petroleum-related organic compounds including volatile organic compounds (VOCs) and semi-VOCs (SVOCs). SP is also known to be effective in degrading many of the contaminants in SW 846 Method 8270 through direct persulfate oxidation and/or the reaction with free radicals formed during the persulfate decomposition process. However, the high-ring PAHs (e.g., five or more rings) are generally more resistant to SP (i.e., degradation at the slowest rate) and present the greatest difficulty to remediate.

The study was conducted with the primary goal of evaluating the feasibility of using the persulfate-based oxidation process either through in-situ or ex-situ treatment systems to mineralize or chemically transfer the target contaminants into harmless products. The technology investigated here could be a promising alternative toward an effective and permanent solution for this petroleum contaminated site. A series of bench-scale tests were conducted to investigate two persulfate-based oxidation processes: persulfate alone oxidation and chelated-iron (i.e., Fe(II)-EDTA) catalyzed persulfate oxidation. The specific objectives of the study were: (1) to evaluate the effectiveness of the chemical oxidation using sodium persulfate for degradation of the compounds of concern (COC) in native soils and (2) to acquire critical engineering data in support of the design for pilot-scale and full-scale remedial applications and management of the site.

2. Scope of Work

Four bench-scale tests (namely Tasks 1, 2, 3 and 4) as described below were proposed.

- **Task 1**: Preparation and characterization of contaminated site soils and groundwater
- **Task 2**: Determination of the oxidant (i.e. SP) demand of native soils
- **Task 3**: Effectiveness evaluation of the degradation of target COCs with SP and Fe(II)-EDTA catalyzed SP in site soil matrixes

- **Task 4**: Evaluation of the degradation of target COCs with SP and Fe(II)-EDTA catalyzed SP in contaminated groundwater

For the first phase of the treatability study, Tasks 1 to 3 were selected and conducted using site soils and groundwater collected from the impacted areas. This report presents the testing process, obtained data, results and findings to Plumley Engineering in support of selection and design of the remedies for the site and management and planning of the project.

3. Description of Tasks

Description of the tasks conducted in this study is provided in the section that follows.

- **Task 1:** In order to be able to compare the results obtained under various testing conditions and treatment processes, the tests were conducted using uniform and homogenized soil and groundwater. To produce uniform soil and groundwater sources for the study, specific soil and groundwater samples were used to make composite soils and groundwater. The composite soil and groundwater were characterized for relevant parameters including VOCs, SVOCs, pH, total organic carbon (TOC), and metals including iron (Fe), manganese (Mn), chromium (Cr), arsenic (As), selenium (Se) and lead (Pb) prior to use in the tests. The methods used for determination of the parameters are listed in Table 3.1.

- **Task 2:** This task was performed to determine the oxidant demand of two separate composite site soils (labeled as CS-I and CS-II). The CS-I and CS-II soils were made from 10 soils collected from a test pit of the studied site. Soil oxidant demand (SOD) and other parameters such as the rate of consumption and the half-life of SP in the soil matrixes were determined. The SOD data and the results of the COCs destruction tests (i.e., Task 3) could provide the basis for determination of the SP dose and the chemical demand for the pilot-scale and full-scale field applications.

- **Task 3:** In this task, the effectiveness of SP ($Na_2S_2O_8$) and Fe-EDTA catalyzed SP in destroying the target COCs in native soils was studied. Experiments were conducted to

determine the extent of COC degradation and to compare the performance for the two SP-based oxidation treatment processes investigated in the study. In conjunction with the data obtained in groundwater matrixes (i.e., Task 4), the results of Task 3 could provide insight into the influence of the site soil matrixes on the degradation rates of COCs.

- **Task 4:** Determine the effectiveness of SP and catalyzed SP in destroying the target COCs in the site groundwater matrixes. Experiments aimed to obtain the rates of COC degradation with SP-based oxidation in groundwater matrixes.

4. Experimental Section

4.1 Sampling of Site Soil and Groundwater

Ten site soils and two groundwater samples were sampled during January 3 and 4 of 2005 and delivered through overnight UPS to KCH EnviroTech for the treatability study (Appendix A). The soil and groundwater samples were packed in sample storage coolers and shipped with ice bags to keep the samples cold during the shipping. The samples were in good conditions (cold not frozen) at the time they arrived at KCH EnviroTech on January 5 and 7, 2005 (Figure 4.1).

Each of the 10 site soils (Field I.D.: C-1A, C-1B, C-1C, C-1D, C-1E, C-2A, C-2B, C-2C, C-2D, and C-2E) was collected in 3 8-oz glass jars from a test pit within the contaminated zones of the site. All of the sample containers were filled with the site soil to minimize the loss of VOCs during the shipping and storage.

Two groundwater samples were collected from MW-1 & MW-16 and MW 11, respectively. The groundwater samples were recovered in 10 1-L amber glass bottles (MW-1&MW-16) or in several collapsible jugs (MW-11). All of the sample containers were filled with groundwater to minimize exposure to the air for keeping the integrity of the site groundwater. After the receipt of the soil and groundwater samples, all samples were stored in a refrigerator maintained at 4 °C (Figure 4.2).

4.2 Preparation and Characterization of Site Soil and Groundwater

Composite Site Soil. The ten soils, sampled specifically for the feasibility tests, were recovered from a test pit within the contaminated zones of the studied site. In order to be able to compare the results obtained under various testing conditions and determine the influence of reaction parameters, the 10 soils were used to prepare for two separate composite soils (i.e., CS-I and CS-II) prior to use in the tests. Stones, gravel and other debris with a diameter greater than 10 mm were removed during the compositing and homogenization process.

The CS-I and CS-II composite soils were made from C-1A to C-1E and C-2A to C-2E soils, respectively. The soils were homogenized with the procedures described below:

1. The site soils were removed from the sample jars stored in a refrigerator maintained at 4 °C into Ziploc bags.
2. The soil was then quickly sieved with a 10-mm opening sieve back and forth three times between two large Ziploc bags. The portion of soil particles with a particle size smaller than 10-mm was separated from its counterpart. (The portion of soil less than 10-mm in particle diameter contributes most of the oxidant demand because of organic and inorganic content and large surface area in this portion of the soil.)
3. The portion of soil samples (i.e., < 10-mm) was then transferred into 2-L capacity Ziploc bags that were wrapped by another bag to form a double layer setting. The headspace in the bags was minimized to reduce the evaporation loss of COCs.
4. The soil storage bags were put inside a polypropylene container and preserved in a refrigerator maintained at 4 °C.

The two composite soils were sampled in duplicate (sample I.D.: 0109-T1-CS I and 0109-T1-CS ID for CS-I and 0109-T1-CS II and 0109-T1-CS IID for CS-II) and characterized for COCs, TOC, soil pH, and metal content (including Fe, Mn, Cr, As, Se and Pb) (Table 4.1 and Appendix A). The two composite soils were used in Task 2 and Task 3.

Source Groundwater. The groundwater samples were preserved in a refrigerator maintained at 4 °C immediately after their arrival at the laboratory. In order to have a uniform

groundwater source for the study, the 10 1-L groundwater samples (collected from MW-1 & MW-16) were composited in a 10-L Tedlar bag with a peristaltic pump. Prior to use, the composite groundwater was sampled (in duplicate: 0109-T1-CGW and 0109-T1-CGW D) to characterize for parameters including COCs, TOC, pH, and metal content (including Fe, Mn, Cr, As, Se and Pb). The composite groundwater was used in Task 3 (the degradation of COCs with persulfate-based oxidation processes).

4.3 Determination of the Oxidant Demand of Site Soils (Task 2)

The CS-I and CS-II soils prepared in Task 1 were used in the SOD tests of Task 2. The tests were conducted to determine the soil oxidant demand, the consumption rate and life time of SP in site soil matrixes. All tests were performed using a series of amber glass jar reactors that were placed on a round-motion shaker used to enhance the contact and mass transfer of the oxidant with soils. The shaker was operated under a constant shaking speed of 120 rpm. The reaction temperature was at 20 °C, controlled using an incubator (Figure 4.3). Detailed experimental conditions for determination of the oxidant demand of the two composite soils are shown in Table 4.2.

The testing procedure of the SOD tests involved oxidizing ~50 grams of the composite soil with ~250 mL SP solutions in various concentrations (i.e., 2.5, 5, 10 and 20 g/L $Na_2S_2O_8$). The liquid/soil ratio was approximately 5 to 1 (w/w), and the reactions occurred in a series of 250-mL amber glass jar reactors (Figure 4.3) under mechanical shaking and temperature controlled conditions. The SP concentration was measured by collecting 3 mL samples using a volumetric pipette. The samples were filtered using 0.45 μm syringe filters and measured immediately after filtration. The SP concentration was determined with a pre-established calibration curve, which relates the absorbance at 450 nm as a function of the SP concentration. Other parameters including pH and oxidation reduction potential (ORP) were also monitored during the tests. The instruments used to determine pH, ORP, conductivity and SP are shown in Figure 4.4.

The oxidant concentrations in the reactors were determined periodically during the testing. In addition, control experiments (i.e., oxidant solutions with no soil (i.e., Batch I.D. II-A5

and II-B5 of Table 4.2) were conducted to estimate the amount of oxidant consumption contributed to auto-decomposition during the tests (Control solutions of SP in water showed a 14-day auto- decomposition range of from 2 % to 8 %; See Tables 5.3/5.4, Batch numbers IIA-5, IIB-5, respectively). Consumption of the oxidant by the composite site soils was determined at the end of the tests (14 days). The SOD was calculated using equation 1:

$$SOD = V(C_0-C_s)/m_{soil} \quad (1)$$

where V = the total volume of oxidant solution in the reactor; C_0 = initial oxidant concentration; C_s = the oxidant concentration at the reaction period of 14 days; m_{soil} = the mass of dry soil used in the reaction.

4.4 Degradation of COCs in Soil-Groundwater Matrixes with SP alone and Fe-EDTA Catalyzed SP (Task 3)

In Task 3, two sets of tests (i.e., Task 3A for CS-I and Task 3B for CS-II) were conducted to investigate the ability of persulfate alone and catalyzed persulfate to degrade COCs in soil-groundwater matrixes. The experimental conditions of Task 3 are presented in Table 4.3. In each set of the tests, control experiments (i.e., Batch I.D.: CS-1 Ctrl and CS-II Ctrl; experiments with no addition of the oxidant) were included and used to provide baselines for calculation of the extent of destruction of COCs.

The experiments of Task 3 were run using a series of 500-mL amber glass jars set on a round-motion shaker and at 20 °C. The experimental procedure consisted of adding contaminated soil (~100 g) and contaminated groundwater (~500 mL) into the reaction jars (Figure 4.5). Calculated amounts of SP were then added into the reactors to create desired SP concentrations in the systems. All reaction jars were put on a shaker (120 rpm) that was placed inside an incubator maintained at 20 °C. Samples were collected after a reaction period of 14 days to quantify the COC levels and determine the extent of COC destruction achieved under various reaction conditions. Parameters including pH, ORP and oxidant concentrations were also determined in the tests.

5.0 Results and Discussion

5.1 Characterization of Site Soil and Groundwater

Characteristics of Site Soils. The two composite soils were characterized for VOCs, SVOCs, TOC, moisture content, soil pH, and metals (including Cr, As, Se, Pb, Fe, and Mn). The results of the measurements are listed in Table 5.1. The GC-MS analysis of two replicated samples for each of the CS-I and CS-II soils demonstrated the presence of a number of gasoline-related VOCs and SVOCs, determined by SW-846 Method 8260B and Method 8270C, respectively. As shown in Table 5.1, in the CS-I soil, the predominant VOCs were 1,2,4-trimethylbenzene (13000 μg/kg dry and 14000 μg/kg dry), 1,3,5-trimethylbenzene (5100 μg/kg dry and 5600 μg/kg dry), ethylbenzene (1700 μg/kg dry and 2000 μg/kg dry), m, p-xylene (5300 μg/kg dry and 6300 μg/kg dry), naphthalene (4900 μg/kg dry), n-butylbenzene (2700 μg/kg dry and 3100 μg/kg dry), n-propylbenzene (1900 μg/kg dry and 2100 μg/kg dry).

The major SVOCs in CS-I included 2-methylnaphthalene (6500 μg/kg dry and 6200 μg/kg dry), naphthalene (1600 μg/kg dry and 1400 μg/kg dry), phenathrene (3300 μg/kg dry and 1400 μg/kg dry), fluoranthere (1700 μg/kg dry and 400 μg/kg dry), pyrene (1500 μg/kg dry and 420 μg/kg dry), anthracene (1400 μg/kg dry and 800 μg/kg dry). Other compounds such as benzo(a)anthracene, benzo(b)pyrene and benzo(b)fluoranthene were detected at low levels near their detection limits (330 μg/kg dry). The characterization results have demonstrated the presence of COCs in the CS-I soil and shown sufficient homogeneity of the COCs for the soil to be used in the subsequent tests.

On the other hand, the SVOC data for the two replicated CS-II samples indicated a high degree of heterogeneity in the distribution of COCs in the CS-II soil (Table 5.1). The results illuminated a need of further homogenization for the CS-II soil prior to use in Task 3. The high heterogeneity in either soil texture or contaminant distribution, especially for the compounds with a low aqueous solubility, is not uncommon. Nevertheless, 1,2,4-trimethylbenzene and 2-methylnaphthalene were present in relatively high levels and have a better homogeneity in the CS-II soil.

Total organic carbon content of the CS-I and CS-II soils was 1.4%, and 1.2%, respectively, reflecting a relatively high level of organic matter and COCs in the soils. In addition, both CS-I and CS-II had a pH value of 6.7-6.9. The moisture content, averaged from the two replicate samples, was 21% and 19% for CS-I and CS-II, respectively. The collected site soils appeared to primarily consist of silt and clay that were mixed with fine to medium size sand.

The metal analysis indicated that iron (22500 mg/kg dry for CS-I and 20100 mg/kg dry for CS-II) was abundant in native soils (Table 5.1). Iron, native organic matter and COCs were expected to be the main contributors to the oxidant demand. Moreover, the metal analysis showed that CS-I and CS-II contained As (2.6 mg/kg dry and 2.4 mg/kg dry), Cr (10.7 mg/kg dry and 9.0 mg/kg dry), Pb (47.3 mg/kg dry and 28.8 mg/kg dry), respectively. The Se level was below the reporting limit of 2.5 mg/kg dry for both CS-I and CS-II soils.

Characteristics of Site Groundwater. The characterization of the site groundwater was conducted to determine the groundwater properties and provide insight into the site geochemistry. The composite groundwater was analyzed for VOCs, SVOCs, metals, TOC, pH, ORP, and conductivity. The results, as presented in Table 5.2, show that the groundwater composite collected from MW-1 & MW-16 contained trace amounts of COCs. Analyzed using a GC-MS system by SW-846 Method 8260B, VOCs detected in two replicated samples included 1,2,4-trimethylbenzene (78 µg/Land 83 µg/L), m,p-xylene (6.2 µg/Land 6.3 µg/L), and n-propylbenzene (7.4 µg/Land 7.6 µg/L). Other target VOCs listed in Method 8260B and all SVOCs in Method 8270C were reported as below their detection limits (e.g., from 5 µg/L for VOCs to 10 µg/L for SVOCs, generally).

The site groundwater had a pH value around 6.9 and a conductivity level of ~250 µs/cm. An ORP level of 250 mV indicated that the groundwater was in an oxidative condition during the sampling. Both Fe (4.6 mg/L) and Mn (3.2 mg/L) were low in the collected groundwater. The four elements of concern (i.e., As, Cr, Pb, and Se) were at levels below their reporting limits (1 µg/L for Cr to 10 µg/L for Se). In addition, the groundwater had a relatively low TOC of 44.5 mg/L and was clear in color.

In conclusion, the characterization results indicated that the groundwater collected from MW-1 & MW-16 appeared to have minimal impact by the COCs at the site. The composite groundwater was used as the solution medium in Task 3.

5.2 Determination of Soil Oxidant Demand (SOD)

The oxidant demand of the two soil composites was determined using a series of jar experiments at various oxidant/soil ratios under a water/soil ratio of ~5:1 at 20 °C. All samples were measured for the oxidant concentration against reaction time during the test. The SOD tests were run for 14 days to collect sufficient sampling points for data analysis. The amount of the oxidant consumed at the end (14^{th} day) of the tests is used to estimate the oxidant demand of the CS-I and CS-II soils. The testing results are shown in Tables 5.3 and 5.4.

The data obtained at day 14 was used to determine the SOD using equation 1. The results indicated that the SOD was relatively high, in the range of 11.5 to 22.2 g/kg dry and 14.3 to 29.5 g/kg (the averaged from two duplicate samples) for CS-I and CS-II, respectively (Tables 5.3 and 5.4). The observations were consistent with the results from Task 1 that showed high levels of TOC and COCs (two oxidant scavengers) in the soils. Furthermore, it was evident that the SOD increased with increasing initial SP concentration, most likely due to the auto-decomposition of SP induced by inorganic minerals in the soils.

In an effort to predict the SOD for a SP dose outside the range of the doses tested, the SOD was plotted versus the initial SP dose (Figure 5.1). The two parameters (i.e., SOD and the SP dose) were well correlated, evidenced by a R^2 (the square of correlation coefficient) value of 0.94 for the CS-I data and 0.97 for the CS-II data. Thus, the equations of the fitting curves in Figure 5.1 can be used to predict the SOD at various SP doses.

In Figures 5.2 and 5.3, the oxidant concentration (g/L) was plotted versus reaction time (day) to show the consumption tendency of SP at various doses in the CS-I and CS-II matrixes, respectively. The results indicated that SP in the soils was consumed and continued to decompose during the tests, most likely contributed to the reactions with native soil constituents as well as the self-decomposition of SP catalyzed by inorganic minerals in the

soils. It was also evident that the SP concentration decreased faster in the early stages and at a slower rate in the latter stages of the tests (i.e., after day 9).

In order to predict the SP concentration against reaction time in site soils, the SP consumption data was fitted with a first order decay model (Figures 5.2 and 5.3). The fitting curves have a R^2 value of 0.97~0.79 for the CS-I data and 0.87~0.93 for the CS-II data, reflecting the complexity of the systems. Multiple mechanisms (e.g., the reactions of SP with native organic matters/COCs and the SP decomposition) occurred simultaneously and consumed SP in the systems. Thus, the SP consumption did not simply follow a first-order decay pattern.

The consumption rates (k_1), however, were determined using fitting curves in Figures 5.2 and 5.3 for various SP doses to estimate the half-life ($t_{1/2}$) and variation of SP under the testing conditions. The obtained half-lives and k_1 values are listed in Table 5.5. The data in Table 5.5 indicates that the SP half-life is positively proportional to the initial SP dose (the higher the SP concentration, the greater the half-life). Moreover, as evidenced by the high R^2 (0.98 for CS-I and 0.99+ for CS-II) of the fitting curves in Figure 5.4, the half-life and the initial SP dose is well linearly correlated. The fitting equations in Figure 5.4 enable the ability to estimate the half-life of a SP dose outside the range of the SP doses tested in Task 2.

The residual SP concentration (in C/Co) at day 14 was plotted versus the SP dose for the CS-I and CS-II soils (Figure 5.5). The results showed that the total SP consumption varied from 22% (the 20 g/L dose) to 78% (the 2.5 g/L dose) for the CS-II soil and 18% (the 20 g/L dose) to 80% (the 2.5 g/L dose) for the CS-I soil. In contrast, the SP concentration in the controlled reactors (i.e., Batch I.D.: 2A-5 and IIB-5; with no soils) remained at a level of 92% to 98%, indicating that SP was primarily consumed by reaction and mineral-catalyzed decomposition mechanisms. The data in Figure 5.5 elucidates a relatively long lifetime and great stability of SP in the tested soils.

The variation in pH and ORP is shown in Tables 5.6 and 5.7 for CS-I and CS-II runs, respectively. The pH values in the control reactors (i.e., IIA-5 and IIB-5) decreased significantly, from 5.5 to 2.8 for CS-I and 5.5 to 3.2 for CS-II, revealing the release of protons from the persulfate decomposition. In contrast, the change in pH was minor and

remained between 6 and 6.5 in all of the reaction reactors (i.e., IIA-1 to IIA-4 and IIB-1 to IIB-4), indicating the site soil had a strong buffering capacity for pH. In addition, ORP in the control reactors increased significantly, from 332 mV to 489 mV for the CS-I control (i.e., II-5A) and 333 mV to 470 mV in the CS-II control (i.e., II-5B). As with pH, the variation in ORP in the reaction jars was minor, reflecting the influence of the soil matrixes on the reaction systems.

5.3 Degradation of Gasoline-Related COCs in Soil-Groundwater Matrixes with Persulfate and Fe(II)-EDTA Catalyzed Persulfate (Task 3)

In Task 3, two sets of tests (i.e., Task 3A and Task 3B) were conducted to investigate the effectiveness of SP alone and catalyzed SP (used to enhance the COCs destruction) on the degradation of contaminants detected in site soils. The testing conditions are presented in Table 4.3. In each test, two control experiments (i.e., Batch I.D.: CS I-Ctrl & CS I-Ctrl D and CS II-Ctrl & CS II-Ctrl D; experiments with no addition of the oxidant) were included. The experimental results of Task 3 are shown in Tables 5.8 to 5.11. In general, the COCs detected in Task 1 were also observed in Task 3. However, in Task 3 the COC levels in the control soils (compared to Task 1 data) were lower for CS-I and slightly higher for CS-II (Table 5.9 and Table 5.11), reflecting the influence of the testing process used in Task 3 and the nature of COC heterogeneity in the site soils.

Tables 5.8 a/b and 5.9 a/b present data on the destruction of VOCs in groundwater and soil in the slurry reactors, respectively. The results indicated that both SP alone and Fe-EDTA catalyzed SP were effective in degrading the target VOCs listed in the NYSDEC STARS. For example, the extent of destruction of VOCs in groundwater of the CS-I experiments reached approximately 96%, 88%, 83%, 84% and 96% for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, and m, p-xylene (the five main VOCs detected in the soils), respectively, for both SP alone and catalyzed SP processes (Table 5.12). As with the CS-I runs, the CS-II data showed the extent of destruction at 95%, 87%, 80%, 83% and 95% for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, and m, p-xylene, respectively. As shown in Table 5.12, the VOCs detected in CS-I and CS-II runs

were all degraded to below their GC-MS reporting limits (5 μg/L). Moreover, the results indicated that SP alone was as effective as catalyzed SP in degrading the five main VOCs. In should be noted that acetone was detected in groundwater samples as a by-product formed during the destruction of COCs. It is, however, expected that acetone will be further oxidized with continued exposure to SP.

The VOCs data of the treated soils in the slurry reactors is shown in Tables 5.9 a/b. As with the results of the liquid phase samples, the data showed that both SP alone and catalyzed SP were effective in reducing the concentrations of the target VOCs after a 14-day reaction period. The destruction efficiency of VOCs in soils in the CS-II runs was 93%, 85%, 89%, 86% and 84% by SP alone and 77%, 75%, 89%, 54% and 70% by catalyzed SP for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, m, p-xylene, n-butylbenzene, and n-propylbenenen, respectively (Table 5.13). The data in Tables 5.9 a/b shows that the detected soil VOCs were all degraded to near or below their GC-MS reporting limits. Moreover, as shown in Table 5.14, significant amounts of SP still remained in the systems at the end of the tests. It is expected that dissolution and destruction of the COCs in the treated soils by SP will continue until the COCs or SP is exhausted in the systems.

The SVOCs data collected from the liquid phase samples provide little information due to low aqueous solubilities of the SVOCs in the systems (Tables 5.10 a/b). Thus, the data analysis was based on the soil SVOCs data. Moreover, because the CS-I data showed significant heterogeneity in the distribution of SVOCs (resulting in a high uncertainty in data interpretation), conclusions were made primarily based on the soil SVOCs data of the CS-II runs.

As shown in Tables 5.11 a/b, most of the SVOCs listed in the NYSDE STARS were detected in the treated soils. As with the VOCs results, the SVOCs data indicated that most of the SVOCs in soils were effectively degraded in the systems. Both SP alone and Fe(II)-EDTA catalyzed SP were effective in reducing the concentrations of the target SVOCs within a 14-day reaction period. The extent of destruction of the target SVOCs in the CS-II runs was in the range of 64%~78% and 84%~89% for SP alone and catalyzed SP, respectively (Table 5.13). Although the results have demonstrated the ability of SP to degrade most of the

targeted SVOCs, it is evident that the target SVOCs still remained in the soils at the end of the tests. The results reveal the need to induce more vigorous reaction conditions in the systems so that the large amount of residual SP could be used to enhance the destruction efficiency and shorten the treatment time.

The variation in pH and ORP in the tests are detailed in Table 5.14. As with the data observed in the SOD tests, the change in pH was minor and remained between 5.8 and 6.3 in all of the reactors for both CS-I and CS-II, which demonstrated a strong buffering capacity for pH. The ORP level (in the range of 237 mV to 250 mV for the reaction reactors) was only slightly higher that that (in the range of 241 mV to 245 mV) for the controls, which reflected the influence of the soil matrixes on the reaction systems. Because the metal mobilization primarily depends on pH and ORP, impacts of the chemical oxidation with SP on the leaching of metals (i.e., As, Cr, and Pb) from the site soil are expected to be insignificant.

6. Conclusions and Recommendations

This feasibility study was conducted with the goals of: (1) determining the soil oxidant demand for sodium persulfate and the appropriate oxidant dose for pilot-scale and full-scale field applications, (2) examining the fate of the oxidant in site soil matrixes, and (3) evaluating the effectiveness of the employed persulfate oxidation process for degradation of the COCs detected in native soils. The results of the study support the following conclusions:

- The SOD for SP in the site soils was significant, in the range of 11.5 g/kg dry (for the 2.5 g/L dose) to 22.2 g/kg dry (for the 20 g/L dose) for the CS-I soil and in the range of 14.3 g/kg dry to 29.5 g/kg dry for the CS-II soil. The SOD was higher for the CS-II soil, most likely due to a higher COC content in CS-II. Moreover, the results indicated that the SOD increased with increasing initial SP concentration.

- Persulfate in the soil matrixes was consumed and continued to decompose during the tests. Total consumption of SP varied from 22% (for the 20 g/L dose) to 78% (for the 2.5

g/L dose) for the CS-II soil and 18% (for the 20 g/L dose) to 80% (for the 2.5 g/L dose) for the CS-I soil. Comparison of the above data with that (8% and 2%) from the controls revealed that the SP consumption in the reaction jars was primarily consumed by reaction and mineral-catalyzed decomposition mechanisms.

- The SP consumption data indicated that the half-life of SP was positively proportional to the initial persulfate dose (the higher the persulfate concentration, the greater the half-life).

- Based on the acquired experimental data, equations for predicting the SOD and half-life against the SP dose were developed for use in subsequent field applications (Figure 5.1 for SOD and Figure 5.4 for half-life).

- The results indicated that both SP alone and Fe-EDTA catalyzed SP were effective in degrading the targeted VOCs listed in the NYSDEC STARS, in both soil and groundwater. For example, after a 14-day reaction, the destruction efficiency of the target VOCs in groundwater from the CS-I runs reached approximately 96%, 88%, 83%, 84% and 96% for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, and m, p-xylene, respectively, with both SP alone and catalyzed SP. Persulfate alone was as effective as catalyzed persulfate in degrading the VOCs detected in the systems.

- The extent of destruction of STARs SVOCs based on the CS-II data was in the range of 64% to 78% and 84% to 89% for SP alone and catalyzed SP, respectively, demonstrating the ability of SP to degrade the target SVOCs. Although actual degradation rates cannot be calculated from the limited data obtained in the tests, the results and experience suggest that sufficient degradation may be achieved in the field in a 6-8 week timeframe if proper reaction conditions are maintained.

- The change in pH and ORP was minor in soil-groundwater matrixes, implying that the native soil had a strong buffering capacity for pH and ORP. Because the mobilization of metals in soils is strongly controlled by pH and ORP, impacts of the chemical oxidation

with SP on the leaching of metals (i.e., As, Cr, and Pb) from the site soil are expected to be insignificant.

- Under the testing conditions, gas and heat generated from the reactions were not observed. Acetone was detected as an intermediate produced during the reactions. It is, however, expected that acetone will be degraded by SP with continued exposure to the oxidant.

***Recommendations*:**

This study has demonstrated the ability of SP to degrade most of the COCs detected in the soils of the studied site. Given a sufficient reaction time and SP dose, the SP alone oxidation process could effectively reduce the concentrations of the target VOCs and SVOCs in the impacted soils. However, the experimental results have also revealed the need to induce more vigorous reaction conditions in the systems so that the residual SP could be used to enhance the destruction efficiency and shorten the treatment time. The Fe-EDTA catalyzed SP under the testing conditions did not significantly enhance the destruction efficiency of COCs as compared to the SP alone process. Moreover, it appeared that the destruction of SVOCs (mostly low solubility organic compounds) was limited by their inherently low solubility and dissolution. It is, therefore, recommended that the SP alone process could be used but be applied at a higher reaction temperature (e.g., 35 °C or 40 °C) and used with a surfactant to increase both the solubility and dissolution of COCs.

Limited bench/field scale testing is recommended to optimize a remedial design. Field application of SP at elevated reaction temperature of 35° to 40° C to enhance contaminant destruction efficiency at an SP dose of 11, 15 or 30 g/kg dry depending on the level of COCs in the impacted soil should be applied. A co-oxidant (e.g., calcium peroxide) at an appropriate dose (the data might be determined through bench/pilot testing) can be added to the soil as a heat generator for the system. The soils should be maintained at 40-50% moisture for 60 days. Covering the soil piles with black plastic sheeting to add heat from solar radiation and to keep soil moisture high is recommended. Use of an environmentally

friendly and biodegradable surfactant such as Biosolve at 0.5% will increase the dissolved SVOC concentrations and enhance SP destruction."

This data can then be applied to full scale up of the remedial system. It should be recognized that oxidation with SP is shown to be effective. However, the exact dose and amount of time required to reduce COCs to the clean-up goals without adding excess SP needs to be determined to optimize and scale up treatment for the entire site.

Table 3.1. Summary of analytical instruments and methods used in the study

Parameters	Instruments	Analysis methods
pH and ORP	Accumet XL15 pH/ORP meter	Solution pH (4500-H^+in Standard Methods for the Examination of Water and Wastewater (1995); Soil pH (SW 846 Method 9045C)
Conductivity	Orion Model 105 Conductivity meter meter/platinum combination electrode	Standard methods for water
Sodium Persulfate	Spectronic Genesys 5 Spectrophotometer	Colorimetric method
VOCs and semi-VOCs	Gas Chromatography/Mass Spectrometry	SW-846 Method 8260B and Method 8270C
Total organic carbon	OI Analytical 700 TOC Analyzer for liquid/ Perkin-Elmer 2400 CHN for solid or equivalent	Standard methods for water and soil
Metal ions (e.g., Se, As, Cr, Pb, Fe, and Mn)	Perkin-Elmer ICP-MS, ICP-AES or GFAA or equivalent	3050A for digestion/6010A for ICP or 7000A for GFAA (SW-846)

Table 4.1 Characterization of composite soils (CS-I and CS-II) and composite groundwater (MW-1 & MW-16)

Field I.D.	Lab I.D.	Analytes determined for characterization	Sample Matrix
0109-T1-CS I	AG94241	SVOCs, VOCs, TOC, Metals, pH and Moisture	CS-I composite soil
0109-T1-CS ID	AG94242	SVOCs, VOCs and pH	CS-I composite soil (duplicate)
0109-T1-CS II	AG94243	SVOCs, VOCs, TOC, Metals, pH and Moisture	CS-II composite soil
0109-T1-CS IID	AG94244	SVOCs, VOCs and pH	CS-II composite soil (duplicate)
0109-T1-CGW	AG94245	SVOCs, VOCs, TOC, Metals, pH, ORP and Conductivity	Composite groundwater
0109-T1-CGW D	AG94246	SVOCs, VOCs, pH, ORP and Conductivity	Composite groundwater (duplicate)

Table 4.2. Experimental conditions for determination of the SOD – sodium persulfate

Batch Number	Sample Type /Description	Initial Na2S2O8 g/L	Groundwater /Dry Soil Ratio	Number of Replicates	Total Oxidant Solution, mL	Na2S2O8/Soil Ratio (g/kg-dry soil)
II-A1	Treatment - SP SOD	2.5	5:1	2	250	14
II-A2	Treatment - SP SOD	5	5:1	2	250	28
II-A3	Treatment - SP SOD	10	5:1	2	250	56
II-A4	Treatment - SP SOD	20	5:1	2	250	111
II-A5	Control I	2.5	No soil	1	250	No soil
II-A6	Control II	D.I.	5:1	1	250	

Batch Number	Sample Type /Description	Initial Na2S2O8 g/L	Groundwater /Dry Soil Ratio	Number of Replicates	Total Oxidant Solution, mL	Na2S2O8/Soil Ratio (g/kg-dry soil)
II-B1	Treatment - SP SOD	2.5	5:1	2	250	14
II-B2	Treatment - SP SOD	5	5:1	2	250	28
II-B3	Treatment - SP SOD	10	5:1	2	250	56
II-B4	Treatment - SP SOD	20	5:1	2	250	111
II-B5	Control I	5	No soil	1	250	No soil
II-B6	Control II	D.I.	5:1	1	250	

Note: 1. The experiments were conducted in duplicate. One of the two replicated samples was monitored for the variation of persulfate concentration and pH with time. The other one was only measured at the end of the test (14 days)

Table 4.3 Experimental conditions of degradation of COCs in soil slurry systems with SP and Fe-(II)-EDTA catalyzed SP

Batch Number	Test Conditions	Total Reaction Vol., mL	Na2S2O8 g/L	Fe(II)-EDTA mg/L as Fe(II)	Groundwater /Dry Soil Ratio	Number of Replicates	Temp. °C
CSI-A1	Degradation of COCs with persulfate in soil slurry	500	20		5:1	2	20
CSI-A2	Degradation of COCs with Fe(II)-EDTA catalyzed persulfate in soil slur	500	20	250	5:1	2	20
CS I-Ctrl	Slurry control	500			5:1	2	20

Batch Number	Test Conditions	Total Reaction Vol., mL	Na2S2O8 g/L	Fe(II)-EDTA mg/L as Fe(II)	Groundwater /Dry Soil Ratio	Number of Replicates	Temp. °C
CSII-B1	Degradati0on of COCs with persulfate in soil slurry	500	20		5:1	2	20
CSII-B2	Degradation of COCs with Fe(II)-EDTA catalyzed persulfate in soil slur	500	20	250	5:1	2	20
CS II-Ctrl	Slurry control	500			5:1	2	20

Note: 1. Samples were collected for analysis of the targeted COCs including VOCs and semi-VOCs.
2. Parameters included SP and pH were determined in the tests

Table 5.1. Characteristics of the CS-I and CS-II soils used in this study (Task 1)

	Composite Site Soil, ug/kg dry			
Field I.D.	**CS-I**		**CS-II**	
KCH Sample I.D.	0109-T1-CS I	0109-T1-CS ID	0109-T1-CS II	0109-T1-CS IID
Phoenixlab Sample I.D.	AG94241	AG94242	AG94243	AG94244
NYSDECSTARS List (VOCs by SW-846 8260B)				
1,2,4-Trimethylbenzene	13000	14000	2000	1200
1,3,5-Trimethylbenzene	5100	5600	BRL (1200)	BRL (1200)
Benzene	BRL (<1000)	BRL (<500)	BRL (1200)	BRL (1200)
Ethylbenzene	1700	2000	BRL (1200)	BRL (1200)
Isopropylbenzene	BRL (<1000)	1100	BRL (1200)	BRL (1200)
m.p-Xylene	5300	6300	BRL (1600)	BRL (1200)
Methyl tert-butyl ether	BRL (<2000)	BRL (<1000)	BRL (1200)	BRL (1200)
Naphthalene	4900	BRL (<500)	BRL (1200)	BRL (1200)
n-Butylbenzene	2700	3100	BRL (1200)	BRL (1200)
n-Propylbenzene	1900	2100	BRL (1200)	BRL (1200)
o-Xylene	BRL (<1000)	BRL (<500)	BRL (1200)	BRL (1200)
p-Isopropyltoluene	BRL (<1000)	680	BRL (1200)	BRL (1200)
sec-Butylbenzene	BRL (<1000)	820	BRL (1200)	BRL (1200)
tert-Butylbenzene	BRL (<1000)	BRL (<500)	BRL (1200)	BRL (1200)
Toulene	BRL (<1000)	BRL (<500)	BRL (1200)	BRL (1200)
NYSDECSTARS List (SVOCs by SW-846 8270C)				
Acenaphthene	720	500	(BRL <1700)	3600
Anthracene	1400	800	3200	18000
Benzo (a) anthracene	730	BRL (<330)	(BRL <1700)	7900
Benzo (a) Pyrene	550	BRL (<330)	(BRL <1700)	6200
Benzo (b) Fluoranthene	620	BRL (<330)	(BRL <1700)	6700
Benzo (g, h,i) Perylene	BRL (<330)	BRL (<330)	(BRL <1700)	2800
Benzo (k) Fluoranthene	BRL (<330)	BRL (<330)	(BRL <1700)	2100
Chrysene	690	BRL (<330)	(BRL <1700)	6500
Dibenzo(a,h)anthracene	BRL (<330)	BRL (<330)	(BRL <1700)	(BRL<1700)
Fluoranthene	1700	400	2700	22000
Fluorene	840	610	1900	5200
Indeno (1,2,3-cd) pyrene	BRL (<330)	BRL (<330)	(BRL <1700)	2400
Naphthalene	1600	1400	(BRL <1700)	2600
Phenanthrene	3300	1400	5800	28000
Pyrene	1500	420	2200	17000
Others				
2-Methylnaphthalene	6500	6200	25000	25000
General Chemistry Parameters and Metals				
pH	6.65	6.67	6.85/6.84	6.84
TOC, mg/kg dry	14000		12000	
As, mg/kg	2.6		2.42	
Cr, mg/kg	10.7		8.97	
Fe, mg/kg	22500		20100	
Mn, mg/kg	284		701	
Pb, mg/kg	47.3		28.8	
Se, mg/kg	BDL (2.5)		BDL (2.5)	
moisture, %	21	21	19	18

Table 5.2. Characteristics of the site groundwater used in this study (Task 1)

	Composite Groundwater, ug/L	
Field I.D.	MW-1 & MW-16 GW	MW-1 & MW-16 GW D
KCH Sample I.D.	0109-T1-CGW I	0109-T1-CGW ID
Phoenixlab Sample I.D.	AG94245	AG94246
NYSDECSTARS List (VOCs by SW-846 8260B)		
1,2,4-Trimethylbenzene	78	83
1,3,5-Trimethylbenzene	BRL (<5)	BRL (<5)
Benzene	BRL (<5)	BRL (<5)
Ethylbenzene	BRL (<5)	BRL (<5)
Isopropylbenzene	6.2	6.6
m.p-Xylene	BRL (<5)	BRL (<5)
Methyl tert-butyl ether	BRL (<10)	BRL (<10)
Naphthalene	BRL (<5)	BRL (<5)
n-Butylbenzene	BRL (<5)	BRL (<5)
n-Propylbenzene	7.4	7.6
O-Xylene	BRL (<5)	BRL (<5)
p-Isopropyltoluene	BRL (<5)	BRL (<5)
sec-Butylbenzene	BRL (<5)	BRL (<5)
tert-Butylbenzene	BRL (<5)	BRL (<5)
Toulene	BRL (<5)	BRL (<5)
NYSDECSTARS List (SVOCs by SW-846 8270C)		
Acenaphthene	BRL (<10)	BRL (<10)
Anthracene	BRL (<10)	BRL (<10)
Benzo (a) anthracene	BRL (<10)	BRL (<10)
Benzo (a) Pyrene	BRL (<10)	BRL (<10)
Benzo (b) Fluoranthene	BRL (<10)	BRL (<10)
Benzo (g, h,i) Perylene	BRL (<10)	BRL (<10)
Benzo (k) Fluoranthene	BRL (<10)	BRL (<10)
Chrysene	BRL (<10)	BRL (<10)
Dibenzo(a,h)anthracene	BRL (<10)	BRL (<10)
Fluoranthene	BRL (<10)	BRL (<10)
Fluorene	BRL (<10)	BRL (<10)
Indeno (1,2,3-cd) pyrene	BRL (<10)	BRL (<10)
Naphthalene	BRL (<10)	BRL (<10)
Phenanthrene	BRL (<10)	BRL (<10)
Pyrene	BRL (<10)	BRL (<10)
General Chemistry Parameters and Metals		
pH	6.94	6.86
ORP, mV	251.2	255.5
Conductivity, us/cm	207	208
TOC, mg/l	2.3	
As, mg/l	0.005	
Cr, mg/l	BRL (<0.001)	
Fe, mg/l	4.6	
Mn, mg/l	3.2	
Pb, mg/l	BRL (<0.002)	
Se, mg/l	BRL (<0.01)	

Table 5.3. Experimental results of the soil oxidant (sodium persulfate) demand tests for CS-I (Task 2)

	16-Jan Mon	17-Jan Tue	19-Jan Thu	21-Jan Sat	23-Jan Mon	25-Jan Wed	27-Jan Fri	30-Jan Mon		
	Reaction Time, Day								C/Co	SOD
Batch	Na2S2O8 Conc., g/L									g/kg Dry
Number	0	1	3	5	7	9	11	14	14	14
IIA-1	2.75	2.23	1.73	1.39	1.24	1.10	0.94	0.72	0.26	12.49
IIA-1D	--	--	--	--	--	--	--	1.04	0.38	10.48
IIA-2	5.17	4.82	4.23	3.75	3.70	3.66	3.50	3.05	0.59	12.95
IIA-2D	--	--	--	--	--	--	--	3.39	0.66	10.90
IIA-3	10.96	9.79	9.07	8.51	8.27	8.24	8.04	7.95	0.73	18.43
IIA-3D	--	--	--	--	--	--	--	8.02	0.73	18.01
IIA-4	21.45	20.06	19.07	18.75	18.59	18.49	17.82	17.74	0.83	22.75
IIA-4D	--	--	--	--	--	--	--	17.92	0.84	21.61
IIA-5	2.86	2.87	2.83	2.83	2.82	2.81	2.75	2.64	0.92	1.36
IIA-6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		

~~3.~~1. Batch experiments for determination of the soil oxidant demand: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

~~4.~~2. See Table 4.1 for the corresponding testing condition of each batch number.

Table 5.4. Experimental results of the SOD tests for CS-II (Task 2)

	16-Jan Mon	17-Jan Tue	19-Jan Thu	21-Jan Sat	23-Jan Mon	25-Jan Wed	27-Jan Fri	30-Jan Mon		
	Reaction Time, Day								C/Co	SOD
Batch	Na2S2O8 Conc., g/L									g/kg Dry
Number	0	1	3	5	7	9	11	14		14
IIB-1	3.00	2.11	1.50	1.18	1.01	0.93	0.85	0.65	0.22	14.40
IIB-1D	--	--	--	--	--	--	--	0.69	0.23	14.12
IIB-2	5.49	4.49	3.95	3.57	3.29	3.11	2.95	2.56	0.47	17.91
IIB-2D								2.76	0.50	16.70
IIB-3	10.89	9.81	9.07	8.37	8.09	7.82	7.33	7.11	0.65	23.15
IIB-3D	--	--	--	--	--	--	--	7.15	0.66	22.89
IIB-4	22.04	19.96	19.55	19.10	18.94	18.73	17.34	17.15	0.78	29.95
IIB-4D	--	--	--	--	--	--	--	17.31	0.79	28.97
IIB-5	5.66	5.88	5.92	5.63	5.56	5.46	5.76	5.54	0.98	0.70
IIB-6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		

~~1.~~3. Batch experiments for determination of the soil oxidant demand: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

~~2.~~4. See Table 4.1 for the corresponding testing condition of each batch number.

Table 5.5. Estimated consumption rate (k_1) and half-life of SP at four tested doses in CS-I and CS-II soils (Task 2)

	t1/2	t1/2	k1	k1
Initial Sodium Persulfate	day	day	1/day	1/day
g/L	CS-I	CS-II	CS-I	CS-II
3	7.7	7.0	0.0896	0.0982
5.3	20.5	14.4	0.0337	0.0479
11	34.3	24.2	0.0202	0.0286
22	59.7	45.8	0.0116	0.0151

Table 5.6. Variation of pH and ORP during the SOD tests for CS-I (Task 2)

	16-Jan Mon	17-Jan Tue	19-Jan Thu	21-Jan Sat	25-Jan Wed	27-Jan Fri	30-Jan Mon	30-Jan Mon	30-Jan Mon
	Reaction Time, Day							Time, Day	
Batch	pH							ORP, mV	
Number	0	1	3	5	9	11	14	0	14
IIA-1	6.79	6.68	6.54	6.48	6.33	6.26	6.40	310	280
IIA-1D	--	--	--	--	--	--	6.45	--	279
IIA-2	6.08	6.61	6.49	6.43	6.43	6.48	6.41	306	282
IIA-2D	--	--	--	--	--	--	6.33	--	286
IIA-3	6.12	6.49	6.39	6.32	6.3	6.36	6.36	299	285
IIA-3D	--	--	--	--	--	--	6.11	--	299
IIA-4	6.08	6.41	6.21	6.15	6.12	6.12	6.09	300	300
IIA-4D	--	--	--	--	--	--	5.90	--	312
IIA-5	5.46	3.43	2.93	2.85	3.21	2.81	2.84	332	489
IIA-6	5.62	7.42	7.21	7.27	7.02	7.03	7.01	262	249

3.1. Batch experiments for determination of the soil oxidant demand: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

4.2. See Table 4.1 for the corresponding testing condition of each batch number.

Table 5.7. Variation of pH and ORP during the SOD tests for CS-II (Task 2)

	16-Jan Mon	17-Jan Tue	19-Jan Thu	23-Jan Mon	25-Jan Wed	27-Jan Fri	30-Jan Mon	16-Jan Mon	30-Jan Mon
	Reaction Time, Day							Time, Day	
Batch	pH							ORP, mV	
Number	0	1	3	7	9	11	14	0	14
IIB-1	5.90	6.62	6.49	6.43	6.41	6.39	6.43	307	281
IIB-1D	--	--	--	--	--	--	6.34	--	286
IIB-2	5.96	6.64	6.36	6.36	6.38	6.43	6.42	305	281
IIB-2D	--	--	--	--	--	--	6.18	--	295
IIB-3	5.89	6.40	6.30	6.08	6.30	6.31	6.29	306	289
IIB-3D	--	--	--	--	--	--	6.01	--	299
IIB-4	5.86	6.35	6.12	6.08	6.11	6.17	6.16	311	298
IIB-4D	--	--	--	--	--	--	5.76	--	318
IIB-5	5.49	3.28	3.31	3.25	3.20	3.19	3.16	333	470
IIB-6	6.62	7.20	7.15	7.11	7.12	7.07	7.03	266	245

~~1.~~3. Batch experiments for determination of the soil oxidant demand: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

~~2.~~4. See Table 4.1 for the corresponding testing condition of each batch number.

Table 5.8a. VOCs data of groundwater samples in the CS-I slurry reactors at the end of the tests (Task 3: CS-I groundwater)

	COCs in Groundwater, ug/L					
Field I.D.	T4CS I-A1GW	T4CS I-A1GW D	T4CS I-A2GW	T4CS I-A2GW D	T4CS I-Ctrl	T4CS I-Ctrl D
Phoenixlab Sample I.D.	AG99760	AG99761	AG99762	AG99763	AG99764	AG99765
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (VOCs by SW-846 8260B)						
1,2,4-Trimethylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	38	200
1,3,5-Trimethylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	15	69
Benzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	50	7.1
Ethylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	22	41
Isopropylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	13
m.p-Xylene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	92	130
Methyl tert-butyl ether	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
Naphthalene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	86
n-Butylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	8.4
n-Propylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	13	19
o-Xylene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	8.4
p-Isopropyltoluene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
sec-Butylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
tert-Butylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
Toulene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	7.1

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.8b. VOCs data of groundwater samples in the CS-II slurry reactors at the end of the tests (Task 3: CS-II groundwater)

	COCs in Groundwater, ug/L					
Field I.D.	T4CS II-B1GW	T4CS II-B1GW D	T4CS II-B2GW	T4CS II-B2GW D	T4CS II-Ctrl	T4CS II-Ctrl D
Phoenixlab Sample I.D.	AG99766	AG99767	AG99768	AG99769	AG99770	AG99771
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (VOCs by SW-846 8260B)						
1,2,4-Trimethylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	180	34
1,3,5-Trimethylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	65	14
Benzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	6.8	43
Ethylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	38	21
Isopropylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	14	9.2
m.p-Xylene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	120	84
Methyl tert-butyl ether	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
Naphthalene	BRL (<5)	BRL (<5)	BRL (<5)	5.2	82	BRL (<5)
n-Butylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	7.6	BRL (<5)
n-Propylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	19	12
o-Xylene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	7.9	BRL (<5)
p-Isopropyltoluene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
sec-Butylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
tert-Butylbenzene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)
Toulene	BRL (<5)	BRL (<5)	BRL (<5)	BRL (<5)	6.4	BRL (<5)

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.9a. VOCs data of soil samples in the CS-I slurry reactors at the end of the tests (Task 3- CS-I Soil)

	COCs in Soil, ug/kg dry					
Field Sample I.D.	T4CS I-A1 S	T4CS I-A1D S	T4CS I-A2 S	T4CS I-A2D S	T4CS I-Ctrl S	T4CS I-Ctrl D S
Phoenixlab Sample I.D.	AG99772	AG99773	AG99774	AG99775	AG99776	AG99777
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (VOCs by SW-846 8260B)						
1,2,4-Trimethylbenzene	230	260	220	290	3300	8100
1,3,5-Trimethylbenzene	100	110	90	130	1300	3300
Benzene	BRL (<10)	BRL (<21)	BRL (<10)	BRL (<20)	BRL (<20)	BRL (<540)
Ethylbenzene	BRL (<10)	BRL (<21)	BRL (<10)	BRL (<20)	140	*430*
Isopropylbenzene	22	25	BRL (<10)	29	110	BRL (<540)
m.p-Xylene	34	36	36	41	1100	1500
Methyl tert-butyl ether	BRL (<10)	BRL (<42)	BRL (<20)	BRL (<40)	BRL (<40)	BRL (<540)
Naphthalene	BRL (<10)	110	BRL (<10)	BRL (<20)	BRL (<20)	BRL (<540)
n-Butylbenzene	85	99	79	120	170	2000
n-Propylbenzene	42	46	38	57	170	BRL (<540)
o-Xylene	BRL (<10)	BRL (<21)	BRL (<10)	BRL (<20)	25	BRL (<540)
p-Isopropyltoluene	28	33	29	30	79	620
sec-Butylbenzene	26	30	25	36	59	540
tert-Butylbenzene	BRL (<10)	BRL (<21)	BRL (<10)	BRL (<20)	BRL (<20)	BRL (<540)
Toulene	BRL (<10)	BRL (<21)	BRL (<10)	BRL (<20)	BRL (<20)	BRL (<540)

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.9b. VOCs data of soil samples in the CS-II slurry reactors at the end of the tests (Task 3: CS-II soil)

	COCs in Soil, ug/kg dry					
Field Sample I.D.	T4CS II-B1 S	T4CS II-B1D S	T4CS II-B2 S	T4CS II-B2D S	T4CS II-Ctrl S	T4CS II-Ctrl D S
Phoenixlab Sample I.D.	AG99778	AG99779	AG99780	AG99781	AG99782	AG99783
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (VOCs by SW-846 8260B)						
1,2,4-Trimethylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	820	2400	1800
1,3,5-Trimethylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	*350*	1100	910
Benzene	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<570)	BRL (<500)	BRL (<500)
Ethylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<570)	BRL (<500)	*290*
Isopropylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	*220*	BRL (<500)	*470*
m.p-Xylene	BRL (<500)	BRL (<500)	BRL (<500)	*150*	1600	1200
Methyl tert-butyl ether	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<1100)	BRL (<1000)	BRL (<1000)
Naphthalene	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<570)	BRL (<500)	1000
n-Butylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	870	1200	1000
n-Propylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	*400*	970	850
o-Xylene	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<570)	BRL (<500)	BRL (<500)
p-Isopropyltoluene	BRL (<500)	BRL (<500)	BRL (<500)	*220*	BRL (<500)	*260*
sec-Butylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	*410*	BRL (<500)	500
tert-Butylbenzene	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<570)	BRL (<500)	*110*
Toulene	BRL (<500)	BRL (<500)	BRL (<500)	BRL (<570)	BRL (<500)	BRL (<500)

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.10a. SVOCs data of groundwater in the CS-I slurry reactors at the end of the tests (Task 3: CS-I groundwater)

	COCs in Groundwater, ug/L					
Field I.D.	T4CS I-A1GW	T4CS I-A1GW D	T4CS I-A2GW	T4CS I-A2GW D	T4CS I-Ctrl	T4CS I-Ctrl D
Phoenixlab Sample I.D.	AG99760	AG99761	AG99762	AG99763	AG99764	AG99765
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (SVOCs by SW-846 8270C)						
Acenaphthene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Anthracene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Benzo (a) anthracene	BRL (<0.06)	BRL (<0.06)	BRL (<0.06)	BRL (<0.06)	BRL (<0.06)	BRL (<0.06)
Benzo (a) Pyrene	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)
Benzo (b) Fluoranthene	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)
Benzo (g, h,i) Perylene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Benzo (k) Fluoranthene	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)
Chrysene	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)
Dibenzo(a,h)anthracene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Fluoranthene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Fluorene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Indeno (1,2,3-cd) pyrene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Naphthalene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	10	11
Phenanthrene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Pyrene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Others						
2-Methylnaphthalene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	28	29
Acetone	250	260	380	400	<50	<25

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.10b. SVOCs data of groundwater in the CS-II slurry reactors at the end of the tests (Task 3: CS-II groundwater)

	COCs in Groundwater, ug/L					
Field I.D.	T4CS II-B1GW	T4CS II-B1GW D	T4CS II-B2GW	T4CS II-B2GW D	T4CS II-Ctrl	T4CS II-Ctrl D
Phoenixlab Sample I.D.	AG99766	AG99767	AG99768	AG99769	AG99770	AG99771
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (SVOCs by SW-846 8270C)						
Acenaphthene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Anthracene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Benzo (a) anthracene	BRL (<0.06)	BRL (<0.06)	0.06	BRL (<0.06)	0.11	0.12
Benzo (a) Pyrene	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)	BRL (<0.2)
Benzo (b) Fluoranthene	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)	BRL (<0.08)
Benzo (g, h,i) Perylene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Benzo (k) Fluoranthene	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)	BRL (<0.5)
Chrysene	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)	BRL (<4.8)
Dibenzo(a,h)anthracene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Fluoranthene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Fluorene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Indeno (1,2,3-cd) pyrene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Naphthalene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Phenanthrene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Pyrene	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)	BRL (<10)
Others						
2-Methylnaphthalene	49	42	43	46	120	120
Acetone	370	400	460	490	<25	<25

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.11a. SVOCs data of soil samples in the CS-I slurry reactors at the end of the tests (Task 3: CS-I soil)

	COCs in Soil, ug/kg dry					
Field Sample I.D.	T4CS I-A1 S	T4CS I-A1D S	T4CS I-A2 S	T4CS I-A2D S	T4CS I-Ctrl S	T4CS I-Ctrl D S
Phoenixlab Sample I.D.	AG99772	AG99773	AG99774	AG99775	AG99776	AG99777
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (SVOCs by SW-846 8270C)						
Acenaphthene	*230*	BRL (<200)	*350*	*40*	230	360
Anthracene	1300	*130*	4700	190	330	2100
Benzo (a) anthracene	790	*80*	3500	190	*110*	1600
Benzo (a) Pyrene	660	*70*	3000	*150*	*110*	1300
Benzo (b) Fluoranthene	790	*100*	3500	210	*140*	1500
Benzo (g, h,i) Perylene	370	*50*	1600	*90*	*70*	780
Benzo (k) Fluoranthene	260	*60*	*1200*	*70*	*50*	*600*
Chrysene	720	*90*	2900	180	*130*	1300
Dibenzo(a,h)anthracene	*100*	BRL (<200)	*450*	BRL (<170)	BRL (<200)	200
Fluoranthene	1900	*170*	8700	400	260	3700
Fluorene	320	*80*	*700*	*110*	260	*530*
Indeno (1,2,3-cd) pyrene	310	*40*	*1300*	*90*	*60*	*650*
Naphthalene	350	230	*550*	300	530	*530*
Phenanthrene	2600	370	6800	480	640	3200
Pyrene	1700	*160*	6800	320	270	2800
Others						
2-Methylnaphthalene	1700	1600	3200	2100	3300	5000

(SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm;
Reaction time: 14 days ; Temp ~ 20 ± 1 °C

Table 5.11b. SVOCs data of soil samples in the CS-II slurry reactors at the end of the tests (Task 3: CS-II soil)

	COCs in Soil, ug/kg dry					
Field Sample I.D.	T4CS II-B1 S	T4CS II-B1D S	T4CS II-B2 S	T4CS II-B2D S	T4CS II-Ctrl S	T4CS II-Ctrl D S
Phoenixlab Sample I.D.	AG99778	AG99779	AG99780	AG99781	AG99782	AG99783
Testing Conditions	SP 20 g/L	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	Control (No SP)
NYSDECSTARS List (SVOCs by SW-846 8270C)						
Acenaphthene	*780*	*270*	*200*	510	2000	*2800*
Anthracene	6900	1500	1100	2600	16000	16000
Benzo (a) anthracene	5000	1600	1200	1500	11000	11000
Benzo (a) Pyrene	4400	1400	1100	1300	9900	9500
Benzo (b) Fluoranthene	4600	1700	1300	1400	11000	9700
Benzo (g, h,i) Perylene	2500	*870*	*700*	780	5100	5000
Benzo (k) Fluoranthene	1900	*570*	*550*	*620*	5000	*4400*
Chrysene	4300	1500	1100	1300	9600	9400
Dibenzo(a,h)anthracene	*700*	*230*	*200*	*210*	1500	*1400*
Fluoranthene	12000	3500	2600	3400	29000	27000
Fluorene	1500	*700*	*520*	740	4300	*4700*
Indeno (1,2,3-cd) pyrene	2300	*700*	*570*	*630*	5000	*4200*
Naphthalene	2100	*700*	*510*	700	2400	5300
Phenanthrene	12000	4000	2800	3700	29000	26000
Pyrene	9200	2700	2000	2700	23000	21000
Others						
2-Methylnaphthalene	18000	14000	10000	11000	28000	15000

1. (SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp ~ 20 ± 1 °C
2. Mislabeling between AG99781 and AG99782 was found and corrected.

Table 5.12. Average Destruction Efficiency (in %) of COCs in groundwater samples at the end of the tests (Task 3)

	Average Conc. of COCs in Groundwater, ug/L			Average %	
Field I.D.	T4CS I-A1GW	T4CS I-A2GW	T4CS I-Ctrl	T4CS I-A1GW	T4CS I-A2GW
Testing Conditions	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	No SP		
NYSDECSTARS List (VOCs by SW-846 8260B)					
1,2,4-Trimethylbenzene	5	5	119	95.8	95.8
1,3,5-Trimethylbenzene	5	5	42	88.1	88.1
Benzene	5	5	29	82.5	82.5
Ethylbenzene	5	5	32	84.1	84.1
m.p-Xylene	5	5	111	95.5	95.5
n-Propylbenzene	5	5	16	68.8	68.8
2-Methylnaphthalene	10	10	29	64.9	64.9

	Average Conc. of COCs in Groundwater, ug/L			Average %	
Field I.D.	T4CS II-B1GW	T4CS II-B2GW	T4CS II-Ctrl	T4CS II-B1GW	T4CS II-B2GW
Testing Conditions	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	No SP		
NYSDECSTARS List (VOCs by SW-846 8260B)					
1,2,4-Trimethylbenzene	5	5	107	95.3	95.3
1,3,5-Trimethylbenzene	5	5	40	87.3	87.3
Benzene	5	5	25	79.9	79.9
Ethylbenzene	5	5	30	83.1	83.1
Isopropylbenzene	5	5	12	56.9	56.9
m.p-Xylene	5	5	102	95.1	95.1
n-Propylbenzene	5	5	16	67.7	67.7
2-Methylnaphthalene	45.5	44.5	120	62.1	62.9

1. The BRL of 5 µg/L is used to estimate the extent of destruction of VOCs.
2. The destruction efficiency is calculated as "(1-residual COC/Control COC) x 100%."

Table 5.13. Average Destruction Efficiency (in %) of COCs in soil samples at the end of the tests (Task 3)

	Average Conc. of COCs in Soil, ug/kg dry			Average %	
Field Sample I.D.	T4CS II-B1 S	T4CS II-B2 S	T4CS II-Ctrl S	T4CS II-B1 S	T4CS II-B2 S
Testing Conditions	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	Control (No SP)	SP 20 g/L	SP 20 g/L-Fe 250 mg/L
NYSDECSTARS List (VOCs by SW-846 8260B)					
1,2,4-Trimethylbenzene	*150*	*485*	2100	92.9	76.9
1,3,5-Trimethylbenzene	*150*	*250*	1005	85.1	75.1
m.p-Xylene	*150*	*150*	1400	89.3	89.3
n-Butylbenzene	*150*	510	1100	86.4	53.6
n-Propylbenzene	*150*	*275*	910	83.5	69.8

	Average Conc. of COCs in Soil, ug/kg dry			Average %	
Field Sample I.D.	T4CS II-B1 S	T4CS II-B2 S	T4CS II-Ctrl S	T4CS II-B1 S	T4CS II-B2 S
Testing Conditions	SP 20 g/L	SP 20 g/L-Fe 250 mg/L	No SP		
NYSDECSTARS List (SVOCs by SW-846 8270C)					
Acenaphthene	*525*	*355*	2400	78.1	85.2
Anthracene	4200	1850	16000	73.8	88.4
Benzo (a) anthracene	3300	1350	11000	70.0	87.7
Benzo (a) Pyrene	2900	1200	9700	70.1	87.6
Benzo (b) Fluoranthene	3150	1350	10350	69.6	87.0
Benzo (g, h,i) Perylene	1685	*740*	5050	66.6	85.3
Benzo (k) Fluoranthene	1235	*585*	4700	73.7	87.6
Chrysene	2900	1200	9500	69.5	87.4
Dibenzo(a,h)anthracene	*465*	*205*	1450	67.9	85.9
Fluoranthene	7750	3000	28000	72.3	89.3
Fluorene	1100	*630*	4500	75.6	86.0
Indeno (1,2,3-cd) pyrene	1500	*600*	4600	67.4	87.0
Naphthalene	1400	*605*	3850	63.6	84.3
Phenanthrene	8000	3250	27500	70.9	88.2
Pyrene	5950	2350	22000	73.0	89.3
2-Methylnaphthalene	16000	10500	21500	25.6	51.2

1. The lowest estimated reporting value (i.e., 150 µg/L written in italic) for VOCs is used to estimate the extent of destruction of groundwater VOCs.
2. The destruction efficiency is calculated as "(1-residual COC/Control COC) x 100%".

Table 5.14. Variation of pH and ORP in the COCs-destruction tests (Task 3)

	Rea ction Time, Day				
Batch	Na2S2O8, g/L		pH		ORP, mV
Number	0	14	0	14	14
CS I-A1	21.7	16.83	6.32	6.84	258
CS I-A1 D	--	17.07	--	6.94	250
CS I-A2	21.8	15.65	5.81	6.10	299
CS I-A2 D	--	15.55	--	6.13	299
CS I-Ctrl	None	<0.05	7.02	7.16	243
CS I-Ctrl D	None	<0.05	--	7.20	241
CS II-B1	21.7	16.99	5.93	7.18	243
CS II-B1 D	--	16.80	--	7.21	237
CS II-B2	21.6	16.56	5.82	6.83	254
CS II-B2 D	--	16.69	--	6.76	258
CS II-Ctrl	None	<0.05	7.06	7.24	245
CS II-Ctrl	None	<0.05	--	7.28	243

1. (SP)o = ~20 g/L; Liquid/Soil 5:1 (g/g); Total liquid volume: ~500 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp ~ 20 ± 1 °C
2. See Table 4.2 for the corresponding testing condition of each batch number.

Figure 4.1. The soil and groundwater samples collected within the impacted areas of the studied site (Task 1)

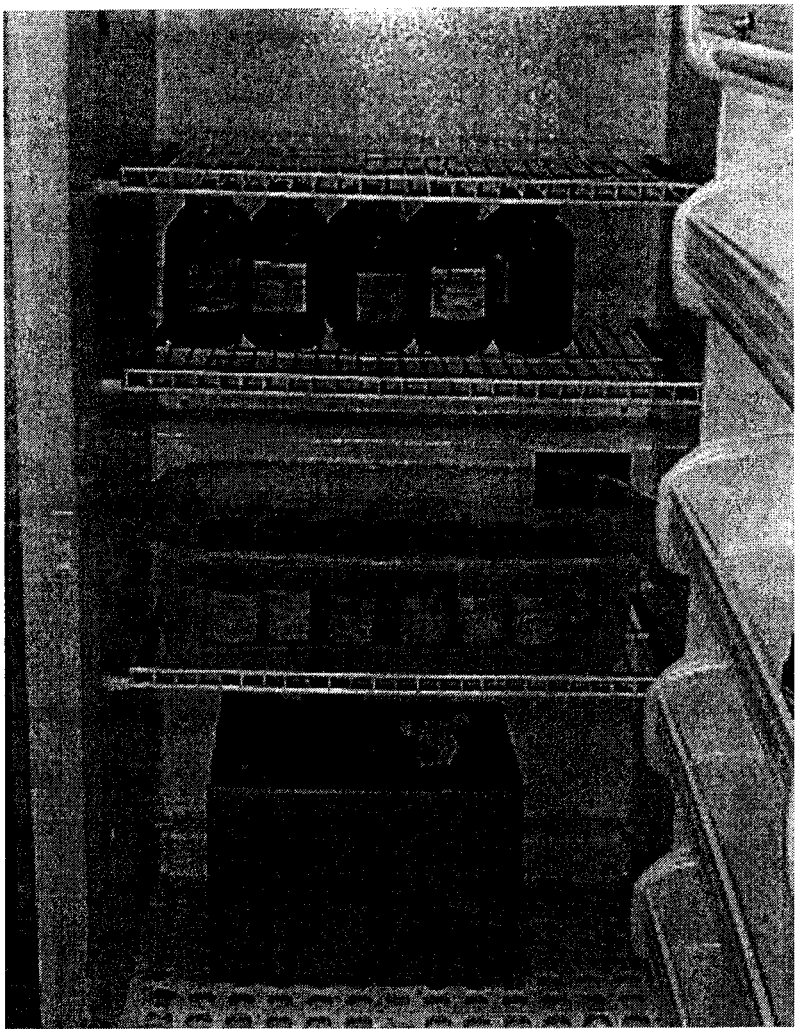

Figure 4.2. Native soil and groundwater samples stored in a refrigerator set at 4 °C (Task 1)

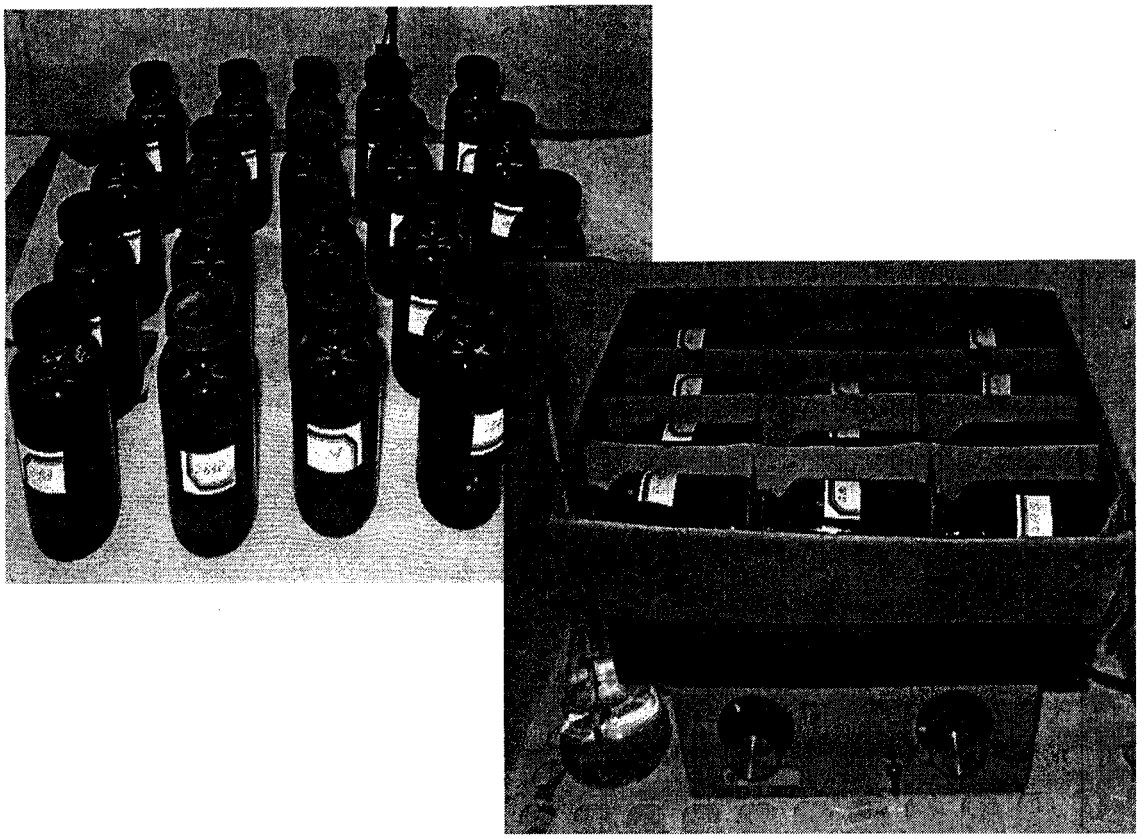

Figure 4.3. The 250-mL jar reactors and the batch system used for the soil oxidant demand tests (Task 2).

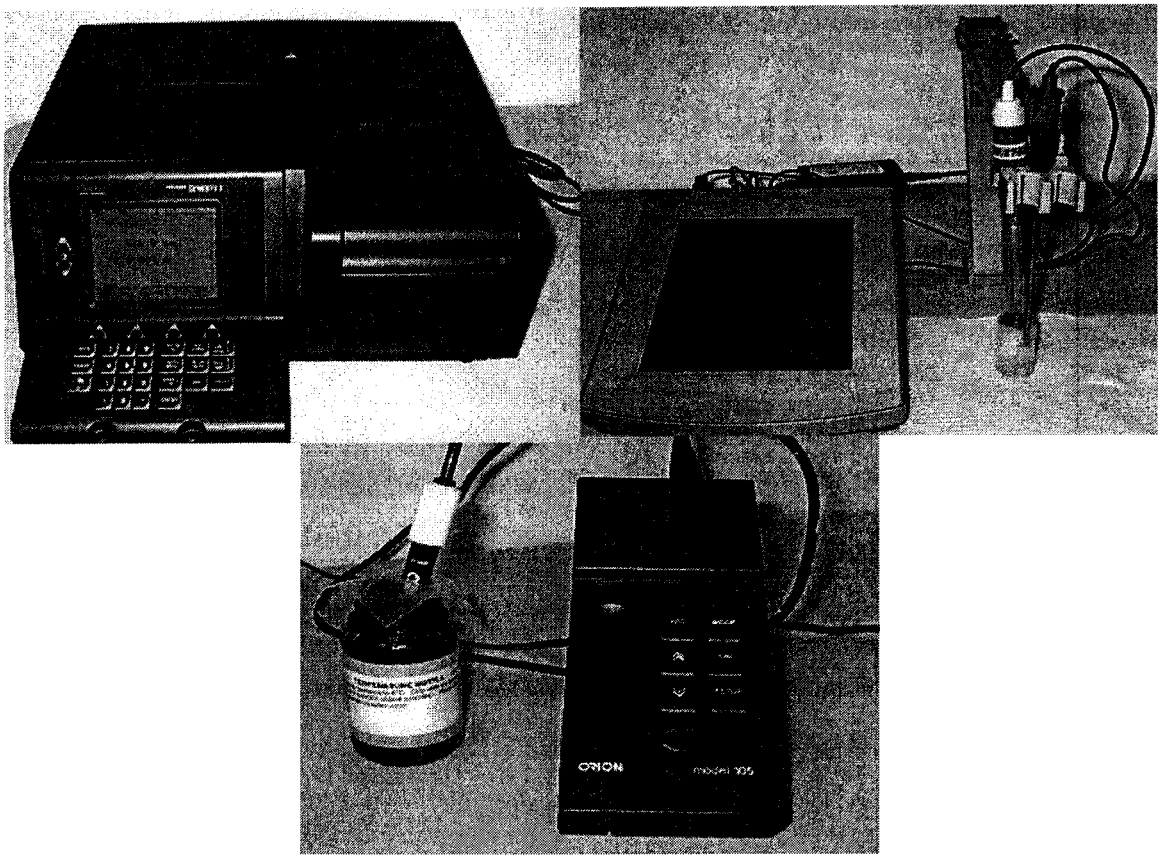

Figure 4.4. The instruments used to measure pH, ORP, conductivity and SP in the study (Task 2).

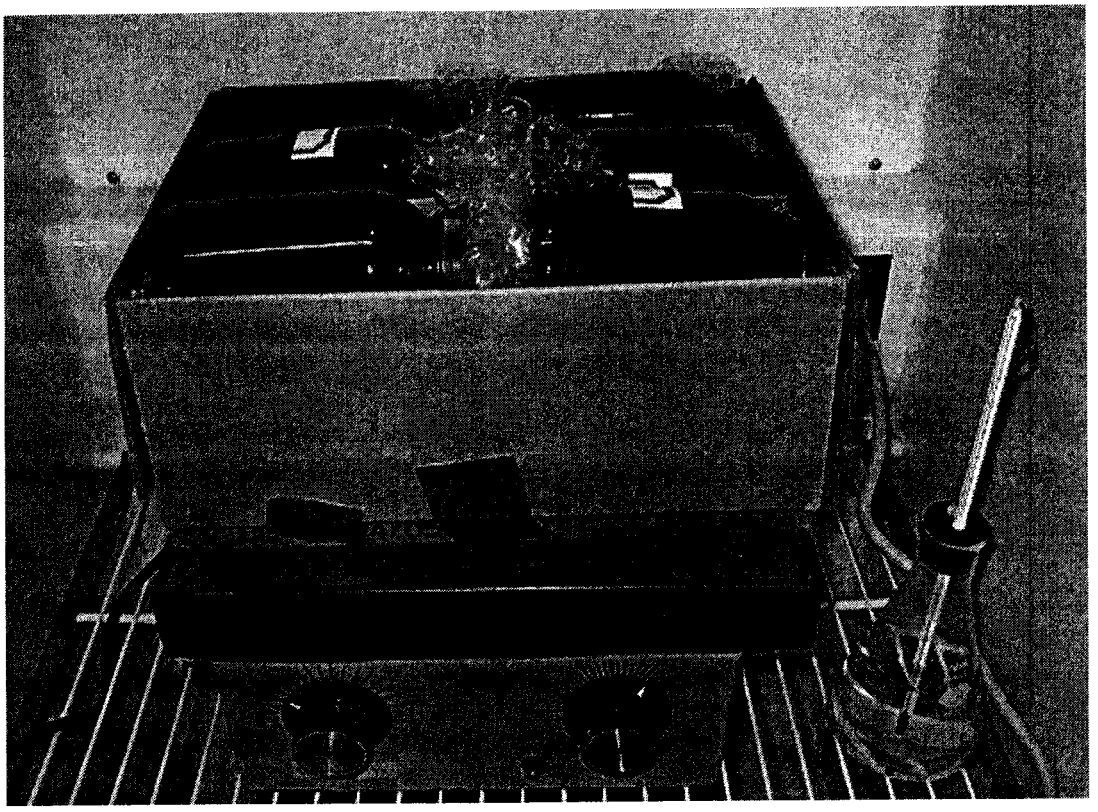

Figure 4.5. The batch tests conducted for the degradation of COCs in soil-groundwater matrixes (Task 3)

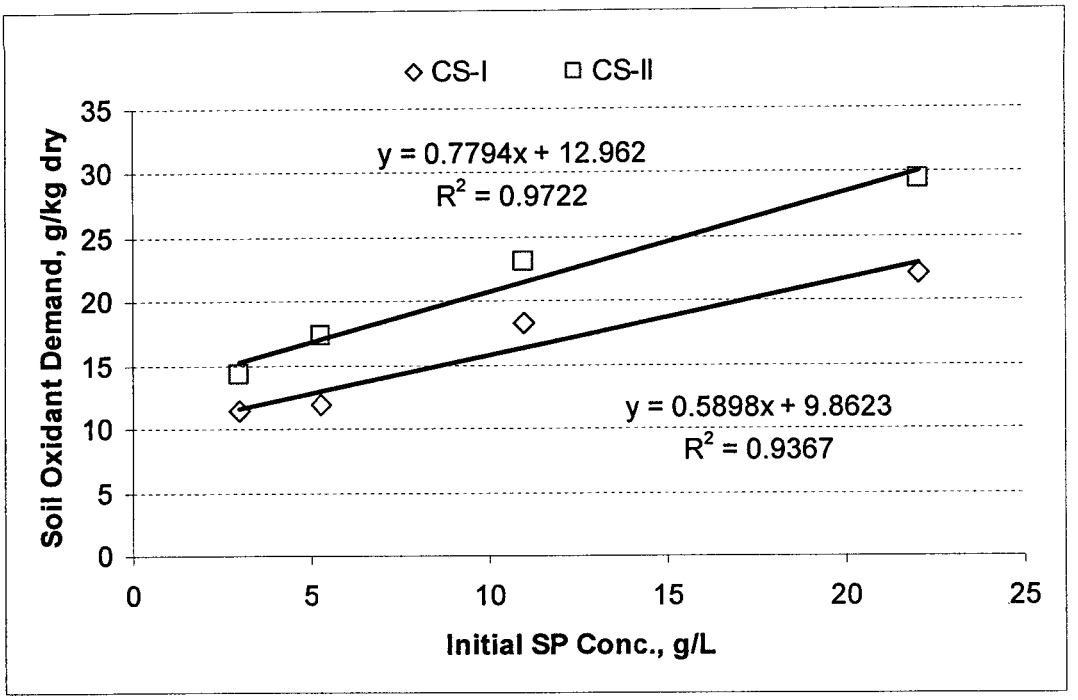

Figure 5.1. Plot of the soil oxidant (SP) demand versus initial SP dose (Task 2)
Experiment: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

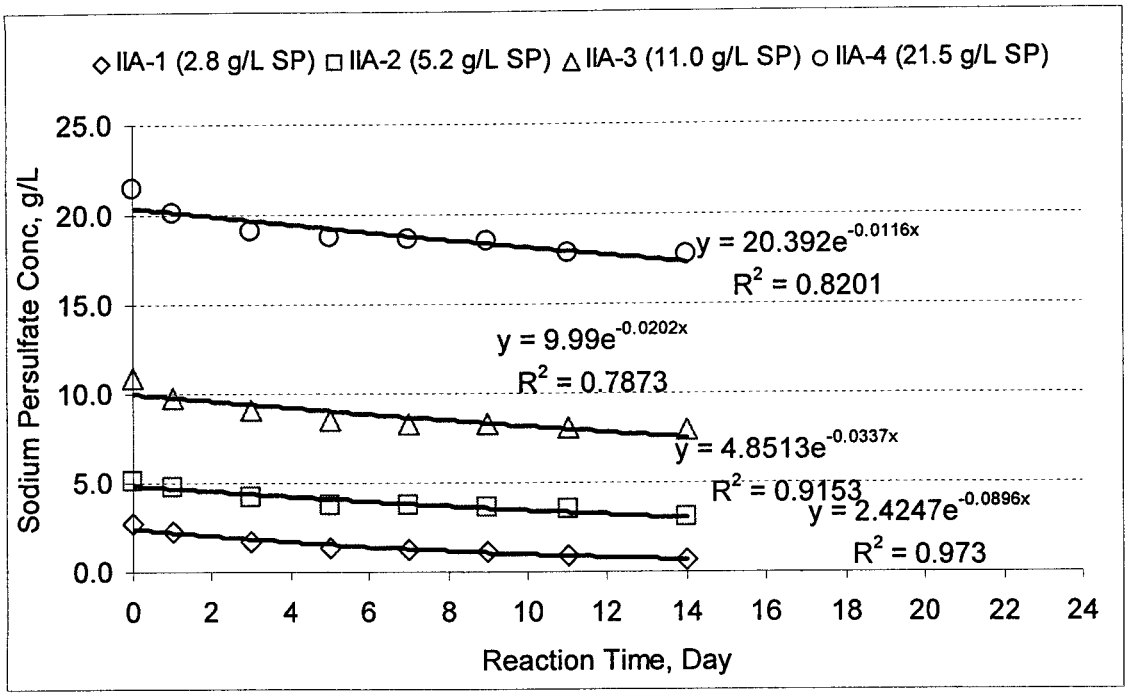

Figure 5.2. Variation of SP concentration as a function of reaction time for CS-I (Task 2)

Experiment: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

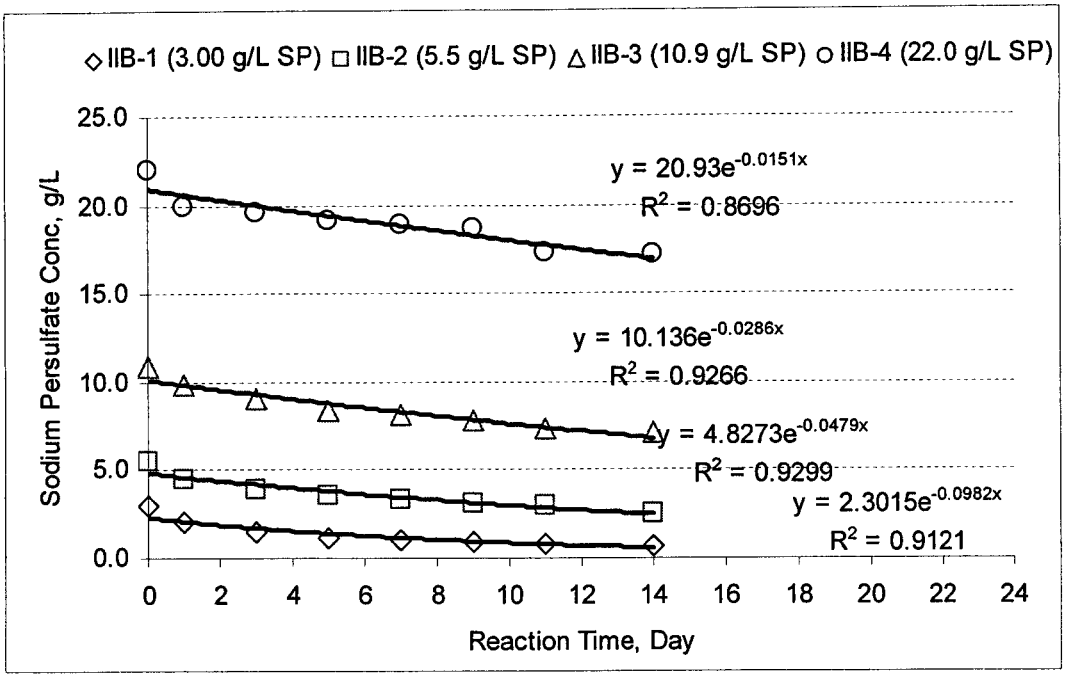

Figure 5.3. Variation in SP concentration as a function of reaction time for CS-II (Task 2)

Experiment: (SP)o = ~2.5 g/L, 5.0 g/L, 10 g/L and 20 g/L; Liquid/Soil ~5:1 (g/g); Total liquid volume: ~250 mL; Shaking speed: 120 rpm; Reaction time: 14 days ; Temp = 20 ± 1 °C

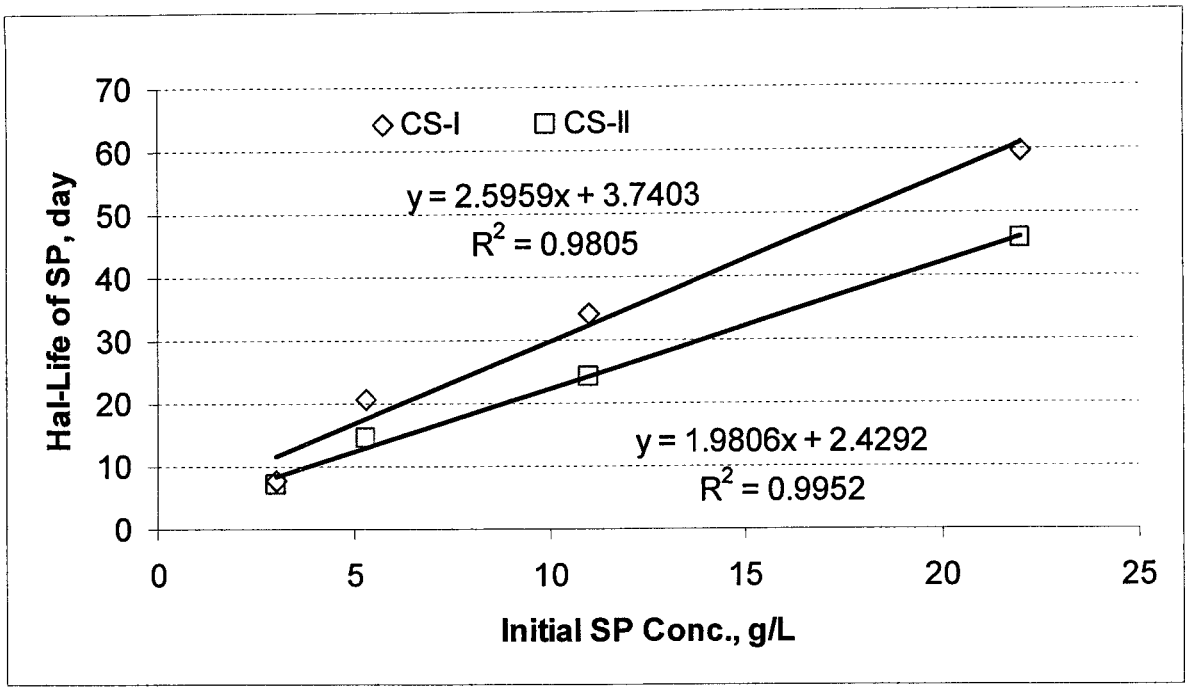

Figure 5.4. Correlation of the SP half-life with the SP dose (Task 2)

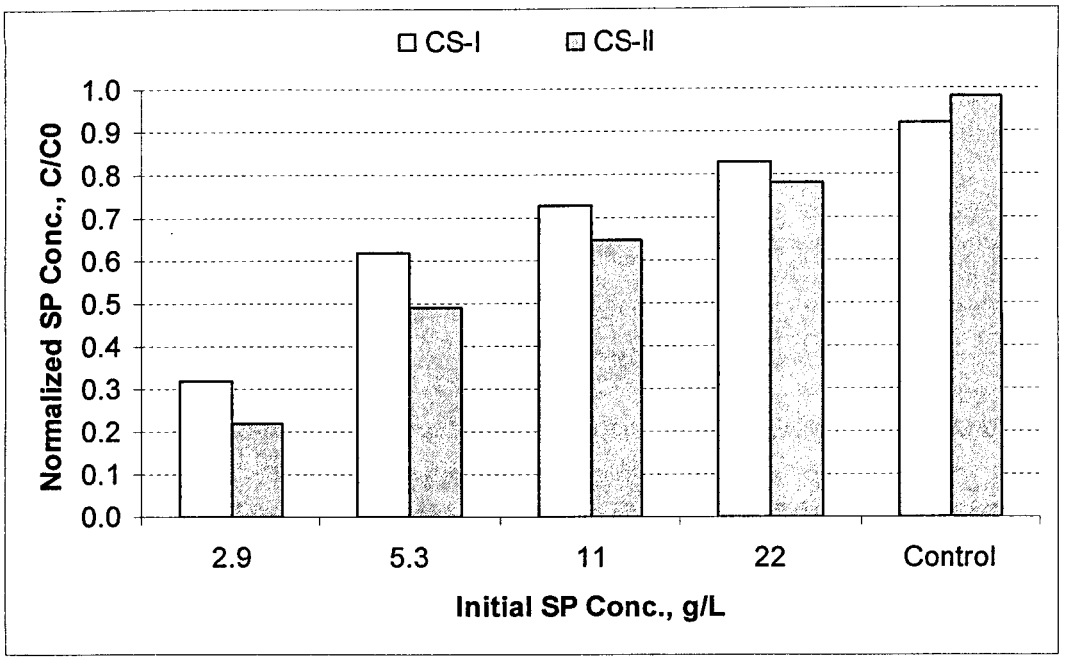

Figure 5.5. Plot of residual SP concentrations (in C/Co) at the end of the tests versus initial SP doses (Task 2)

APPENDIX C

REPORT OF ANALYSES

Report of Analyses

Prepared by:

Microbe Inotech Laboratories, Inc.

the MiL, Inc.

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Microbe Inotech Laboratories, Inc.
Summary Report of Analysis
[MILB – 3640A]

Bill Spizuoco
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January 24, 2006

Description and Chain of Custody Record Information:

- Thursday, January 5, 2005 – 9:43 AM: Received by courier 12 total samples consisting of 10 soil and 2-liquid samples for Aerobic Biofeasibility Study with Chemistry and the 4 isolated strains subjected to an endpoint analysis completed using Gasoline, Oil No. 4, Oil No. 6, and a free phase product.
- MILB Report & Invoice No.: MILB-3640A.
- Purchase Order No.: 2003118

Processing:

[Standard Bacterial Plate Count 9215 - standard spread plate method] Within 20 minutes of reception an aliquot from each sample is checked for weight or volume and serially diluted. The dilutions are aseptically transferred in a laminar flow biological cabinet and plated onto previously prepared and dried TSA medium in Petri plates. Observations for colony forming units per 1 milliliter (CFU/mL) or gram (CFU/g) are made after 24 and 48 hours of incubation at 30°C.

Summary – Final Results:

Direct Count: Colony Forming Units per 1 gram or milliliter of sample. Results reported as CFU/g or CFU/mL			
Sample Name	**Test Type**	**24 Hour count**	**48 Hour count**
C-1A (3640A-1)	Total Plate Counts	9.0×10^4 CFU/g	2.2×10^5 CFU/g
C-1B (3640A-2)	Total Plate Counts	2.2×10^5 CFU/g	3.2×10^5 CFU/g
C-1C (3640A-3)	Total Plate Counts	5.3×10^4 CFU/g	1.1×10^6 CFU/g
C-1D (3640A-4)	Total Plate Counts	4.0×10^4 CFU/g	2.1×10^5 CFU/g
C-1E (3640A-5)	Total Plate Counts	5.0×10^4 CFU/g	5.9×10^5 CFU/g
C-2A (3640A-6)	Total Plate Counts	6.6×10^3 CFU/g	6.7×10^3 CFU/g
C-2B (3640A-7)	Total Plate Counts	9.0×10^4 CFU/g	6.0×10^5 CFU/g
C-2C (3640A-8)	Total Plate Counts	5.0×10^4 CFU/g	7.0×10^4 CFU/g
C-2D (3640A-9)	Total Plate Counts	2.4×10^5 CFU/g	2.8×10^5 CFU/g
C-2E (3640A-10)	Total Plate Counts	2.9×10^4 CFU/g	4.5×10^4 CFU/g
MW-1 & MW-16 (3640A-11)	Total Plate Counts	2.0×10^1 CFU/mL	1.1×10^3 CFU/mL
Recovery Sump (3640A-12)	Total Plate Counts	8.2×10^2 CFU/mL	9.1×10^2 CFU/mL

<1= none detected

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Approximate Percentages of Strain Types in Each Sample (with growth):

Sample→ Strain ↓	C-1A (3640A-1)	C-1B (3640A-2)	C-1C (3640A-3)	C-1D (3640A-4)	C-1E (3640A-5)	C-2A (3640A-6)	C-2B (3640A-7)	C-2C (3640A-8)	C-2D (3640A-9)	C-2E (3640A-10)	Mw-1 & Mw-16 (3640A-11)	Recovery Sump (3640A-12)
3640A-1	10%	--	--	--	--	--	--	--	--	--	--	--
*3640A-2	50%	15%	10%	--	10%	10%	10%	30%	--	--	10%	--
*3640A-3	5%	--	15%	10%	30%	--	10%	--	--	--	--	--
*3640A-4	10%	30%	--	25%	10%	--	15%	--	--	10%	--	--
*3640A-5	10%	--	--	10%	--	--	--	--	--	--	30%	60%
3640A-6	10%	--	--	--	--	--	--	--	--	--	--	--
3640A-7	5%	--	--	--	--	--	--	--	--	--	20%	--
3640A-8	--	30%	--	10%	--	--	--	5%	--	--	--	--
3640A-9	--	5%	--	--	--	--	--	--	--	--	--	--
*3640A-10	--	20%	--	--	--	--	20%	10%	20%	--	--	--
3640A-11	--	--	40%	--	--	--	--	--	--	--	--	--
3640A-12	--	--	30%	15%	--	--	10%	--	--	--	--	--
3640A-13	--	--	5%	--	--	--	--	--	--	--	--	--
3640A-14	--	--	--	5%	--	--	--	--	--	--	5%	--
3640A-15	--	--	--	5%	--	--	--	--	--	--	20%	--
3640A-16	--	--	--	10%	25%	--	--	--	--	20%	5%	--
3640A-17	--	--	--	5%	--	--	--	--	--	--	--	--
3640A-18	--	--	--	5%	--	--	--	--	--	40%	--	--
*3640A-19	--	--	--	--	25%	--	25%	35%	--	--	10%	10%
*3640A-20	--	--	--	--	--	40%	--	20%	20%	--	--	--
3640A-21	--	--	--	--	--	40%	--	--	--	--	--	--
3640A-22	--	--	--	--	--	10%	--	--	20%	30%	--	--
3640A-23	--	--	--	--	--	--	10%	--	10%	--	--	--
3640A-24	--	--	--	--	--	--	--	--	30%	--	--	--
3640A-25	--	--	--	--	--	--	--	--	--	--	--	30%

* denotes strains selected for identification and contaminate endpoint analysis

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BiOLOG® Processing (FF/GP2 BiOLOG® Plates):

GP2 BiOLOG®Processing (GP2 = Gram Positive [second generation]): Gram-positive bacteria were streaked onto BiOLOG® Universal Growth agar (BUG) and allowed to incubate at 30°C for 24 hours. After 24 hours the sample strain was suspended into a sterile saline solution, then the solution was loaded into the appropriate micro-titer plate (GP2 BiOLOG®). The plate was incubated at 30°C and then, using an automated micro-plate reader, examined at 24 hours and compared against version 4.20 of the GP BiOLOG® database to obtain the bacterial identification.

The client is strongly urged to examine the data sheets accompanying the chromatogram of the strains for alternate possible identities not summarized here. Should a question be raised on the basis of sample history, ecology and source, this additional information may be enlightening.

Summary Results by BiOLOG®:

Strain Number	ID by Biolog Aerobic Method	Percent Probability	Sim. Coef.	Dist. Coef.
3640A-1-2	*Bacillus cereus/thuringiensis*	95%	0.83	1.92
3640A-1-3	*Capnocytphaga canimorsus*	93%	0.65	4.60
3640A-1-4	*Geobacillus thermoglucosidasius*	93%	0.85	1.34
3640A-1-5	*Sphingomonas sanguinis*	92%	0.52	6.77
3640A-2-10	*Bacillus maroccanus*	--	0.37	9.82
3640A-5-19	*Rahnella aquatilis*	100%	0.64	5.49
3640A-6-20	*Staphylocuccus sciuri*	98%	0.55	6.90

Disclaimer: **the MiL, inc.** is not a human clinical diagnostic laboratory and makes no warranty to the fitness of this data for such purposes.

Similarity and Distance Coefficient:

In order to create the database that we use to identify your organisms, thousands of species of bacteria had to be tested. In fact each species itself had to be tested hundreds of times to determine a set of characteristics unique to each species. The species characteristics that are in our database are an "average" of the characteristics of hundreds of tested bacteria of the same species. The Similarity and Distance Coefficient of your organism refers to the similarity and distance to the hypothetical 'mean' organism in the database. The database organism has a similarity coefficient of one and a distance of zero. So the closer your strain is to one and zero the more closely it matches the mean organism in the database.

- **A good match is one with a similarity coefficient greater than 0.5, a distance coefficient of less than 7.0, and a probability approaching 100%**

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Endpoint Assay Processing:

The tested bacterial strains were grown overnight on Trypticase Soy (Broth) Agar (TSA) at 30°C and then suspended in sterile saline to a turbidity of 40%-50%T. The strains are then placed into a 96-well microtiter plate that contains an undisclosed growth medium of mineral salts, vitamins and buffer without a major carbon source. The wells also contain a tetrazolium dye redox indicator system. Bacterial growth (metabolic respiration/oxidation of carbon sources) is monitored by tetrazolium reduction as measured at 590nm in a microplate reader. **Gasoline, Diesel, Oil No. 6, and Free Phase Product** (@5 µL) were added to selected wells to serve as the major carbon source. Trypticase Soy Broth (TSB) serves as the positive control for bacterial growth and water serves as the negative control for bacterial growth in this assay. Total volume of each well is 150µL.

Total growth is measured after 24 hours of incubation at 30°C. The data is processed and given with background blank values subtracted. Bar-chart interpretation of the data is provided on the pages following the executive summary report of analysis. The design template of the experiment is located in the raw data section of this report. The template shows the arrangement and position of strains in the matrix. Individual strain feasibility for biodegradation potential is reported as one of the following classifications:

- Excellent Degrader
- Good Degrader
- Fair Degrader
- Minimal Degrader
- No Effect
- Growth Inhibited

Aerobic Endpoint Assay Results:

(Also see graphical results at end of Summary Report)

Contaminant ⇒ Strain ⇓	Gasoline	Diesel	No. 6 oil	Free Phase
3640A-1-2	No Effect	No Effect	No Effect	No Effect
3640A-1-3	Growth Inhibited	Growth Inhibited	Growth Inhibited	Growth Inhibited
3640A-1-4	No Effect	Growth Inhibited	Growth Inhibited	Growth Inhibited
3640A-1-5	No Effect	No Effect	No Effect	No Effect
3640A-2-10	No Effect	No Effect	No Effect	No Effect
3640A-5-19	Growth Inhibited	No Effect	No Effect	No Effect
3640A-6-20	Growth Inhibited	Growth Inhibited	Growth Inhibited	No Effect

Solids Nutrient Chemistry Results – mg/Kg-dry (pH is a unit-less quantity):

Sample ⇒ Analyte ⇓	C-1A	C-1B	C-1C	C-1D	C-1E	C-2A	C-2B	C-2C	C-2D	C-2E	Method
Organic Matter	8.90	6.80	5.10	7.60	7.80	4.10	6.90	5.70	6.40	7.10	ASTM Method D2974
Percent Moisture	20.1	17.7	21.0	21.5	22.2	15.0	21.5	25.2	20.8	13.9	*2540G
Total Solids	79.9	82.3	79.0	78.5	77.8	85.0	78.5	74.8	79.2	86.1	*2540G
Nitrogen, Ammonia (as N)	23.7	13.3	10.5	93.7	21.6	12.6	22.2	52.4	15.4	8.14	*4500-NH_3 BF
Nitrogen, Nitrite (as N)	0.68	0.98	0.32	0.88	0.51	0.31	0.42	0.31	0.82	1.11	*4500-NO_2 B
Phosphorus, Orthophosphate (as P)	12.2	19.7	9.81	22.0	6.11	6.18	7.64	7.35	13.9	16.6	*4500-P BE
Iron	23200	25500	29000	36600	25000	18400	26600	32900	36900	28900	SW-846 ICP Method 6010B
Sulfate, Turbidimetric	<626	<608	277	<1270	281	<588	<637	<668	<631	<581	SW-846 Method 9038
pH (1:1)	7.79	7.67	7.30	7.41	7.41	7.63	7.79	7.37	7.59	7.75	SW-846 Method 9045C
Nitrogen, Nitrate (as N)	2.7	3.0	2.4	2.6	2.2	2.0	2.3	2.1	2.0	1.8	SW-846 Method 9210

***Indicates Standard Methods 18th Edition (Method #) –**

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Liquid Nutrient Chemistry Results – mg/L-liquid (pH is a unit-less quantity):

Sample ⇒ Analyte ⇓	MW-1 & MW-16	Recovery Sump	Method
pH	7.11	7.24	*4500–H B
Iron	58.0	2.59	*3030F, 3120B Total
Nitrogen, Ammonia (as N)	0.66	<0.10	*4500–NH_3 F Total
Nitrogen, Nitrite (as N)	0.08	<0.01	*4500–NO_2 B
Nitrogen, Nitrate (as N)	0.62	0.26	*4500–NO_3 D
Phosphorus, Orthophosphate (as P)	3.94	0.062	*4500–P BE
Sulfate, Turbidimetric	155	139	*4500–SO_4 E
Total Organic Carbon (TOC)	13	7.9	*5310C, Organic Carbon
***Indicates Standard Methods 18th Edition (Method #) –**			

Nutrient Chemistry Which Should Be Maintained for Optimum Activity:

pH of Sample:	6.5 – 8.0 are considered good conditions
Iron:	Satisfactory (>10 mg/L)
Total Organic Carbon:	
Nitrogen as N:	C:N:P ratio is typically poor at contaminated sites and usually low on available nitrogen
Ammonia:	
Nitrite:	
Nitrate	Optimum C:N:P ratio to be maintained (120 – 100):10:1
o-Phosphate	

Comments:

A comment made by a member of the regulatory community sums up what must be done in our opinion to successfully implement bioremediation.

> *A regulator looks for the data necessary to determine that a proposed treatment technology, if properly installed and operated, will reduce the contaminant concentrations in the soil and water to legally mandated limits. In this sense the use of biological treatment systems calls for the same level of investigation, demonstration of effectiveness, and monitoring as any conventional remediation system [National Research Council, 1993].*

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To support implementation of bioremediation, the property owner must scientifically demonstrate that degradation of site contaminants can occur at rates sufficient to be protective of human health and the environment. This document provides data that supports a technical course of action, which, if followed, should support bioremediation at sites where this type of process is protective of the environmental quality of ground water and soils. Bioremediation results from the integration of several attenuation mechanisms, which may be classified as either destructive or nondestructive. Destructive processes include biodegradation, abiotic oxidation, and hydrolysis. Nondestructive attenuation mechanisms include sorption, dilution (caused by dispersion and infiltration), and volatilization. The chemical parameters for soil and groundwater can significantly affect bacterial populations therefore monitoring of bioremediation projects may include these albeit less frequently than comparative population counts and degradative studies as completed herein.

Dissolved Oxygen and BTEX data:

An inverse relationship between dissolved oxygen and BTEX concentrations is an important indication of aerobic biodegradation and may be used as evidence that biodegradation of fuel hydrocarbons is occurring. Low dissolved oxygen levels in an area with fuel hydrocarbon contamination generally indicates that an active zone of aerobic hydrocarbon biodegradation is present. Dissolved oxygen is the most thermodynamically favored electron acceptor used in the biodegradation of fuel hydrocarbons. Measurements of dissolved oxygen concentrations are used to estimate the mass of contaminant, which can be biodegraded by aerobic processes. Each 1.0 mg /L of dissolved oxygen consumed by microbes will destroy approximately 0.29 mg/L of BTEX compounds. During aerobic biodegradation, dissolved oxygen levels are reduced to below background levels as aerobic respiration occurs. Anaerobic bacteria (obligate anaerobes) generally cannot function at dissolved oxygen levels greater than about 0.5 mg/L.

Nitrate:

After dissolved oxygen has been depleted in the microbiological treatment zone, nitrate may be used as an electron acceptor for anaerobic biodegradation. Measurements of nitrate concentrations can be used to estimate the mass of contaminant, which can be biodegraded by denitrification processes. Each 1.0 mg/L of nitrate-nitrogen consumed by microbes results in the destruction of approximately 0.9 mg/L of BTEX compounds. Each 1.0 mg/L of nitrate consumed by microbes results in the destruction of approximately 0.21 mg/L of BTEX compounds.

Sulfate:

After dissolved oxygen and nitrate have been depleted in the microbiological treatment zone, sulfate may be used as an electron acceptor for anaerobic biodegradation. Sulfate concentrations are used as an indicator of anaerobic degradation of fuel compounds. Each 1.0 mg/L of sulfate consumed by microbes results in the destruction of approximately 0.22 mg/L of BTEX compounds.

Ferrous Iron (Fe II):

In some cases ferric iron is used as an electron acceptor during anaerobic biodegradation of petroleum hydrocarbons. During this process, ferric iron is reduced to the ferrous form, which may be soluble in water. Ferrous iron concentrations are used as an indicator of anaerobic degradation of fuel compounds. Each 1.0 mg/L of ferrous iron produced during microbial iron oxidation results in the degradation of 0.047 mg/L of BTEX. Bacteria are capable of producing "siderophores", iron-specific chelating or binding agents to scavenge for iron. [For more information see the following reference, *Iron Chelation in Plants and Soil Microorganisms*, L.L Barton and B.C. Hemming (editors), Academic Press, Inc., New York, 1993, 490pp. ISBN 0-12-079870-0.].

Temperature:

Ground water temperature directly affects the solubility of oxygen and other geochemical species. The solubility of dissolved oxygen is temperature dependent, being more soluble in cold water than in warm water. Ground water temperature also affects the metabolic acidity of bacteria. Rates of hydrocarbon biodegradation roughly double for every 10 – degree Celsius (10°C) increase in temperature ("Q" 10 rule) over the temperature range between 5 and 25°C. Ground water temperatures less than about 5°C tend to inhibit biodegradation, and slow rates of biodegradation are generally observed in such waters.

pH:

The pH of ground water has an effect on the presence and activity of microbial populations in ground water. This is especially true for methanogens. Microbes capable of degrading petroleum hydrocarbon compounds generally prefer pH values varying from 6.5 to 8 standard units.

Total Petroleum Hydrocarbons and Aromatic Hydrocarbons:

These analytes are used to determine the type and distribution of fuel hydrocarbon in the aquifer. The combined concentrations of BTEX and the trimethylbenzenes (TMB) should not be greater than 50 percent of the TPH concentration. If these compounds are found in concentrations greater than 50 percent of the TPH concentration, sampling errors such as emulsification of product in the ground water sample should be investigated.

Thank you from the staff on project:

Bruce C. Hemming, Ph.D.
President & CEO

Andrew William Johnson
Laboratory Manager

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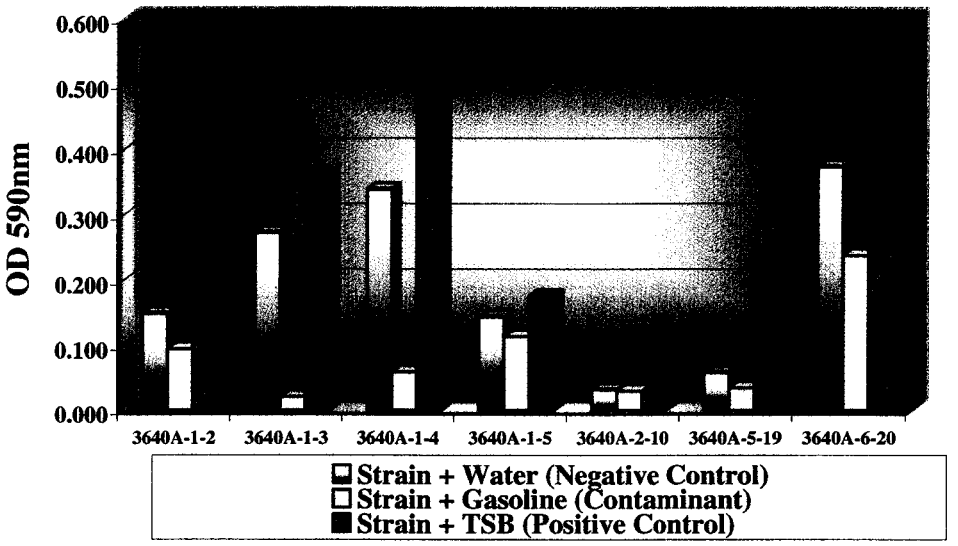
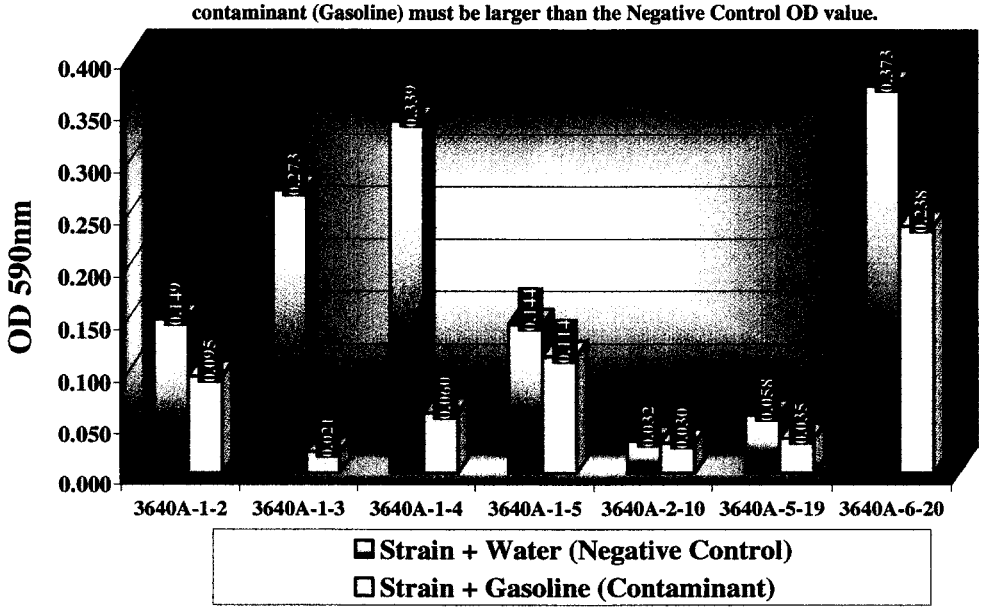
Plumley Engineering 3640A
Aerobic Endpoint Assay 7 Strains with Gasoline



Same Data as Above Without Positive Growth Control (TSB)

Note: For Strains to be considered Biodegrading organisms the OD value for the contaminant (Gasoline) must be larger than the Negative Control OD value.



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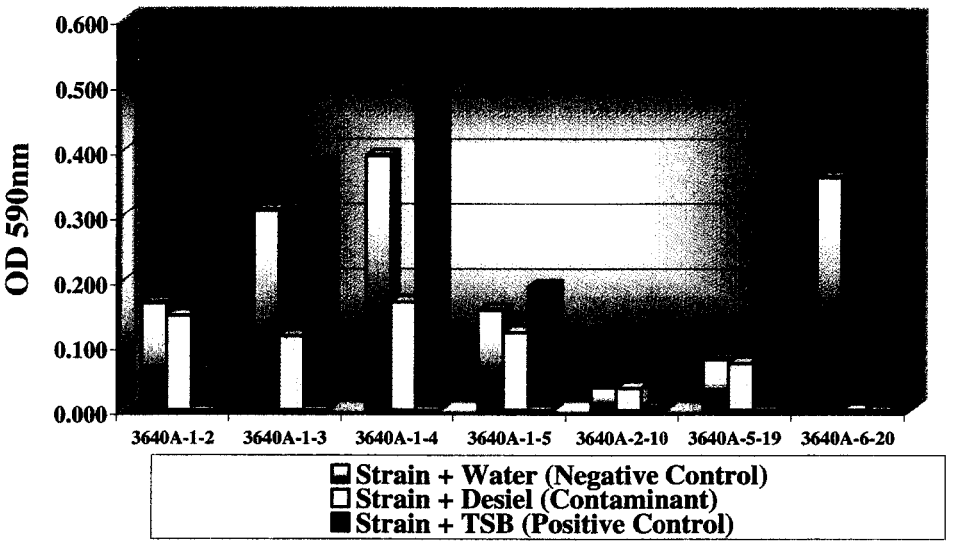
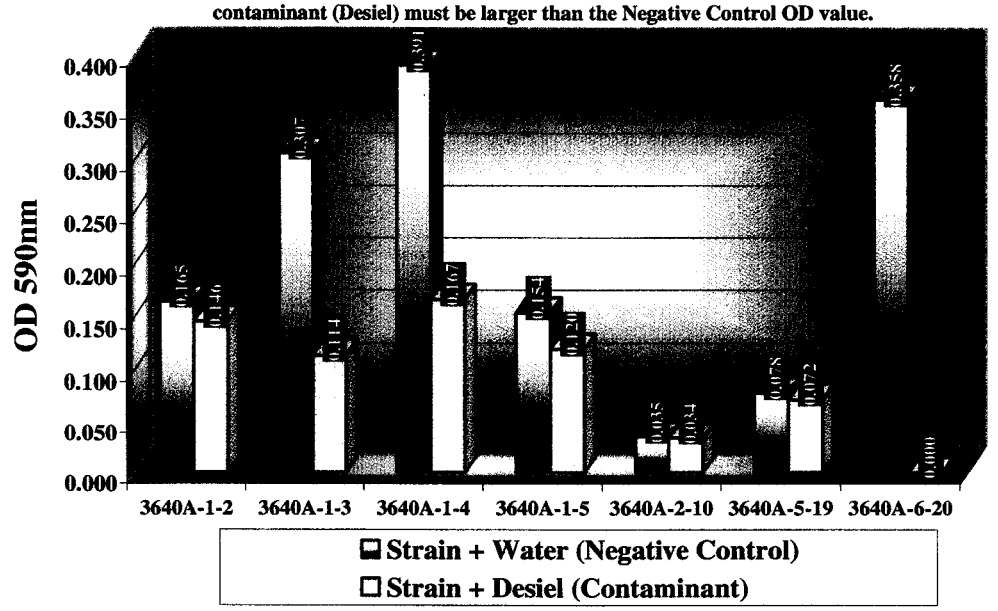
Aerobic Endpoint Assay 7 Strains with Desiel



Same Data as Above Without Positive Growth Control (TSB)

Note: For Strains to be considered Biodegrading organisms the OD value for the contaminant (Desiel) must be larger than the Negative Control OD value.



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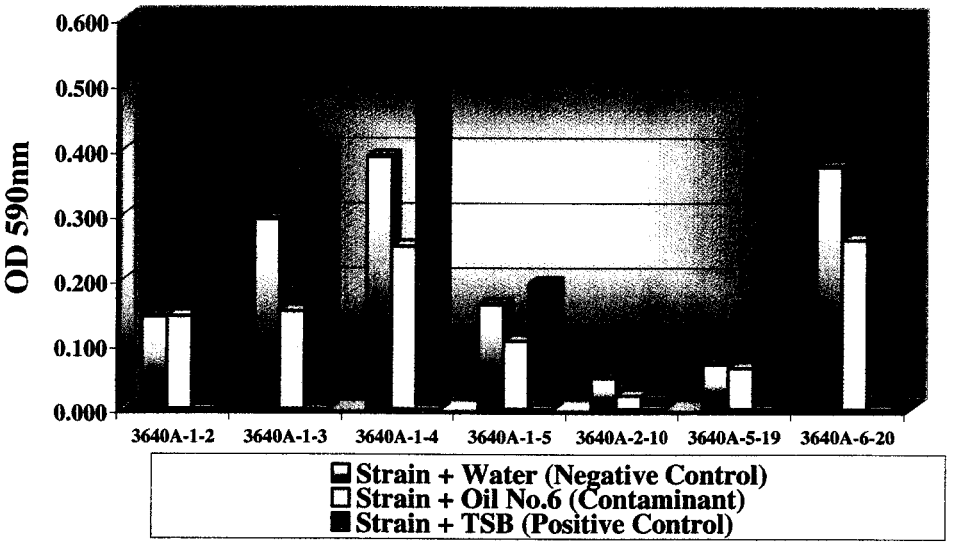
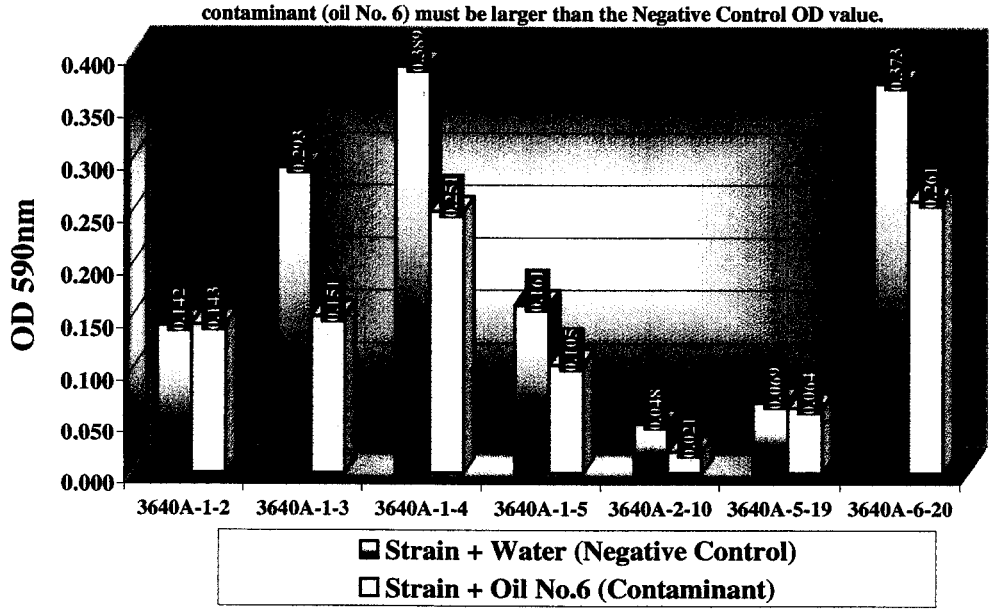
Plumley Engineering 3640A
Aerobic Endpoint Assay 7 Strains with oil No. 6



Same Data as Above Without Positive Growth Control (TSB)

Note: For Strains to be considered Biodegrading organisms the OD value for the contaminant (oil No. 6) must be larger than the Negative Control OD value.



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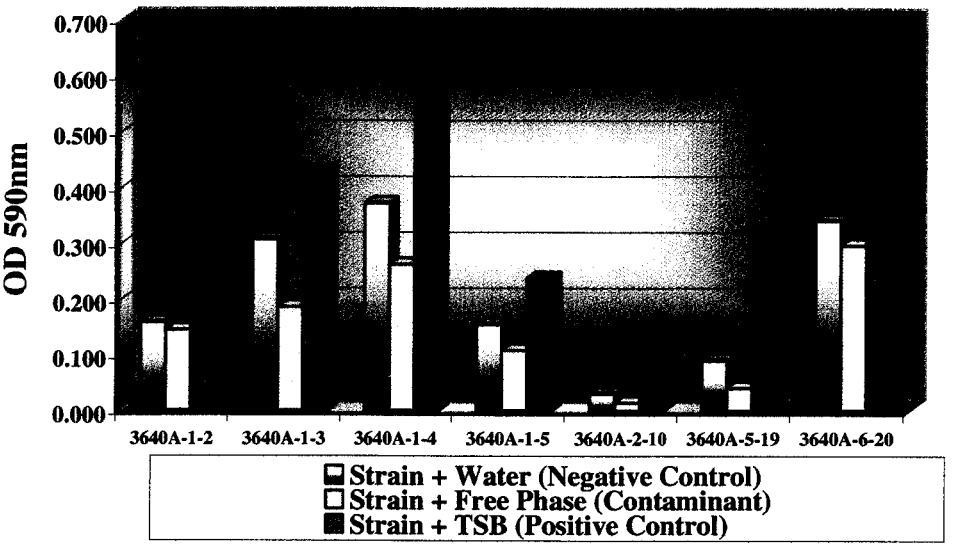
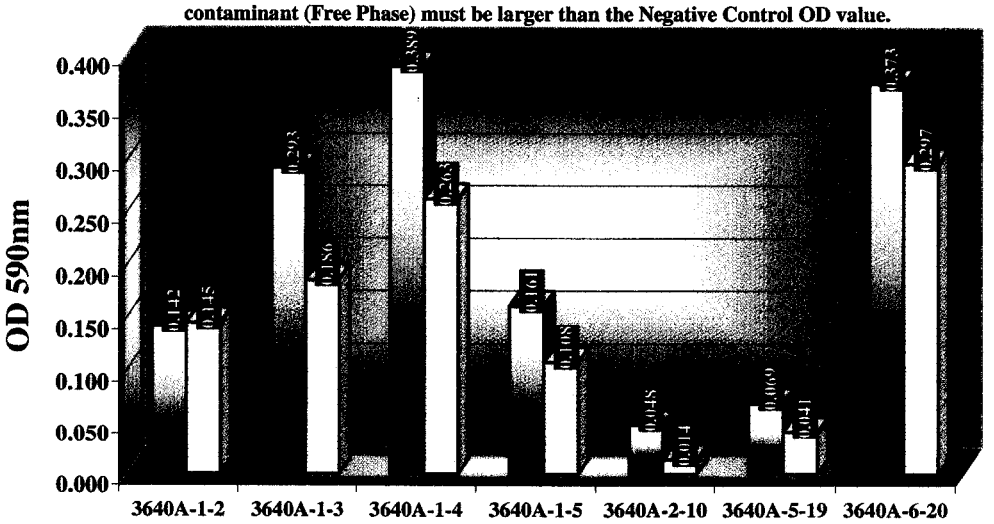
Plumley Engineering 3640A
Aerobic Endpoint Assay 7 Strains with Free Phase



Same Data as Above Without Positive Growth Control (TSB)

Note: For Strains to be considered Biodegrading organisms the OD value for the contaminant (Free Phase) must be larger than the Negative Control OD value.



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the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-1
Lab ID: 06010139-001 **Collection Date:** 1/3/2006 11:00:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**8.90**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**20.1**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**79.9**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.53		**23.7**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.12	H	**0.68**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.26		**12.2**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	118		**23200**	mg/Kg-dry	50	1/11/2006 2:40:39 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	626		**< 626**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
(1:1)	NELAP	1.00		**7.79**		1	1/6/2006 2:00:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.5	H	**2.7**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

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the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-2

Lab ID: 06010139-002 **Collection Date:** 1/3/2006 11:05:00 AM

Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**6.80**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**17.7**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**82.3**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.41		**13.3**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.12	H	**0.98**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.08		**19.7**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	113		**25500**	mg/Kg-dry	50	1/11/2006 2:42:30 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	608		**< 608**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
1:1)	NELAP	1.00		**7.67**		1	1/6/2006 2:02:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.4	H	**3.0**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-3
Lab ID: 06010139-003 **Collection Date:** 1/3/2006 11:10:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**5.10**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**21.0**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**79.0**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.54		**10.5**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.13	H	**0.32**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.33		**9.81**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	122	S	**29000**	mg/Kg-dry	50	1/11/2006 2:44:21 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	633	J	**277**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
1:1)	NELAP	1.00		**7.30**		1	1/6/2006 2:06:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.5	JH	**2.4**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

SW-846 3050B, 6010B, Metals by ICP

Fe - Sample concentration is greater than 5 times the spike level.

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-4
Lab ID: 06010139-004 **Collection Date:** 1/3/2006 11:15:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**7.60**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**21.5**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**78.5**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.60		**93.7**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.13	H	**0.88**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.37		**22.0**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	127		**36600**	mg/Kg-dry	50	1/11/2006 2:49:56 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	1270		**< 1270**	mg/Kg-dry	20	1/12/2006	SMK
S[illegible] 846 9045C								
[illegible]:1)	NELAP	1.00		**7.41**		1	1/6/2006 2:14:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.6	H	**2.6**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-5
Lab ID: 06010139-005 **Collection Date:** 1/3/2006 11:20:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**7.80**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1	H	**22.2**	%	1	1/11/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1	H	**77.8**	%	1	1/11/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.69		**21.6**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.13	H	**0.51**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.43	J	**6.11**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	126		**25000**	mg/Kg-dry	50	1/11/2006 2:51:48 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	643	J	**281**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
(1:1)	NELAP	1.00		**7.41**		1	1/6/2006 2:18:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.6	JH	**2.2**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative
Standard Methods 18th Ed. 2540 G
Sample required re-analysis out of hold time.

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WorkOrder: 06010139 **Client Sample ID:** 3640A-6
Lab ID: 06010139-006 **Collection Date:** 1/3/2006 11:25:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**4.10**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**15.0**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**85.0**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.29		**12.6**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.12	H	**0.31**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	5.88		**6.18**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	118		**18400**	mg/Kg-dry	50	1/11/2006 2:53:40 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	588		**< 588**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
:1)	NELAP	1.00		**7.63**		1	1/6/2006 2:20:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.4	JH	**2.0**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-7
Lab ID: 06010139-007 **Collection Date:** 1/3/2006 11:30:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**6.90**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**21.5**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**78.5**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.54		**22.2**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.13	H	**0.42**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.37		**7.64**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	122		**26600**	mg/Kg-dry	50	1/11/2006 2:55:31 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	637		**< 637**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
(1:1)	NELAP	1.00		**7.79**		1	1/6/2006 3:27:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.6	JH	**2.3**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-8

Lab ID: 06010139-008 **Collection Date:** 1/3/2006 11:35:00 AM

Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**5.70**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**25.2**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**74.8**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.47		**52.4**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.13	H	**0.31**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.68		**7.35**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	124		**32900**	mg/Kg-dry	50	1/11/2006 2:57:24 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	668		**< 668**	mg/Kg-dry	10	1/12/2006	SMK
SW-846 9045C								
:1)	NELAP	1.00		**7.37**		1	1/6/2006 3:29:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.7	JH	**2.1**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

the MiL, inc.

WorkOrder: 06010139
Lab ID: 06010139-009
Report Date: 16-Jan-06

Client Sample ID: 3640A-9
Collection Date: 1/3/2006 11:40:00 AM
Matrix: SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**6.40**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**20.8**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**79.2**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.69		**15.4**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.13	H	**0.82**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	6.31		**13.9**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	126		**36900**	mg/Kg-dry	50	1/11/2006 3:04:42 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	631		**< 631**	mg/Kg-dry	10	1/12/2006	SMK
846 9045C								
(1:1)	NELAP	1.00		**7.59**		1	1/6/2006 3:31:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.5	JH	**2.0**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-10
Lab ID: 06010139-010 **Collection Date:** 1/3/2006 11:45:00 AM
Report Date: 16-Jan-06 **Matrix:** SOLID

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
ASTM D2974								
Organic Matter		0.10		**7.10**	wt%	1	1/11/2006	KLE
Percent Moisture		0.1		**13.9**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 2540 G								
Total Solids		0.1		**86.1**	%	1	1/10/2006	KLE
STANDARD METHODS 18TH ED. 4500-NH3 B F								
Nitrogen, Ammonia (as N)		2.23	S	**8.14**	mg/Kg-dry	1	1/12/2006	NNH
STANDARD METHODS 18TH ED. 4500-NO2 B								
Nitrogen, Nitrite (as N)	NELAP	0.12	H	**1.11**	mg/Kg-dry	1	1/11/2006 10:00:00 AM	SMK
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	5.81		**16.6**	mg/Kg-dry	25	1/10/2006 9:20:00 AM	NLF
SW-846 3050B, 6010B, METALS BY ICP								
Iron	NELAP	112		**28900**	mg/Kg-dry	50	1/11/2006 3:06:34 PM	CRK
SW-846 9038								
Sulfate, Turbidimetric	NELAP	581	S	**< 581**	mg/Kg-dry	10	1/12/2006	SMK
-846 9045C								
(1:1)	NELAP	1.00		**7.75**		1	1/6/2006 3:33:00 PM	NMP
SW-846 9210								
Nitrogen, Nitrate (as N)	NELAP	2.3	JH	**1.8**	mg/Kg-dry	1	1/10/2006 4:45:00 PM	SMR

Sample Narrative

Standard Methods 18th Ed. 4500-NH3 B F

Spike recovery rounds to 85% which is within acceptable range.

SW-846 9038

MS/MSD did not recover because of matrix interference.

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WorkOrder: 06010139
Lab ID: 06010139-011
Report Date: 16-Jan-06

Client Sample ID: 3640A-11
Collection Date: 1/3/2006 11:50:00 AM
Matrix: AQUEOUS

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
EPA 600 350.1 (TOTAL)								
Nitrogen, Ammonia (as N)	NELAP	0.10		**0.66**	mg/L	1	1/10/2006	NNH
STANDARD METHOD 18TH ED. 4500-H B								
pH	NELAP	1.00	H	**7.11**		1	1/6/2006 10:34:00 AM	NMP
STANDARD METHODS 15TH ED. 426 C								
Sulfate, Turbidimetric		100		**155**	mg/L	20	1/6/2006	SMK
STANDARD METHODS 18TH ED. 2540 B								
Total Solids	NELAP	100	H	**2820**	mg/L	1	1/12/2006	KLE
STANDARD METHODS 18TH ED. 3030 F, 3120 B, METALS BY ICP (TOTAL)								
Iron	NELAP	0.0200		**58.0**	mg/L	1	1/13/2006 10:16:35 AM	JMW
STANDARD METHODS 18TH ED. 4500-NO2 B (TOTAL)								
Nitrogen, Nitrite (as N)	NELAP	0.01	H	**0.08**	mg/L	1	1/6/2006 3:00:00 PM	SMK
STANDARD METHODS 18TH ED. 4500-NO3 D (TOTAL)								
Nitrogen, Nitrate (as N)	NELAP	0.20	H	**0.62**	mg/L	1	1/6/2006 1:40:00 PM	SMR
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	0.100	H	**3.94**	mg/L	5	1/6/2006 11:40:00 AM	NLF
STANDARD METHODS 18TH ED. 5310 C, ORGANIC CARBON								
Total Organic Carbon (TOC)		1.0		**13**	mg/L	1	1/11/2006	SMR

Sample Narrative
Standard Methods 18th Ed. 2540 B
Sample analysis did not meet hold time requirements.

the MiL, inc.

WorkOrder: 06010139 **Client Sample ID:** 3640A-12
Lab ID: 06010139-012 **Collection Date:** 1/3/2006 11:55:00 AM
Report Date: 16-Jan-06 **Matrix:** AQUEOUS

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Analyst
EPA 600 350.1 (TOTAL)								
Nitrogen, Ammonia (as N)	NELAP	0.10		**< 0.10**	mg/L	1	1/10/2006	NNH
STANDARD METHOD 18TH ED. 4500-H B								
pH	NELAP	1.00	H	**7.24**		1	1/6/2006 10:36:00 AM	NMP
STANDARD METHODS 15TH ED. 426 C								
Sulfate, Turbidimetric		100		**139**	mg/L	20	1/6/2006	SMK
STANDARD METHODS 18TH ED. 2540 B								
Total Solids	NELAP	100	H	**476**	mg/L	1	1/12/2006	KLE
STANDARD METHODS 18TH ED. 3030 F, 3120 B, METALS BY ICP (TOTAL)								
Iron	NELAP	0.0200		**2.59**	mg/L	1	1/13/2006 10:21:38 AM	JMW
STANDARD METHODS 18TH ED. 4500-NO2 B (TOTAL)								
Nitrogen, Nitrite (as N)	NELAP	0.01	H	**< 0.01**	mg/L	1	1/6/2006 3:00:00 PM	SMK
STANDARD METHODS 18TH ED. 4500-NO3 D (TOTAL)								
Nitrogen, Nitrate (as N)	NELAP	0.20	H	**0.26**	mg/L	1	1/6/2006 1:40:00 PM	SMR
STANDARD METHODS 18TH ED. 4500-P E								
Phosphorus, Orthophosphate (as P)	NELAP	0.020	H	**0.062**	mg/L	1	1/6/2006 11:40:00 AM	NLF
STANDARD METHODS 18TH ED. 5310 C, ORGANIC CARBON								
Total Organic Carbon (TOC)		1.0		**7.9**	mg/L	1	1/11/2006	SMR

Sample Narrative
Standard Methods 18th Ed. 2540 B
Sample analysis did not meet hold time requirements.

MICROBE INOTECH LABORATORIES, INC. - 7259 LANSDOWNE AVENUE SUITE 200 ST. LUOUS MO 63119-3421
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www.microbeinotech.com

Biolog™

INTERPRETATION OF THE CARBON SOURCE PATTERN RECOGNITION DATA USING THE BIOLOG™ MULTI-WELL PLATE METHOD

The MiL, Inc. utilizes the Biolog Microplate System™ for microbial identification and characterization by carbon source pattern recognition. The microplate technique allows for characterization by 95 different tests yielding a potential of $4x10^{28}$ patterns generated from a single microplate. Each strain of microorganism yields a distinct pattern that will be recognized by the Biolog Micrologᵀᴹ software. Microplates are available for Gram Negative, Gram Positive, Yeasts, Lactic Acid Bacteria and Fungi analysis. Custom analyses are performed by the MiL, Inc. and can be particularly useful in biodegradation or additional selective media development studies. Additional interpretative instructions are provided with such custom services.

To characterize a given microbial isolate the organism is streaked onto a selective medium that will support vigorous growth.
The more fastidious organisms may require chocolate or BHI agar for growth, whereas many environmental organisms grow better in more minimal media. The culture plates are incubated at 28° to 35°C for 24 hours for bacteria, or 3-5 days for yeast and mold. Some thermophillic strains are often incubated at up to 50°C. After incubation colonies are removed from the culture plate by using a saline moistened cotton swab. A suspension of uniform turbidity is prepared in 0.85% saline with gelling agents and compared with known turbidimetric standard. The bacterial suspension is inoculated into the microplate wells and the plate is covered with the microplate lid.

The inoculated plates are incubated at 28°-35°C for 4 hours or overnight (16-24 hours) for bacteria, or 3-5 days for yeast and mold. Should other dilutents be requested or used, such changes will be noted.

Microplates may be read at 4 or 24 hours due to the fact that some organisms give results at 4 hours and may become unreadable at 24 hours. The plates are read using a microplate reader at 590 nm (490nm for mold). The absorbance or transmittance (color) in each well is referenced against the negative control well (A-1) so that any purple color recorded above this control level is read as a positive utilization of that particular carbon source. The data values are reported as the percent color change as compared to well A-1 utilizing the following formula.

$$\% \text{ color change} = \frac{OD590(\text{well}) - OD590 (\text{well A-1})}{OD590 (\text{well A-1})}$$

Positive results will be reported in brackets. Generally, if the Percent Color Change is equal to or greater than 40, the reaction in the given well is considered to be positive. However, the parameters for each substrate may be different and the positive test below a value of 40 is possible. The reported results will be otherwise considered negative. The computer algorithms employed provide standardization of settings ensuring repeatability and avoidance of operator bias. Names of all carbon source substrates employed are provided in the results regardless of response.

We, the microbiologists of the MiL, find these methods to be excellent for strain characterization or differentiation between closely related isolates.

GN2 MicroPlate™

A1 Water	A2 α-Cyclodextrin	A3 Dextrin	A4 Glycogen	A5 Tween 40	A6 Tween 80	A7 N-Acetyl-D-Galactosamine	A8 N-Acetyl-D-Glucosamine	A9 Adonitol	A10 L-Arabinose	A11 D-Arabitol	A12 D-Cellobiose
B1 i-Erythritol	B2 D-Fructose	B3 L-Fucose	B4 D-Galactose	B5 Gentiobiose	B6 α-D-Glucose	B7 m-Inositol	B8 α-D-Lactose	B9 Lactulose	B10 Maltose	B11 D-Mannitol	B12 D-Mannose
C1 D-Melibiose	C2 β-Methyl-D-Glucoside	C3 D-Psicose	C4 D-Raffinose	C5 L-Rhamnose	C6 D-Sorbitol	C7 Sucrose	C8 D-Trehalose	C9 Turanose	C10 Xylitol	C11 Pyruvic Acid Methyl Ester	C12 Succinic Acid Mono-Methyl Ester
D1 Acetic Acid	D2 Cis-Aconitic Acid	D3 Citric Acid	D4 Formic Acid	D5 D-Galactonic Acid Lactone	D6 D-Galacturonic Acid	D7 D-Gluconic Acid	D8 D-Glucosaminic Acid	D9 D-Glucuronic Acid	D10 α-Hydroxybutyric Acid	D11 β-Hydroxybutyric Acid	D12 γ-Hydroxybutyric Acid
E1 p-Hydroxy-phenlyacetic Acid	E2 Itaconic Acid	E3 α-Ketobutyric Acid	E4 α-Ketoglutaric Acid	E5 α-Ketovaleric Acid	E6 D,L-Lactic Acid	E7 Malonic Acid	E8 Propionic Acid	E9 Quinic Acid	E10 D-Saccharic Acid	E11 Sebacic Acid	E12 Succinic Acid
F1 Bromosuccinic Acid	F2 Succinamic Acid	F3 Glucuronamide	F4 L-Alaninamide	F5 D-Alanine	F6 L-Alanine	F7 L-Alanyl-Glycine	F8 L-Asparagine	F9 L-Aspartic Acid	F10 L-Glutamic Acid	F11 Glycyl-L-Aspartic Acid	F12 Glycyl-L-Glutamic Acid
G1 L-Histidine	G2 Hydroxy-L-Proline	G3 L-Leucine	G4 L-Ornithine	G5 L-Phenylalanine	G6 L-Proline	G7 L-Pyroglutamic Acid	G8 D-Serine	G9 L-Serine	G10 L-Threonine	G11 D,L-Carnitine	G12 γ-Aminobutyric Acid
H1 Urocanic Acid	H2 Inosine	H3 Uridine	H4 Thymidine	H5 Phenylethyl-amine	H6 Putrescine	H7 2-Aminoethanol	H8 2,3-Butanediol	H9 Glycerol	H10 D,L,α-Glycerol Phosphate	H11 α-D-Glucose-1-Phosphate	H12 D-Glucose-6-Phosphate

GP2 MicroPlate™

A1 water	A2 α-cyclodextrin	A3 β-cyclodextrin	A4 dextrin	A5 glycogen	A6 inulin	A7 mannan	A8 tween40	A9 tween80	A10 N-acetyl-D-glucosamine	A11 N-acetyl-D-mannosamine	A12 amygdalin
B1 L-arabinose	B2 D-arabitol	B3 arbutin	B4 cellobiose	B5 D-fructose	B6 L-fucose	B7 D-galactose	B8 D-galacturonic acid	B9 gentiobiose	B10 D-gluconic acid	B11 α-D-glucose	B12 m-inositol
C1 α-D-lactose	C2 lactulose	C3 maltose	C4 maltotriose	C5 D-mannitol	C6 D-mannose	C7 D-melezitose	C8 D-melibiose	C9 α-methyl D-galactoside	C10 β-methyl D-galactoside	C11 3-methyl glucose	C12 α-methyl D-glucoside
D1 β-methyl D-glucoside	D2 α-methyl D-mannoside	D3 palatinose	D4 D-psicose	D5 D-raffinose	D6 L-rhamnose	D7 D-ribose	D8 salicin	D9 sedoheptulosan	D10 D-sorbitol	D11 stachyose	D12 sucrose
E1 D-tagatose	E2 D-trehalose	E3 turanose	E4 xylitol	E5 D-xylose	E6 acetic acid	E7 α-hydroxybutyric acid	E8 β-hydroxybutyric acid	E9 γ-hydroxybutyric acid	E10 p-hydroxyphenyl acetic acid	E11 α-keto glutaric acid	E12 α-keto valeric acid
F1 lactamide	F2 D-lactic acid methyl ester	F3 L-lactic acid	F4 D-malic acid	F5 L-malic acid	F6 methyl pyruvate	F7 mono-methyl succinate	F8 propionic acid	F9 pyruvic acid	F10 succinamic acid	F11 succinic acid	F12 N-acetyl L-glutamic acid
alaninamide	G2 D-alanine	G3 L-alanine	G4 L-alanyl-glycine	G5 L-asparagine	G6 L-glutamic acid	G7 glycyl-L-glutamic acid	G8 L-pyroglutamic acid	G9 L-serine	G10 putrescine	G11 2,3-butanediol	G12 glycerol
H1 adenosine	H2 2-deoxy adenosine	H3 inosine	H4 thymidine	H5 uridine	H6 adenosine-5'-monophosphate	H7 thymidine-5'-monophosphate	H8 uridine-5'-monophosphate	H9 fructose-6-phosphate	H10 glucose-1-phosphate	H11 glucose-6-phosphate	H12 D-L-α-glycerol phosphate

Program	: Biolog MicroLog3 4.20
Save To File	: C:\Biolog420\3640A-1-2.D4C
Unrestricted Access?	: Yes
Read Time	: Jan 20 2006 13:47
Parent File	: Original Data Record
Plate Number	: 1
Incubation Time	: 4-6
Sample Number	: 3640A-1-2
Strain Type	: GP-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Automatic: Color: 13/67
Number +/b/- Reactions	: 19 / 15 / 62
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GP602.KID

Plate Type: GP2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	0	-36	{ 45}	< 132>	{ 22}	-26	-29	< 222>	< 126>	-3	-22	-41
B	{ 40}	-22	-26	-24	{ 44}	-43	-40	-24	-40	-36	< 114>	-24
C	0	-27	< 84>	{ 54}	-27	{ 52}	-10	-48	-49	-66	{ 59}	-28
D	{ 17}	-47	{ 22}	3	-36	-55	{ 27}	-75	-71	-35	-55	{ 18}
E	-2	< 150>	-2	-53	2	-5	-16	-1	-47	-67	-42	< 213>
F	0	-44	{ 29}	-34	< 82>	-18	-14	-18	< 88>	-8	-121	-32
G	{ 27}	0	< 120>	< 85>	{ 14}	-61	1	-42	-74+	-36	-46	< 132>
H	< 265>	< 178>	< 164>	< 237>	< 198>	{ 30}	< 118>	< 86>	-7	-114	-48	-3

=> Species ID: Bacillus cereus/thuringiensis <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Bacillus cereus/thuringiensis	95	0.83	1.92	GP-ROD SB
2)	Bacillus mycoides	4	0.03	2.98	GP-ROD SB
3)	Bacillus anthracis subgroup A	1	0.01	3.50	GP-ROD SB
4)	Bacillus anthracis subgroup B	0	0.00	4.87	GP-ROD SB
5)	Bacillus anthracis subgroup D	0	0.00	5.63	GP-ROD SB
6)	Deinococcus radiopugnans	0	0.00	6.18	GP-COC CAT+
7)	Staphylococcus aureus ss aureus	0	0.00	6.75	GP-COC CAT+
8)	Bacillus anthracis subgroup C	0	0.00	7.62	GP-ROD SB
9)	Staphylococcus hyicus	0	0.00	7.82	GP-COC CAT+
10)	Deinococcus radiodurans	0	0.00	7.95	GP-COC CAT+
Other)					

Print Time = Jan 20 2006 13:48

Program	: Biolog MicroLog3 4.20
Save To File	: ....
Unrestricted Access?	: Yes
Read Time	: Jan 20 2006 10:24
Parent File	:
Plate Number	: 1
Incubation Time	: 16-24
Sample Number	: 3640A-1-3
Strain Type	: GN-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Automatic: Color: -15/24
Number +/b/- Reactions	: 9 / 18 / 69
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GN602.KID

Plate Type: GN2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	{ 0}	< 42>	< 51>	< 185-	-80	-159	{ -2}	{ 16}	-76	{ 12}	-98	-71
B	-52	{ -1}	{ -1}	-27+	{ -7}	{ -3}	-22	{ 8}	< 39>	{ 0}	-77	-120+
C	-51	-17	-36	-25	-24	-27	-26	-38	-43	-68	< 142>	< 135>
D	-61	{ -2}	-143	-137	-58	-42	-64	-33	-42	-60	-50	-93
E	-112	-111	< 31>	{ 9}	-127	-56	-69	-136	-87	-103	-163	-39
F	< 81-	{-15}	-102	-66	-185	< 85-	-74	-58	{ 4}	-87	-68	-74
G	-104	-105	-133	-88	-92	{ 17}	-85	-143	-52	-105	-197	{ 1}
H	-127	-97	-125	-64	{ 7}	{ 7}	-143	-127	-148	-100	-170	-116

=> Species ID: Capnocytophaga canimorsus <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Capnocytophaga canimorsus	93	0.65	4.60	GN-FAS OXI+
2)	Burkholderia glumae	4	0.02	5.70	GN-NENT OXI+
3)	Neisseria subflava	2	0.01	5.97	GN-FAS OXI+
4)	Xanthomonas campestris pv poinsetttiicola	1	0.01	6.23	GN-NENT OXI-
5)	Neisseria canis	0	0.00	6.47	GN-FAS OXI+
6)	Neisseria elongata ss elongata	0	0.00	7.00	GN-FAS OXI+
7)	Neisseria meningitidis	0	0.00	7.00	GN-FAS OXI+
8)	Flavobacterium resinovorum	0	0.00	7.18	GN-NENT OXI+
9)	Flavobacterium mizutaii-like (CDC group II-I)	0	0.00	7.30	GN-NENT OXI+
10)	Haemophilus parasuis	0	0.00	7.43	GN-FAS OXI-
Other)					

Print Time = Jan 20 2006 10:24

Program	: Biolog MicroLog3 4.20
Save To File	: ....
Unrestricted Access?	: Yes
Read Time	: Jan 20 2006 10:20
Parent File	:
Plate Number	: 1
Incubation Time	: 16-24
Sample Number	: 3640A-1-4
Strain Type	: GP-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Manual: Color: -9/143
Number +/b/- Reactions	: 3 / 22 / 71
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GP602.KID

Plate Type: GP2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	{ 0}	-16	-36	-20	{ 85}	-27	-36	-32	-36	{ -2}	-21	-32
B	-26	-21	-32	-16	-18	-30	-26	-35	-29	-27	-32	-26
C	-13	-26	-26	-18	-17	-16	-26	-36	-15	-24	-32	-27
D	-18	-26	-33	-15	-25	-26	-24	-38	-28	-32	-25	-29
E	-13	-14	-18	-14	-17	{ 25}	-27	-17	-42	-25	{ 28}	-11
F	-13	{ -5}	-23	{ 111}	< 167>	{ 11}	< 179>	-27	{ 49}	{ 45}	{ 86}	-27
G	{ 56}	-45	< 197-	{ 34}	{ -3}	{ 1}	{ 66}	{ -1}	{ -1}	{ 100}	-20	-30
H	{ 41}	{ 64}	-11	{ 26}	-14	-29	-25	-34	-29	-26	-18	-29

=> Species ID: Geobacillus thermoglucosidasius (55 C) <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Geobacillus thermoglucosidasius (55 C)	93	0.85	1.34	GP-ROD SB
2)	Turicella otitidis	5	0.04	2.32	GP-ROD CAT+
3)	Corynebacterium auris	1	0.01	3.02	GP-ROD CAT+
4)	Kurthia zopfii	0	0.00	3.17	GP-ROD CAT+
5)	Brevibacterium otitidis	0	0.00	3.57	GP-ROD CAT+
6)	Arthrobacter cumminsii	0	0.00	3.62	GP-ROD CAT+
7)	Pediococcus pentosaceus	0	0.00	4.03	GP-COC CAT-
8)	Deinococcus radiophilus	0	0.00	4.33	GP-COC CAT+
9)	Tsukamurella inchonensis	0	0.00	4.39	GP-ROD CAT+
10)	Corynebacterium urealyticum	0	0.00	4.39	GP-ROD CAT+
Other)					

Print Time = Jan 20 2006 10:21

Program	: Biolog MicroLog3 4.20
Save To File	: ....
Unrestricted Access?	: Yes
Read Time	: Jan 19 2006 13:26
Parent File	:
Plate Number	: 1
Incubation Time	: 16-24
Sample Number	: 3640A-1-5
Strain Type	: GN-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Automatic: Color: 11/33
Number +/b/- Reactions	: 18 / 4 / 74
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GN602.KID

Plate Type: GN2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	0	-6	< 214>	7	-25	-16	-10	-7	-9	1+	-15	< 75>
B	3	11+	{ 22}	{ 21}	< 162>	< 117>	-7	< 97>	< 102>	< 373>	1	{ 19}
C	< 54>	< 43>	-5	< 122>	8	< 58-	< 268>	< 221>	< 208>	{ 22}	< 207>	< 165>
D	-7	-56	-45	-54	-44	-43	-30	-49	-47	-39	-31	-45
E	-34	-44	-37	-35	-40	1	-50	-46	-47	-36	-40	-22
F	-33	-14	-37	-38	-28	-22	-27	-28	-34	-35+	-40	-44
G	-38	-42	-47	-48	-46	-1	-8	-27	-24	-27	-17	-51
H	-64	-58	-50	-41	-58	-36	-36	< 92-	< 136>	0	-26	-24

=> Species ID: Sphingomonas sanguinis <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Sphingomonas sanguinis	92	0.52	6.77	GN-NENT
2)	Sphingomonas terrae	3	0.02	7.90	GN-NENT
3)	Sphingobacterium spiritovorum	1	0.01	8.20	GN-NENT OXI+
4)	Sphingobacterium multivorum	1	0.01	8.29	GN-NENT OXI+
5)	CDC group DF-3 (Capnocytophaga)	1	0.00	8.35	GN-FAS OXI-
6)	Sphingobacterium thalpophilum	1	0.00	8.40	GN-NENT OXI+
7)	Flavobacterium mizutaii	0	0.00	8.77	GN-NENT OXI+
8)	Sphingobacterium multivorum-like	0	0.00	9.10	GN-NENT OXI+
9)	Rhizobium rhizogenes	0	0.00	9.99	GN-NENT OXI+
10)	Actinobacillus muris	0	0.00	10.11	GN-FAS
Other)					

Print Time = Jan 19 2006 13:26

Program	: Biolog MicroLog3 4.20
Save To File	: C:\Biolog420\3640A-2-10.D4C
Unrestricted Access?	: Yes
Read Time	: Jan 20 2006 13:55
Parent File	: Original Data Record
Plate Number	: 1
Incubation Time	: 4-6
Sample Number	: 3640A-2-10
Strain Type	: GP-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Manual: Color: 32/61
Number +/b/- Reactions	: 30 / 14 / 52
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GP602.KID

Plate Type: GP2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	0	{ 36}	< 90>	< 170>	{ 44}	< 77>	6	23	17	< 123>	< 81>	-15
B	21	14	{ 57}	{ 42}	< 123>	-4	-14	19	< 71>	{ 58}	< 146>	30
C	-27	-26	< 97>	< 103-	< 85>	{ 50}	{ 45}	-7	-2	-36	< 64>	-35
D	4+	-74	-11	19+	-38	-71	-33	-80	-31	18	-50	< 65>
E	-28	< 130>	< 64>	-1	-22	< 148-	15	20	5+	-2	{ 36}	< 251>
F	-57	{ 43}	26	{ 46}	< 91>	-113	-2+	12	< 209>	25	-1	19
G	23	< 85>	< 126>	< 90>	{ 39}	< 66>	21+	18+	< 155>	-79	{ 57}	-50+
H	< 95>	< 144>	< 148>	< 218>	< 172>	12	< 76-	-368	{ 44}	-38	-52	{ 54}

=> No ID <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Bacillus maroccanus	---	0.37	9.82	GP-ROD SB
2)	Staphylococcus xylosus	---	0.03	10.60	GP-COC CAT+
3)	Staphylococcus caprae	---	0.00	11.48	GP-COC CAT+
4)	Staphylococcus haemolyticus	---	0.00	12.39	GP-COC CAT+
5)	Staphylococcus delphini	---	0.00	12.47	GP-COC CAT+
6)	Staphylococcus chromogenes	---	0.00	12.64	GP-COC CAT+
7)	Staphylococcus lugdunensis	---	0.00	12.71	GP-COC CAT+
8)	Bacillus anthracis subgroup C	---	0.00	12.77	GP-ROD SB
9)	Staphylococcus sciuri	---	0.00	12.83	GP-COC CAT+
10)	Staphylococcus muscae	---	0.00	13.04	GP-COC CAT+
Other)					

Print Time = Jan 20 2006 13:55

Program	: Biolog MicroLog3 4.20
Save To File	: ....
Unrestricted Access?	: Yes
Read Time	: Jan 19 2006 13:23
Parent File	:
Plate Number	: 1
Incubation Time	: 16-24
Sample Number	: 3640A-5-19
Strain Type	: GN-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Automatic: Color: 30/119
Number +/b/- Reactions	: 28 / 4 / 64
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GN602.KID

Plate Type: GN2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	0	< 225-	< 456>	< 307-	-11	-2	-5	< 352>	-5	< 299>	-13	< 391>
B	3	< 495>	1	< 266>	< 521>	< 542>	-5	< 415>	< 260>	< 435>	< 325>	< 564>
C	< 514>	< 161>	< 388>	< 573>	{ 48}	< 256>	< 703>	< 594>	{ 68}	< 299-	< 218>	14
D	-10	-18	-20	-22	-15	27	< 131>	-15	-11	-19	-17	-18
E	-11	-3	28	-8	-3	-9	-17	-18	-9	-11	-14	-42
F	-10	-3	11	-16	-9	-15	-9	-13	-9	-16	-15	-37
G	-9	-9	-17	-14	-13	-15	-14	-9	-3	-7	-6	-30
H	-21	< 366>	< 189>	{ 103}	-27	-22	-19	-12	14+	9+	{ 67}	< 187>

=> Species ID: Rahnella aquatilis <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Rahnella aquatilis	100	0.64	5.49	GN-ENT
2)	Actinobacillus capsulatus	0	0.00	7.96	GN-FAS OXI+
3)	Actinobacillus hominis	0	0.00	8.08	GN-FAS OXI+
4)	Pasteurella caballi	0	0.00	8.96	GN-NENT OXI+
5)	Pasteurella langaaensis	0	0.00	9.48	GN-NENT
6)	Actinobacillus equuli	0	0.00	9.52	GN-FAS
7)	Enterobacter intermedius	0	0.00	9.72	GN-ENT
8)	Mannheimia haemolytica	0	0.00	10.00	GN-NENT OXI+
9)	CDC group DF-3 (Capnocytophaga)	0	0.00	10.31	GN-FAS OXI-
10)	Pasteurella pneumotropica	0	0.00	10.61	GN-NENT OXI+
Other)					

Print Time = Jan 19 2006 13:24

Program	: Biolog MicroLog3 4.20
Save To File	: ....
Unrestricted Access?	: Yes
Read Time	: Jan 20 2006 10:35
Parent File	:
Plate Number	: 1
Incubation Time	: 16-24
Sample Number	: 3640A-6-20
Strain Type	: GP-ALL
Strain Number	:
Strain Name	:
Other	:
Data Input Mode	: Reader
590/750 Filters Used	: 6 / 5
Threshold Mode	: Manual: Color: 20/196
Number +/b/- Reactions	: 64 / 23 / 9
Database To Search	: MicroLog
Data Base(s) Searched	: C:\Biolog420\Databases\GP602.KID

Plate Type: GP2

Key : <X>: positive; <X-: mismatched positive; X: negative; X+: mismatched negative
{X}: borderline; -X: less than A1 well

Color	1	2	3	4	5	6	7	8	9	10	11	12
A	0	-93	-98	< 742>	{ 48}	-3	< 223>	<1264>	<1308>	< 784>	< 510>	< 549>
B	< 235>	-68	< 636>	< 864>	< 929>	< 365-	< 345>	< 213-	< 633>	< 264>	< 854>	< 211>
C	< 265-	{ 152}	-138+	< 378>	< 855>	< 565>	< 402>	{ 194}	{ 68}	{ 172}	< 862>	{ 87}
D	< 779>	-142	{ 158}	<1004>	{ 103}	{ 125}	<1008>	< 800>	{ 62}	< 545>	{ 185}	< 771>
E	< 277>	< 833>	{ 187}	{ 128}	< 234>	< 200>	{ 52}	0	< 231>	{ 64}	< 304>	<1003>
F	{ 140}	{ 51}	{ 101}	{ 70}	< 886>	< 404>	< 508>	-90	<1088>	< 263-	{ 189}	< 287>
G	< 206>	< 202>	< 336>	< 385>	< 875>	< 952>	< 405>	< 221-	< 411>	< 266-	< 532>	< 829>
H	< 708>	< 631>	< 756>	< 725>	< 843>	< 294>	< 284>	{ 39}	{ 94}	{ 153}	< 197>	< 414>

=> Species ID: Staphylococcus sciuri <=

	Species	PROB	SIM	DIST	TYPE
=>1)	Staphylococcus sciuri	98	0.55	6.90	GP-COC CAT+
2)	Corynebacterium nitrilophilus	1	0.00	8.57	GP-ROD CAT+
3)	Brevibacterium otitidis	1	0.00	8.63	GP-ROD CAT+
4)	Staphylococcus lentus	1	0.00	8.67	GP-COC CAT+
5)	Bacillus anthracis subgroup A	0	0.00	9.75	GP-ROD SB
6)	Brevibacterium mcbrellneri	0	0.00	10.02	GP-ROD CAT+
7)	Gordonia rubropertinctus	0	0.00	10.90	GP-ROD CAT+
8)	Rhodococcus rhodochrous	0	0.00	11.39	GP-ROD CAT+
9)	Bacillus anthracis subgroup D	0	0.00	12.55	GP-ROD SB
10)	Dermacoccus nishinomiyaensis	0	0.00	12.70	GP-COC CAT+
Other)					

Print Time = Jan 20 2006 10:35

Endpoint - Biofeasibility

3640A-A-Gas

Plate#1

	1	2	3	4	5	6	7	8	9	10	11	12
A	0.017	-0.008	-0.013	0.005	0.062	0.045	0.018	0.022	0.002	0.017	0.040	0.063
	0.017	-0.008	-0.013	0.005	0.062	0.045	0.018	0.022	0.002	0.017	0.040	0.063
B	0.168	0.140	0.132	0.155	0.120	0.117	0.147	0.144	0.217	0.244	0.239	0.250
	0.168	0.140	0.132	0.155	0.120	0.117	0.147	0.144	0.217	0.244	0.239	0.250
C	0.333	0.309	0.212	0.237	0.063	0.046	0.063	0.059	0.327	0.385	0.459	0.397
	0.333	0.309	0.212	0.237	0.063	0.046	0.063	0.059	0.327	0.385	0.459	0.397
D	0.349	0.371	0.361	0.277	0.083	0.090	0.109	0.107	0.444	0.479	0.609	0.532
	0.349	0.371	0.361	0.277	0.083	0.090	0.109	0.107	0.444	0.479	0.609	0.532
E	0.168	0.142	0.140	0.127	0.154	0.139	0.160	0.152	0.198	0.164	0.207	0.256
	0.168	0.142	0.140	0.127	0.154	0.139	0.160	0.152	0.198	0.164	0.207	0.256
F	0.032	0.049	0.017	0.030	0.054	0.064	0.075	0.076	0.008	0.048	0.087	0.076
	0.032	0.049	0.017	0.030	0.054	0.064	0.075	0.076	0.008	0.048	0.087	0.076
G	0.086	0.053	0.056	0.039	0.065	0.070	0.070	0.084	0.244	0.267	0.285	0.265
	0.086	0.053	0.056	0.039	0.065	0.070	0.070	0.084	0.244	0.267	0.285	0.265
H	0.405	0.391	0.378	0.317	0.248	0.270	0.319	0.275	0.671	0.560	0.624	0.544
	0.405	0.391	0.378	0.317	0.248	0.270	0.319	0.275	0.671	0.560	0.624	0.544

Endpoint
Lm1 600
Automix: Once Calibrate: On

Plate Last Read:
2:56 PM 1/17/2006

Wavelength Combination: !Lm1
Data Mode: Absorbance
Plate Blank Used Lm1 = 0.107

dH2O

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B1	1	0.168	0.149
	B2		0.140	
	B3		0.132	
	B4		0.155	
3640A-1-3	C1	2	0.333	0.273
	C2		0.309	
	C3		0.212	
	C4		0.237	
3640A-1-4	D1	3	0.349	0.339
	D2		0.371	
	D3		0.361	
	D4		0.277	
3640A-1-5	E1	4	0.168	0.144
	E2		0.142	
	E3		0.140	
	E4		0.127	
3640A-2-10	F1	5	0.032	0.032
	F2		0.049	
	F3		0.017	
	F4		0.030	
3640A-5-19	G1	6	0.086	0.058
	G2		0.053	
	G3		0.056	
	G4		0.039	
3640A-6-20	H1	7	0.405	0.373
	H2		0.391	
	H3		0.378	
	H4		0.317	

Gas

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B5	1	0.120	0.132
	B6		0.117	
	B7		0.147	
	B8		0.144	
3640A-1-3	C5	2	0.063	0.058
	C6		0.046	
	C7		0.063	
	C8		0.059	
3640A-1-4	D5	3	0.083	0.097
	D6		0.090	
	D7		0.109	
	D8		0.107	
3640A-1-5	E5	4	0.154	0.151
	E6		0.139	
	E7		0.160	
	E8		0.152	
3640A-2-10	F5	5	0.054	0.067
	F6		0.064	
	F7		0.075	
	F8		0.076	
3640A-5-19	G5	6	0.065	0.072
	G6		0.070	
	G7		0.070	
	G8		0.084	
3640A-6-20	H5	7	0.248	0.278
	H6		0.270	
	H7		0.319	
	H8		0.275	
dH2O	A5	8	0.062	0.037
	A6		0.045	
	A7		0.018	
	A8		0.022	

TSB

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B9	1	0.217	0.237
	B10		0.244	
	B11		0.239	
	B12		0.250	
3640A-1-3	C9	2	0.327	0.392
	C10		0.385	
	C11		0.459	
	C12		0.397	
3640A-1-4	D9	3	0.444	0.516
	D10		0.479	
	D11		0.609	
	D12		0.532	
3640A-1-5	E9	4	0.198	0.206
	E10		0.164	
	E11		0.207	
	E12		0.256	
3640A-2-10	F9	5	0.008	0.055
	F10		0.048	
	F11		0.087	
	F12		0.076	
3640A-5-19	G9	6	0.244	0.265
	G10		0.267	
	G11		0.285	
	G12		0.265	
3640A-6-20	H9	7	0.671	0.600
	H10		0.560	
	H11		0.624	
	H12		0.544	
dH2O	A9	8	0.002	0.030
	A10		0.017	
	A11		0.040	
	A12		0.063	

Endpoint - Biofeasibility

3640A-A-Diesel

Plate#1

	1	2	3	4	5	6	7	8	9	10	11	12
A	0.001	-0.008	0.010	-0.003	-0.016	-0.051	-0.046	-0.031	0.016	0.069	0.023	0.052
	0.001	-0.008	0.010	-0.003	-0.016	-0.051	-0.046	-0.031	0.016	0.069	0.023	0.052
B	0.168	0.162	0.163	0.169	0.142	0.134	0.170	0.139	0.185	0.197	0.203	0.237
	0.168	0.162	0.163	0.169	0.142	0.134	0.170	0.139	0.185	0.197	0.203	0.237
C	0.309	0.301	0.298	0.320	0.126	0.112	0.108	0.113	0.469	0.389	0.451	0.370
	0.309	0.301	0.298	0.320	0.126	0.112	0.108	0.113	0.469	0.389	0.451	0.370
D	0.354	0.387	0.429	0.397	0.174	0.189	0.153	0.155	0.578	0.652	0.561	0.531
	0.354	0.387	0.429	0.397	0.174	0.189	0.153	0.155	0.578	0.652	0.561	0.531
E	0.180	0.136	0.157	0.144	0.099	0.122	0.153	0.108	0.263	0.200	0.276	0.181
	0.180	0.136	0.157	0.144	0.099	0.122	0.153	0.108	0.263	0.200	0.276	0.181
F	0.042	0.035	0.039	0.024	0.020	0.055	0.061	0.001	0.072	0.021	0.055	0.039
	0.042	0.035	0.039	0.024	0.020	0.055	0.061	0.001	0.072	0.021	0.055	0.039
G	0.076	0.078	0.097	0.062	0.062	0.090	0.087	0.052	0.274	0.267	0.256	0.257
	0.076	0.078	0.097	0.062	0.062	0.090	0.087	0.052	0.274	0.267	0.256	0.257
H	0.411	0.327	0.369	0.327	0.312	0.271	0.212	0.235	0.627	0.589	0.566	0.560
	0.411	0.327	0.369	0.327	0.312	0.271	0.212	0.235	0.627	0.589	0.566	0.560

Endpoint

Lm1 600

Automix: Once
Calibrate: On

Plate Last Read:
2:55 PM 1/17/2006

Wavelength Combination: !Lm1
Data Mode: Absorbance
Plate Blank Used Lm1 = 0.111

TSB

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B9	1	0.185	0.205
	B10		0.197	
	B11		0.203	
	B12		0.237	
3640A-1-3	C9	2	0.469	0.419
	C10		0.389	
	C11		0.451	
	C12		0.370	
3640A-1-4	D9	3	0.578	0.580
	D10		0.652	
	D11		0.561	
	D12		0.531	
3640A-1-5	E9	4	0.263	0.230
	E10		0.200	
	E11		0.276	
	E12		0.181	
3640A-2-10	F9	5	0.072	0.046
	F10		0.021	
	F11		0.055	
	F12		0.039	
3640A-5-19	G9	6	0.274	0.263
	G10		0.267	
	G11		0.256	
	G12		0.257	
3640A-6-20	H9	7	0.627	0.585
	H10		0.589	
	H11		0.566	
	H12		0.560	
dH2O	A9	8	0.016	0.040
	A10		0.069	
	A11		0.023	
	A12		0.052	

Diesel

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B5	1	0.142	0.146
	B6		0.134	
	B7		0.170	
	B8		0.139	
3640A-1-3	C5	2	0.126	0.114
	C6		0.112	
	C7		0.108	
	C8		0.113	
3640A-1-4	D5	3	0.174	0.167
	D6		0.189	
	D7		0.153	
	D8		0.155	
3640A-1-5	E5	4	0.099	0.120
	E6		0.122	
	E7		0.153	
	E8		0.108	
3640A-2-10	F5	5	0.020	0.034
	F6		0.055	
	F7		0.061	
	F8		0.001	
3640A-5-19	G5	6	0.062	0.072
	G6		0.090	
	G7		0.087	
	G8		0.052	
3640A-6-20	H5	7	0.312	0.257
	H6		0.271	
	H7		0.212	
	H8		0.235	
dH2O	A5	8	-0.016	-0.036
	A6		-0.051	
	A7		-0.046	
	A8		-0.031	

dH2O

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B1	1	0.168	0.165
	B2		0.162	
	B3		0.163	
	B4		0.169	
3640A-1-3	C1	2	0.309	0.307
	C2		0.301	
	C3		0.298	
	C4		0.320	
3640A-1-4	D1	3	0.354	0.391
	D2		0.387	
	D3		0.429	
	D4		0.397	
3640A-1-5	E1	4	0.180	0.154
	E2		0.136	
	E3		0.157	
	E4		0.144	
3640A-2-10	F1	5	0.042	0.035
	F2		0.035	
	F3		0.039	
	F4		0.024	
3640A-5-19	G1	6	0.076	0.078
	G2		0.078	
	G3		0.097	
	G4		0.062	
3640A-6-20	H1	7	0.411	0.358
	H2		0.327	
	H3		0.369	
	H4		0.327	

Endpoint - Biofeasibility

3640A-A-FuelOil#6

Plate#1

	1	2	3	4	5	6	7	8	9	10	11	12
A	-0.008	-0.004	0.006	0.005	0.054	0.071	0.023	0.031	0.014	0.070	0.022	0.044
	-0.008	-0.004	0.006	0.005	0.054	0.071	0.023	0.031	0.014	0.070	0.022	0.044
B	0.158	0.121	0.128	0.158	0.160	0.202	0.195	0.192	0.248	0.228	0.434	0.233
	0.158	0.121	0.128	0.158	0.160	0.202	0.195	0.192	0.248	0.228	0.434	0.233
C	0.279	0.250	0.334	0.321	0.186	0.187	0.188	0.221	0.382	0.398	0.503	0.456
	0.279	0.250	0.334	0.321	0.186	0.187	0.188	0.221	0.382	0.398	0.503	0.456
D	0.337	0.425	0.408	0.386	0.258	0.252	0.309	0.364	0.538	0.553	0.550	0.617
	0.337	0.425	0.408	0.386	0.258	0.252	0.309	0.364	0.538	0.553	0.550	0.617
E	0.151	0.164	0.163	0.166	0.130	0.119	0.184	0.164	0.177	0.239	0.252	0.254
	0.151	0.164	0.163	0.166	0.130	0.119	0.184	0.164	0.177	0.239	0.252	0.254
F	0.013	0.045	0.057	0.076	0.019	0.077	0.069	0.096	0.080	0.050	0.034	0.055
	0.013	0.045	0.057	0.076	0.019	0.077	0.069	0.096	0.080	0.050	0.034	0.055
G	0.025	0.081	0.101	0.067	0.070	0.107	0.143	0.115	0.318	0.296	0.221	0.219
	0.025	0.081	0.101	0.067	0.070	0.107	0.143	0.115	0.318	0.296	0.221	0.219
H	0.381	0.347	0.418	0.344	0.338	0.254	0.277	0.353	0.571	0.549	0.544	0.555
	0.381	0.347	0.418	0.344	0.338	0.254	0.277	0.353	0.571	0.549	0.544	0.555

Endpoint
Lm1 600
Automix: Once Calibrate: On

Plate Last Read:
2:53 PM 1/17/2006

Wavelength Combination: !Lm1
Data Mode: Absorbance
Plate Blank Used Lm1 = 0.118

TSB

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B9	1	0.248	0.286
	B10		0.228	
	B11		0.434	
	B12		0.233	
3640A-1-3	C9	2	0.382	0.435
	C10		0.398	
	C11		0.503	
	C12		0.456	
3640A-1-4	D9	3	0.538	0.565
	D10		0.553	
	D11		0.550	
	D12		0.617	
3640A-1-5	E9	4	0.177	0.231
	E10		0.239	
	E11		0.252	
	E12		0.254	
3640A-2-10	F9	5	0.080	0.055
	F10		0.050	
	F11		0.034	
	F12		0.055	
3640A-5-19	G9	6	0.318	0.264
	G10		0.296	
	G11		0.221	
	G12		0.219	
3640A-6-20	H9	7	0.571	0.555
	H10		0.549	
	H11		0.544	
	H12		0.555	
dH2O	A9	8	0.014	0.038
	A10		0.070	
	A11		0.022	
	A12		0.044	

Fuel Oil #6

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B5	1	0.160	0.188
	B6		0.202	
	B7		0.195	
	B8		0.192	
3640A-1-3	C5	2	0.186	0.196
	C6		0.187	
	C7		0.188	
	C8		0.221	
3640A-1-4	D5	3	0.258	0.296
	D6		0.252	
	D7		0.309	
	D8		0.364	
3640A-1-5	E5	4	0.130	0.150
	E6		0.119	
	E7		0.184	
	E8		0.164	
3640A-2-10	F5	5	0.019	0.066
	F6		0.077	
	F7		0.069	
	F8		0.096	
3640A-5-19	G5	6	0.070	0.109
	G6		0.107	
	G7		0.143	
	G8		0.115	
3640A-6-20	H5	7	0.338	0.306
	H6		0.254	
	H7		0.277	
	H8		0.353	
dH2O	A5	8	0.054	0.045
	A6		0.071	
	A7		0.023	
	A8		0.031	

dH2O

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B1	1	0.158	0.142
	B2		0.121	
	B3		0.128	
	B4		0.158	
3640A-1-3	C1	2	0.279	0.296
	C2		0.250	
	C3		0.334	
	C4		0.321	
3640A-1-4	D1	3	0.337	0.389
	D2		0.425	
	D3		0.408	
	D4		0.386	
3640A-1-5	E1	4	0.151	0.161
	E2		0.164	
	E3		0.163	
	E4		0.166	
3640A-2-10	F1	5	0.013	0.048
	F2		0.045	
	F3		0.057	
	F4		0.076	
3640A-5-19	G1	6	0.025	0.069
	G2		0.081	
	G3		0.101	
	G4		0.067	
3640A-6-20	H1	7	0.381	0.373
	H2		0.347	
	H3		0.418	
	H4		0.344	

Endpoint - Biofeasibility

3640A-A-Subtrate

Plate#1

	1	2	3	4	5	6	7	8	9	10	11	12
A	0.017	-0.015	0.005	-0.007	-0.068	-0.045	-0.074	-0.076	0.014	0.002	-0.056	0.039
	0.017	-0.015	0.005	-0.007	-0.068	-0.045	-0.074	-0.076	0.014	0.002	-0.056	0.039
B	0.161	0.148	0.159	0.163	0.152	0.138	0.155	0.135	0.200	0.205	0.217	0.231
	0.161	0.148	0.159	0.163	0.152	0.138	0.155	0.135	0.200	0.205	0.217	0.231
C	0.360	0.294	0.278	0.301	0.236	0.150	0.185	0.173	0.432	0.433	0.464	0.385
	0.360	0.294	0.278	0.301	0.236	0.150	0.185	0.173	0.432	0.433	0.464	0.385
D	0.375	0.355	0.391	0.365	0.279	0.280	0.261	0.230	0.655	0.641	0.623	0.629
	0.375	0.355	0.391	0.365	0.279	0.280	0.261	0.230	0.655	0.641	0.623	0.629
E	0.155	0.144	0.138	0.177	0.093	0.097	0.127	0.115	0.240	0.212	0.263	0.238
	0.155	0.144	0.138	0.177	0.093	0.097	0.127	0.115	0.240	0.212	0.263	0.238
F	0.010	0.045	0.021	0.043	-0.007	0.011	0.036	0.016	0.068	0.071	0.093	0.053
	0.010	0.045	0.021	0.043	-0.007	0.011	0.036	0.016	0.068	0.071	0.093	0.053
G	0.089	0.095	0.096	0.081	0.035	0.025	0.045	0.059	0.335	0.266	0.286	0.253
	0.089	0.095	0.096	0.081	0.035	0.025	0.045	0.059	0.335	0.266	0.286	0.253
H	0.287	0.308	0.385	0.382	0.368	0.286	0.265	0.267	0.651	0.556	0.582	0.566
	0.287	0.308	0.385	0.382	0.368	0.286	0.265	0.267	0.651	0.556	0.582	0.566

Endpoint
Lm1 600
Automix: Once Calibrate: On

Plate Last Read:
2:50 PM 1/17/2006

Wavelength Combination: !Lm1
Data Mode: Absorbance
Plate Blank Used Lm1 = 0.126

dH2O

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B1	1	0.161	0.158
	B2		0.148	
	B3		0.159	
	B4		0.163	
3640A-1-3	C1	2	0.360	0.308
	C2		0.294	
	C3		0.278	
	C4		0.301	
3640A-1-4	D1	3	0.375	0.372
	D2		0.355	
	D3		0.391	
	D4		0.365	
3640A-1-5	E1	4	0.155	0.154
	E2		0.144	
	E3		0.138	
	E4		0.177	
3640A-2-10	F1	5	0.010	0.030
	F2		0.045	
	F3		0.021	
	F4		0.043	
3640A-5-19	G1	6	0.089	0.090
	G2		0.095	
	G3		0.096	
	G4		0.081	
3640A-6-20	H1	7	0.287	0.341
	H2		0.308	
	H3		0.385	
	H4		0.382	

Standards (µg/ml)

Sample	Concentration	Wells	BackConcCalc	Values	MeanValue	Std.Dev.	CV%

Smallest standard value:
Largest standard value:

Controls

Sample	Wells	Sample#	Values	MeanValue

Samples

Sample	Wells	Values	Outliers	Result	MeanResult	Std.Dev.	CV%

Outlier - Outside standard range

Substrate

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B5	1	0.152	0.145
	B6		0.138	
	B7		0.155	
	B8		0.135	
3640A-1-3	C5	2	0.236	0.186
	C6		0.150	
	C7		0.185	
	C8		0.173	
3640A-1-4	D5	3	0.279	0.263
	D6		0.280	
	D7		0.261	
	D8		0.230	
3640A-1-5	E5	4	0.093	0.108
	E6		0.097	
	E7		0.127	
	E8		0.115	
3640A-2-10	F5	5	-0.007	0.014
	F6		0.011	
	F7		0.036	
	F8		0.016	
3640A-5-19	G5	6	0.035	0.041
	G6		0.025	
	G7		0.045	
	G8		0.059	
3640A-6-20	H5	7	0.368	0.297
	H6		0.286	
	H7		0.265	
	H8		0.267	
dH2O	A5	8	-0.068	-0.066
	A6		-0.045	
	A7		-0.074	
	A8		-0.076	

TSB

Sample	Wells	Sample#	Values	MeanValue
3640A-1-2	B9	1	0.200	0.213
	B10		0.205	
	B11		0.217	
	B12		0.231	
3640A-1-3	C9	2	0.432	0.429
	C10		0.433	
	C11		0.464	
	C12		0.385	
3640A-1-4	D9	3	0.655	0.637
	D10		0.641	
	D11		0.623	
	D12		0.629	
3640A-1-5	E9	4	0.240	0.238
	E10		0.212	
	E11		0.263	
	E12		0.238	
3640A-2-10	F9	5	0.068	0.071
	F10		0.071	
	F11		0.093	
	F12		0.053	
3640A-5-19	G9	6	0.335	0.285
	G10		0.266	
	G11		0.286	
	G12		0.253	
3640A-6-20	H9	7	0.651	0.589
	H10		0.556	
	H11		0.582	
	H12		0.566	
dH2O	A9	8	0.014	-0.000
	A10		0.002	
	A11		-0.056	
	A12		0.039	

Andrew Johnson

From: William J. Spizuoco [wspizuoco@plumleyeng.com]
Sent: Thursday, January 12, 2006 11:20 AM
To: Andrew Johnson
Cc: Frank A. Karboski
Subject: RE: endpoint assay bacterial strains and one change in substrate

Andrew:

Frank and I spoke about the endpoint assay selection of bacterial strains. Here is what we decided.

1) Please apply the following four substrates, one each to each of the four 96 well plates: Gasoline, **Diesel**, No. 6 oil, and the free product you received from Plumley today. Note that I have changed one substrate from No. 4 oil to diesel, as we think this is a better site representative fuel product.

2) Apply the following seven strains to each of the four plates and substrates:

- 3640A-2
- 3640A-3
- 3640A-4
- 3640A-5
- 3640A-10
- 3640A-19
- 3640A-20

Please contact me if you need any further information. Thanks.

Regards, Bill

From: Andrew Johnson [mailto:ajohnson@microbeinotech.com]
Sent: Tuesday, January 10, 2006 5:48 PM
To: Frank A. Karboski; William J. Spizuoco
Subject:

Andrew William Johnson
Laboratory Manager
ajohnson@microbeinotech.com

Microbe Inotech Laboratories, Inc.
7259 Lansdowne Avenue
Suite 200
St. Louis MO 63119-3421
Phone: 314-645-2177 ex 103
Fax: 314-645-2544
www.microbeinotech.com

CHAIN OF CUSTODY RECORD

Matrix: Soil

Project No.: 2003118		Client: City of Utica		# of Containers	Site: Matt Petroleum City of Utica, NY			Sampler's Signature:
Sample No.	Date	Time	Origin/Source		Comp.	Grab	Other	Analyses/Tests Requested
C-1A	1/3/2006	11:04 AM	Test Pit	1		X		Biofeasibility Microbial Study
C-1B	1/3/2006	11:36 AM	Test Pit	1		X		Biofeasibility Microbial Study
C-1C	1/3/2006	12:09 PM	Test Pit	1		X		Biofeasibility Microbial Study
C-1D	1/3/2006	12:28 PM	Test Pit	1		X		Biofeasibility Microbial Study
C-1E	1/3/2006	1:01 PM	Test Pit	1		X		Biofeasibility Microbial Study
C-2A	1/3/2006	10:15 AM	Test Pit	1		X		Biofeasibility Microbial Study
C-2B	1/3/2006	10:42 PM	Test Pit	1		X		Biofeasibility Microbial Study
C-2C	1/3/2006	2:35 PM	Test Pit	1		X		Biofeasibility Microbial Study
C-2D	1/3/2006	1:57 PM	Test Pit	1		X		Biofeasibility Microbial Study
C-2E	1/3/2006	1:33 PM	Test Pit	1		X		Biofeasibility Microbial Study

Turn Around Time:

- ☐ Same Day
- ☐ 1 Work Day
- ☐ 2 Work Days
- ☐ 3 Work Days
- ☐ 4 Work Days
- ☐ 5 Work Days
- ☐ Normal
- ☐ Other _____

Lab Signature:

Received by:	Date/Time:	Relinquished by:	Date/Time:
Signature:		Signature:	
Print:		Print:	
Relinquished by Signature	Date/Time: 1/4/06	Received by: Signature:	Date/Time:
Print: C. GUARINO	11:02 AM	Print:	

Remarks:

Failure to adhere to quoted TATs shall result in reduction of the invoice to the next available billing rate for the specified analysis and 10% reduction in the invoice for this COC.

CONTACT BILL SPIZUOCO OR FRANK KARBOSKI WITH ANY QUESTIONS

PLUMLEY ENGINEERING, P.C.
Civil and Environmental Engineering
8232 LOOP ROAD, BALDWINSVILLE, NEW YORK 13027
(315) 638-8587 Fax: (315) 638-9740 E-mail: Pros@PlumleyEng.com

PLUMLEY ENGINEERING

CHAIN OF CUSTODY RECORD

Page 1 of 2

Matrix: Groundwater

Project No.: 2003118	Client: City of Utica			# of Containers	Site: Matt Petroleum City of Utica, NY			Sampler's Signature:
Sample No.	Date	Time	Origin/Source		Comp.	Grab	Other	Analyses/Tests Requested
MW-1 & MW-16	1/3/2006	5:02 PM	2" Monitoring Well	2		X		Biofeasibility Microbial Study
MW-11 Recovery Sump	1/3/2006	4:35 PM	2" Monitoring Well	1		X		Biofeasibility Microbial Study

Turn Around Time:

- ☐ Same Day
- ☐ 1 Work Day
- ☐ 2 Work Days
- ☐ 3 Work Days
- ☐ 4 Work Days
- ☐ 5 Work Days
- ☐ Normal
- ☐ Other _____

Lab Signature:

Received by:	Date/Time:	Relinquished by:	Date/Time:
Signature:		Signature:	
Print:		Print:	
Relinquished by Signature: C. Guarino Print: C. GUARINO	Date/Time: 11/4/06 11:02AM	Received by: Signature: Print:	Date/Time:

Remarks:

Failure to adhere to quoted TATs shall result in reduction of the invoice to the next available billing rate for the specified analysis and 10% reduction in the invoice for this COC.

CONTACT BILL SPIZUOCO OR FRANK KARBOSKI WITH ANY QUESTIONS

PLUMLEY ENGINEERING, P.C.

Civil and Environmental Engineering

8232 LOOP ROAD, BALDWINSVILLE, NEW YORK 13027

(315) 638-8587 Fax: (315) 638-9740 E-mail: Pros@PlumleyEng.com

PLUMLEY ENGINEERING

CHAIN OF CUSTODY RECORD

Matrix: Soil

Project No.: 2003118		Client: City of Utica		# of	Site: Matt Petroleum City of Utica, NY			Sampler's Signature:
Sample No.	Date	Time	Origin/Source	Containers	Comp.	Grab	Other	Analyses/Tests Requested
MW-4	1/11/2006	12:47 PM	2" Monitoring Well	1		X		Biofeasibility Microbial Study

Turn Around Time:

- ☐ Same Day
- ☐ 1 Work Day
- ☐ 2 Work Days
- ☐ 3 Work Days
- ☐ 4 Work Days
- ☐ 5 Work Days
- ☐ Normal
- ☐ Other _____

Lab Signature:

Received by:	Date/Time:	Relinquished by:	Date/Time:
Signature:		Signature:	
Print:		Print:	
Relinquished by Signature	Date/Time: 11:30	Received by: Signature:	Date/Time:
Print: C. GUARINO	3:00 PM	Print:	

Remarks:

Failure to adhere to quoted TATs shall result in reduction of the invoice to the next available billing rate for the specified analysis and 10% reduction in the invoice for this COC.

CONTACT BILL SPIZUOCO OR FRANK KARBOSKI WITH ANY QUESTIONS

PLUMLEY ENGINEERING, P.C.

Civil and Environmental Engineering

8232 LOOP ROAD, BALDWINSVILLE, NEW YORK 13027

(315) 638-8587 Fax: (315) 638-9740 E-mail: Pros@PlumleyEng.com

PLUMLEY ENGINEERING

the MiL, inc. ATTENTION: C. Guarino Fax: 315-638-9740

Sample Receipt Confirmation Form

This notice is to confirm receipt of samples at Microbe Inotech Laboratories, Inc.,
at 7259 Lansdowne Avenue Suite 200, St. Louis, MO 63119-3421
Telephone: 1-800-688-9144 Fax: 1-314-645-2544
Reach Us Online At: www.microbeinotech.com

Client Information:

Contact: C. Guarino
Firm: Plumley Engineering, P.C.
Phone Number: 315-638-8587
Project Name: Matt Petroleum
Project Number:

the MiL, inc. Information:

Receiving Staff Member: RLD
Assigned MiL Project Number: MILB- 3640A
Shipment Carrier:
Shipment Tracking Number:

Sample Information:

Total Number of Sample Containers: 13 Representing Total Number of Samples: ~~13~~ 12

ELECTRONIC DATE & TIME STAMP

OR Arrived on:
Thursday, January 05, 2006 - 9:43:46 AM
Day of Week Month/Day/Year Time of Day

	List of Samples Received	Condition Upon Receipt	Analysis Requested	Collection Date		
1	C-1A	Intact	Biofeasibility	1	3	06
2	C-1B	"	"	1	3	06
3	C-1C	"	"	1	3	06
4	C-1D	"	"	1	3	06
5	C-1E	"	"	1	3	06
6	C-2A	"	"	1	3	06
7	C-2B	"	"	1	3	06
8	C-2C	"	"	1	3	06
9	C-2D	"	"	1	3	06
10	C-2E	"	"	1	3	06

Continued On Additional Page (If Checked): ☒

Comments or Further Requested Information:

Thank You, _____.
Signature of Sender

the MiL, inc. ATTENTION: C. Guarino Fax: 315-638-9740

	List of Samples Received	Condition Upon Receipt	Analysis Requested	Collection Date
11	MW-1 + MW-16	Intact	Biofeasibility	1 / 3 /2006
12	MW-11 Rinsate/Soap	"	"	1 / 3 /2006
13	~~MW-16~~	"	"	1 / 3 /2006
14				/ /
15				/ /
16				/ /
17				/ /
18				/ /
19				/ /
20				/ /
21				/ /
22				/ /
23				/ /
24				/ /
25				/ /
26				/ /
27				/ /
28				/ /
29				/ /
30				/ /
31				/ /
32				/ /
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34				/ /
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36				/ /
37				/ /
38				/ /
39				/ /
40				/ /

Continued On Additional Page (If Checked): ☐

the MiL, inc. 7259 Lansdowne Avenue Suite 200. St. Louis, MO 63119-3421
Phone: (800) 688-9144 Fax: (314) 344-3031

Warranty And Limits Of Liability

In accepting analytical work, we warrant the accuracy of test results under the conditions employed in the laboratory. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied. We disclaim any other warranties, expressed or implied, including a Warranty of Fitness for Particular Purpose and Warranty of Merchantability. We accept no legal responsibility for the purposes for which the client uses the test results.

APPENDIX D

PLANNING ESTIMATE COSTS PER ALTERNATIVE EVALUATED

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 1A One Foot Clean Soil Cap / Remove Free Product from Wells

	acres	Block Dimensions (ft)	Unit Cost	/ Units	# Units	Cost	Comment
Clean Fill - 1 foot depth entire site	4.5		$20	cu yd	7,260	$48,400	1 foot depth = 3 sq yd/ cu yd
Geo-textile	4.5		$0.55	sq. yd	7,260	$3,993	
Site survey			$2,500	LS	1	$2,500	
Grade-all			$1,900	day	5	$9,500	Spread soil
Roller			$1,200	day	5	$6,000	"
Engineering Design			$10,000	LS	1	$10,000	
Construction Oversight			$10,000	LS	1	$10,000	
						$90,393	

Note: * Cap consists of 5" bituminous paving with 12" gravel base

Cost Line Items	Unit Cost	/ Units	# Units	Cost	Comments
Vaccum Truck, incl operator	$85	hr	80	$6,800	
Mob	$150	LS	2	$300	
Liquid disposal costs	$1.15	gal	50,000	$57,500	assumes 1500 gal truck and 10 days of vac work
Project Mgmt (Engineer)	$115	hr	90	$10,350	
technician oversight	$60	hr	180	$10,800	
Reporting	$125	hr	80	$10,000	
				$186,143	Project Total

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate

Alternative # 1B Cap Site and Install Groundwater Treatment Trenches

Cost Line Items	Unit Cost	/ Units	# Units	Cost	Comments
Remediation Trench install					
Mob/Demob	$2,000	LS	3	$6,000	
Excavator	$1,900	day	15	$28,500	
Dumptrucks (2)	$1,000	day	15	$15,000	
Trench materials					
# 2 stone	$20	cu. yd	2,267	$45,333	330' length, 4' width, 10' depth (SW); 600' (central); 600' (east)
Soil transport & Disposal	$40	tons	4,250	$170,000	
materials (pvc pipe; connectors)	$15	ft	1600	$24,000	
Pumping System					
pump; storage tank, shed, heat	$100,000		1	$100,000	
Electrical Service Installation	$15,000		1	$15,000	
1 GAC drum @ 2 gpm	$5,000	ls	2	$10,000	low end site GW discharge/yr (10 GPD/ft2) = 1E06 gal/yr
4 GAC drums @ 20 gpm	$20,000	ls	2	$40,000	high end site GW discharge/yr (100 GPD/ft2) = 10E06 gal/yr
Project Mgmt (Engineer)	$115	hr	120	$13,800	
Technician	$60	hr	408	$24,480	
Geologist	$80	hr	152	$12,160	
Field Engineer	$90	hr	120	$10,800	
start-up/pilot testing	$150	hr	80	$12,000	
sampling & analysis water (20 wells; 8 quarters; VOC/SVOC)	$300	each	176	$52,800	includes 8 quarterly rounds (VOC/SVOC each + QA/QC)
Comm. Air Monitoring Program	$1,000	day	20	$20,000	
Engineering Design	$125	hr		$50,000	
Reporting	1	LS		$25,000	
				$624,873	Capitol Cost - Trenches
				$274,750	Capitol Cost - Cap f/Option 1A
				$899,623	Total
				$22	Cost per Cu. Yd.
				$12	Cost per Ton
Low O&M treatment cost/yr			$20,000	$35,000	High O&M treatment cost/yr

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 2A Soil Excavation to 5 Feet, Skim Water Table, Dispose & Replace Soil

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume (AOC+ GC) x 5' depth)	25,700	48,187					
Soil Disposal			$40	ton	48,187	$1,927,478	
Clean Fill Delivered			$20	ton	48,187	$963,739	
Equipment: Excavation & Backfill	excavator		$2,500	day	30	$75,000	1000 cu yd/day
	mob/demob		$2,000	LS	5	$10,000	
	2 dump trucks		$1,000	day	30	$30,000	
	Compactor		$1,750	day	30	$52,500	
	Office Trailer		$10,000	LS	1	$10,000	
Groundwater Dewater / Treat / Dispose			$20,000	LS	1	$20,000	System set-up cost
Daily operations			$1,100	day	50	$50,000	
Vacuum Truck (incl. Est. disposal)			$1,000	1 day/week	8	$8,000	
Engineering Design			$125	hr		$230,000	
Project Mgmt. (Engineer)			$115	hr	150	$17,250	
Geologist			$80	hr	200	$16,000	
Field Engineer			$90	hr	400	$36,000	
Technician			$60	hr	400	$24,000	
sampling & analysis							
Soil - Post Excavation Confirmation Sampling			$300	sample	225	$67,500	includesVOC/SVOC each + 15 QA/QC; 1/50' linear perimeter, 1/900 sq ft bottom, 3.5 acres
water (VOC/SVOC)			$300		40	$12,000	wells, treated water before discharge
Landfill Soil Disposal characterization			$825		30	$24,750	Characterization samples
Comm. Air Monitoring Program			$1,000	day	40	$40,000	
Reporting			$1	LS		$35,000	
						$3,649,218	Total Project Cost
						$142	Cost per Cu. Yd.
						$76	Cost Per ton

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 2B Soil Excavation to 8 Feet, Skim Water Table & Off-site Disposal

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	41,120	77,099					Volume based on 8 foot depth across AOC/Gross Cont. Zone
Cont. Soil Transportation & Disposal			$40	ton	77,099	$3,083,965	up to 25% of impacted volume
Clean Backfill			$20	ton	77,099	$1,541,983	
Equipment: Excavation	Excavator		$2,500	day	50	$125,000	1,000 cy/day
	Mob/Demob		$2,000	LS	2	$4,000	
	Dozer		$1,200	day	50	$60,000	
	2 dump trucks		$1,000	day	50	$50,000	25 loads/truck/day
	Office Trailer		$10,000	LS	1	$10,000	1 year
Equipment: Backfill	Roller		$1,200	day	21	$25,200	2,000 cy/day
	Dozer		$1,200	day	21	$25,200	2,000 cy/day
Groundwater Dewater / Treat / Dispose			$20,000	LS	1	$20,000	Equipment setup
Daily Operations			$1,100	day	50	$55,000	O&M
Sheet Piles (RS Means) [Primary AOC; Zone of GC]			$19.40	sq. ft	11,400	$221,160	Days to install 11.6
Engineering Design			$115	hr		$250,000	
Project Mgmt (Engineer)			$115	hr	300	$34,500	
Field Engineer			$90	hr	500	$45,000	
Geologist			$80	hr	1000	$80,000	
Technician			$60	hr	1000	$60,000	
sampling & analysis							includes STARS Memo #1
Soil (VOC/SVOC)			$300	sample	225	$67,500	confirmation samples + QA/QC
Landfill Soil Disposal characterization			$825	each	154	$127,050	2 samples / ton of soil
water (VOC/SVOC)			$300	each	40	$12,000	includes QA/QC
Comm. Air Monitoring Program			$1,000	day	70	$70,000	
Reporting			1	LS		$35,000	
						$6,002,558	Total Cost
						$146	Cost per Cu. Yd.
						$78	Cost per Ton

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 3A Soil Excavation to 5', 100 % Allu Processing, In-Place Soil Compaction

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	25,700	48,187					
Allu Processing (12 passes/ton)			$5,700	day	128	$732,442	2400 cu yds/day by 3 machines based on scale up of pilot test
Equipment: Excavation & Backfill	excavator		$2,200	day	30	$66,000	1000 cu yd/day
	mob/demob		$2,000	LS	6	$12,000	
	2 dump trucks		$1,000	day	30	$30,000	
	Compactor		$1,750	day	30	$52,500	
	Office Trailer		$10,000	LS	1	$10,000	
Groundwater Dewater / Treat / Dispose			$20,000	LS	1	$20,000	System set-up cost
Daily Operations			$1,100	day	35	$35,000	
Sheet Piles (RS Means) [Primary AOC; Zone of GC]			$19.40	sq. ft	11,400	$221,160	Days to install 11.6
Engineering Design			$125	hr		$140,000	
Project Mgmt (engineer)			$115		600	$69,000	
Geologist			$80	hr	900	$72,000	
Field Engineer			$90	hr	1800	$162,000	
Technician			$60	hr	1800	$108,000	
sampling & analysis							40 sidewalls + 170 bottom + 250 soil
Soil - Post Excavation Confirm.			$300	VOC+SVOC	475	$142,500	pile + QA/QC STARS # 1 Memo
water (2 rounds VOC/SVOC)			$300	/ well	60	$18,000	wells, treated water before discharge
Comm. Air Monitoring Program			$1,000	/day	180	$180,000	
Reporting			$35,000	LS	1	$35,000	
						$2,105,602	Total Project Cost
						$82	Cost per Cu. Yd.
						$44	Cost per Ton

NOTE: H2O2 injection to provide oxygen would be at conc. Between 100 - 200 ppm. A single 55 gal. drum of H2O2 can provide between 7,800 gallons to 15,600 gallons of solution in this conc. range.

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 3B Soil Excavation to 8', 100 % Ex-Situ Allu Processing

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	41,120	77,099					Volume based on 8 foot depth across AOC/Gross Cont. Zone
Allu Treatment			$5,700	day	206	$1,171,907	2400 cu yds/day by 3 machines based on scale up of pilot test
Equipment: Excavation	Excavator		$2,500	day	50	$125,000	1,000 cy/day
	Mob/Demob		$2,000	LS	8	$16,000	
	Dozer		$750	day	42	$31,500	
	2 dump trucks		$1,000	day	42	$42,000	25 loads/truck/day
	Office Trailer		$20,000	LS	1	$20,000	3 years
Equipment: Backfill	Roller		$1,200	day	42	$50,400	1,000 cy/day
	Dozer		$1,200	day	42	$50,400	1,000 cy/day
Groundwater Dewater / Treat / Dispose			$20,000	LS	1	$20,000	Equipment setup
Daily Operations			$1,100	day	300	$330,000	O&M
Sheet Piles (RS Means) [Primary AOC; Zone of GC]			$19.40	sq. ft	11,400	$221,160	Days to install 11.6
Engineering Design			$125	hr		$250,000	
Project Mgmt (Engineer)			$115	hr	700	$80,500	
Field Engineer			$90	hr	1200	$108,000	
Geologist			$80	hr	2300	$184,000	
Technician			$60	hr	2300	$138,000	
sampling & analysis							
Soil (VOC/SVOC)			$300	sample	625	$187,500	STARS # 1 confirmation (225 sidewalls/bottom+ 400 for treated soil) + QA/QC
Soil TPH sample screens			$40	sample	250	$10,000	in progress remediation effectiveness screening
water (VOC/SVOC)			$300	each	40	$12,000	perimeter well sampling
Comm. Air Monitoring Program			$1,000	day	200	$200,000	
Reporting			1	LS		$35,000	
						$3,283,367	Total Cost
						$80	Cost per Cu. Yd.
						$43	Cost per Ton

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 3C Soil Excavation to 8', 25% Off-site Disposal, 75% On-site Allu Processing

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	41,120	77,099					Volume based on 8 foot depth across AOC/Gross Cont. Zone
Cont. Soil Transportation & Disposal			$40	ton	19,275	$770,991	up to 25% of impacted volume
Clean Backfill			$20	ton	19,275	$385,496	" " "
Equipment: Excavation			$2,500	day	50	$125,000	1000 cu yd/day
Allu Processing - 3 machines 2.8 cu yd bucket			$5,700	day	200	$1,140,000	2400 cu yds/day by 3 machines based on scale up of pilot test
	Mob/Demob		$2,000	LS	6	$12,000	
	Office Trailer		$15,000	LS	1	$15,000	2 years
Equipment: Backfill	Roller		$1,200	day	60	$72,000	700 - 1000 cy/day compaction rate
	Dozer		$1,200	day	60	$72,000	" " "
	Dump Truck		$500	day	100	$50,000	support excavation + recompaction
GW Dewater / Treat / Dispose			$20,000	LS	1	$20,000	Equipment setup
Daily Opertaions			$1,100	day	250	$275,000	O&M
Sheet Piles (RS Means) [Primary AOC; Zone of GC]			$19.40	sq. ft	10,500	$203,700	Days to install 10.7
Engineering Design			$115	hr		$250,000	
Project Mgmt (Engineer)			$115	hr	800	$92,000	
Field Engineer			$90	hr	1200	$108,000	
Geologist			$80	hr	2000	$160,000	
Technician			$60	hr	2,120	$127,200	
Sampling & Analysis :							STARS # 1 confirmation (225 sidewalls/bottom+ 400 for treated soil) + QA/QC
Soil (VOC/SVOC)			$300	each	625	$187,500	
Landfill Soil Disposal characterization			$825	each	30	$24,750	
water (VOC/SVOC)			$300	each	40	$12,000	
Comm. Air Monitoring Program			$1,000	day	200	$200,000	
Reporting			1	LS		$35,000	
						$4,337,637	Total Cost
						$105	Cost per Cu. Yd.
						$56	Cost per Ton

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 4A Soil Excavation to 8', 25% Off-site Disposal, 75% On-site Hydrogen Peroxide Oxidation (Allu)

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	41,120	77,099					Vol. based on 8' depth across AOC/GC Zone
Cont. Soil Transportation & Disposal			$40	ton	19,275	$770,991	up to 25% of impacted volume
Clean Backfill			$20	ton	19,275	$385,496	" " "
Hydrogen Peroxide Demand**							
Natural Soil Oxidant Demand			$4.5	gal	37,933	$170,697	low end background demand at 1 gm/kg soil
(1 - 20 gm/kg soil)			$4.5	gal	756,497	$3,404,235	high end background demand 20 gm/kg soil
Petrol. Oxidant Demand (3.4 g ox/g petrol, est. 600 mg/kg petrol. conc.)			$4.5	gal	113,079	$508,854	EPA guide on chem ox demand is approximately 3.4 g Ox/g contamnant
Iron (FeSO4)			$2	gal	11,308	$19,223	10% of the demand peroxide
Allu Treatment			$5,700	day	200	$1,140,000	
Equipment: Excavation	Excavator		$1,200	day	42	$50,400	1,000 cy/day
	Mob/Demob		$2,000	LS	8	$16,000	
	Dozer		$750	day	42	$31,500	
	2 dump trucks		$1,000	day	42	$42,000	25 loads/truck/day
	Office Trailer		$10,000	LS	1	$10,000	3 years
Equipment: Backfill	Roller		$1,200	day	42	$50,400	1,000 cy/day
	Dozer		$1,200	day	42	$50,400	1,000 cy/day
Groundwater Pump/Treat/Dispose			$20,000	LS	1	$20,000	Equipment setup
			$1,100	day	120	$132,000	O&M
Sheet Piles [AOC; Zone of GC]			$19.40	sq. ft	11,400	$221,160	Days to install 11.6 (RS Means)
Engineering Design			$125	hr		$250,000	
Project Mgmt (Engineer)			$115	hr	800	$92,000	
Field Engineer			$90	hr	1000	$90,000	
Geologist			$80	hr	2000	$160,000	
Technician			$60	hr	2120	$127,200	
sampling & analysis							STARS Memo #1 confirmation samples
soil			$300	sample	525	$157,500	120 sidewall/bottom+ 400 treated soil + QA/QC
Soil TPH sample screens			$40	sample	250	$10,000	in progress remediation effectiveness screening
Landfill Soil Disposal characterization			$825	each	40	$33,000	
water (1 rounds VOC/SVOC)			$300		40	$12,000	
Comm. Air Monitoring Program			$1,000	day	200	$200,000	
Reporting			$125	hr	200	$25,000	
			Total Cost High Range		$8,009,360	$4,775,822	Total Cost Low Range
					$195	$116	Cost per Cu. Yd.
					$104	$62	Cost per Ton

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 4B Soil Excavation to 8', 25% Off-site Disposal, 75% On-site Sodium Persulfate Chemical Ox (Allu)

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	41,120	77,099					Vol. based on 8' depth across AOC/GC Zone
Soil Transportation & Disposal			$40	ton	19,275	$770,991	up to 25% of impacted volume
Clean Backfill			$20	ton	19,275	$385,496	" " "
Persulfate Ox. Demand f/Bench Study**							11.5 - 29.5 g/kg
Total Soil Oxidant Demand			$2,640	ton	1,615	$4,262,369	low end ox demand at 11.5 - 14.3 g/kg soil
(11 - 30 gm/kg soil)			$2,640	ton	2,168	$5,722,313	high end ox demand 22.3 -29.5 g/kg soil
Allu Treatment			$5,700	day	200	$1,140,000	2400 cu yds/day by 3 machines based on scale up of pilot test
Equipment: Excavation	Excavator		$2,500	day	50	$125,000	1,000 cy/day
	Mob/Demob		$2,000	LS	8	$16,000	
	Dozer		$1,200	day	50	$60,000	
	2 dump trucks		$1,000	day	50	$50,000	25 loads/truck/day
	Office Trailer		$10,000	LS	1	$10,000	3 years
Equipment: Backfill	Roller		$1,200	day	50	$60,000	1,000 cy/day
	Dozer		$750	day	50	$37,500	1,000 cy/day
Groundwater Pump/Treat/Dispose			$20,000	LS	1	$20,000	Equipment setup
			$1,100	day	150	$165,000	O&M
Sheet Piles [AOC; Zone of GC]			$19.40	sq. ft	11,400	$221,160	Days to install 11.6 (RS Means)
Engineering Design			$1	LS		$250,000	
Project Mgmt (Engineer)			$115	hr	800	$92,000	
Field Engineer			$90	hr	1000	$90,000	
Geologist			$80	hr	2000	$160,000	
Technician			$60	hr	2120	$127,200	
Sampling & Analysis soil			$300	sample	525	$157,500	STARS Memo #1 confirmation samples (120 sidewalls/bottom+ 400 f/treated soil) + QA/QC
Soil TPH sample screens			$40	sample	250	$10,000	in progress effectiveness screening
Landfill Soil Disposal characterization			$825	each	40	$33,000	
water (VOC/SVOC)			$300	each	40	$12,000	
Comm. Air Monitoring Program			$1,000	day	200	$200,000	
Reporting			1	LS	LS	$35,000	
			Total Cost High Range		$9,950,160	$8,490,216	Total Cost Low Range
					$242	$206	Cost per Cu. Yd.
					$129	$110	Cost per Ton

Matt Petroleum
Persulfate Ox Bench Study

AVEerage Mass Persulfate to Degrade COCs

Estimated Mass of Soils to be Remediated

Sample	SOD (g/kg)		Gross Contam (tons)	AOC (tons)	Mass (kg)	Ave. Mass Oxidant (kg)	Ave. Mass Oxidant (lb)	Oxidant Cost @ $1.00/lb	Cost per Ton for SP
C-1	11.5	22.2	14,645		13,285,763	223,865	493,530	$493,530	$33.70
C-2	14.3	29.5		62,455	56,659,357	1,240,840	2,735,538	$2,735,538	$43.80
			Gross Tons	77,100		TONS= 1,615		$3,229,068	$41.88
Mass of Persulfate needed if Bioremediation first reduced soil volume for treatment by 75%									
C-1	11.5	22.2	3,661		3,321,441	55,966	123,382	$123,382	$33.70
C-2	14.3	29.5		15,614	14,164,839	310,210	683,884	$683,884	$43.80
			Gross Tons	19,275			404	$807,267	$41.88
Maximum Mass Persulfate to Degrade COCs									
C-1	---	22.2	14,645		13,285,763	294,944	650,229	$650,229	$44.40
C-2	---	29.5		62,455	56,659,357	1,671,451	3,684,857	$3,684,857	$59.00
			Gross Tons	77,100		TONS= 2,168		$4,335,086	$56.23

Note: Raw cost for persulfate f/KCH Engineering is $0.87 per pound from America International Chemical

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 5 Thermal Treatment of in-situ Soils

Cost Line Items	cu. yds	tons	Unit Cost	/ Units	# Units	Cost	Comments
Soil Volume	41,120	77,099					
Cont. Soil Transportation & Disposal			$40	ton	19,275	$770,991	up to 25% of impacted volume
Clean Bank Run Gravel/Cobble Fill			$20	ton	19,275	$385,496	
Equipment Mob / Demob			$20,000		2	$40,000	
thermal desorption (in-situ six-phase electical resistivity)			$140	cu yd *	45,231	$6,332,409	High Cost plus add 10% soil volume buffer
12 site review - expected cost			$90	cu yd *	45,231	$4,070,834	Med. Cost: " " " "
low end of cost range			$70	cu yd *	45,231	$3,166,204	Low Range Cost: " " " "
Office Trailer			$10,000	LS	1	$10,000	2 years
Engineering Design			1	LS		$300,000	
Project Mgmt (engineer)			$115	hr	800	$92,000	
technician			$60	hr	2120	$127,200	Based on 40 weeks treatment
Field Engineer			$90	hr	1200	$108,000	
Geologist			$80	hr	2250	$180,000	" " " + drilling oversight
start-up/perf. Testing						$40,000	
sampling & analysis							
soil (VOC/SVOC)			$300	sample	525	$157,500	STARS Memo #1 confirmation samples + QA/QC
Soil TPH sample screens			$40	sample	250	$10,000	in progress remediation effectiveness screening
water (VOC/SVOC)			$300	each	100	$30,000	includes VOC/SVOC each + QA/QC samples
Comm. Air Monitoring Program			$1,000	day	200	$200,000	
Drilling (mob = $200)			$1,500	day (+mob)	25	$37,700	
Reporting			1	LS		$35,000	

Cost/Cu. Yd.	Cost/Ton		
$187	$100	$7,699,809	Upper Range
$132	$70	$5,428,234	Likely Cost
$110	$59	$4,523,604	Lower Range

Note: 1) * Cost of Thermal desportion obtained from range of $30 - $100 per cubic yard and concomitant vapor extraction system at $10 - $40 per cu. yd. (Federal Remediation Technologies Roundtable).

2) * Remediation Technology Cost compendium Year 2000 lists 17 sites with either/or VOCs/SVOCs and shows thermal treatment capital and O&M costs ranging from $558 to $33 per ton treated.

Matt Petroleum Site
Remedial Alternative Evaluation: Cost Estimate
Alternative # 5 In-Situ Thermal Treatment Costs from Completed Projects

Thermal Type	Volume Treated (cu. yds)	Cost/ cu yd	Treat Depth (ft)	Contaminants	Media Type	CLU-in Reference	Comment
Conductive	52	$120-200	12	Halo SVOC, PCB	soil	Missouri Elec Works	
	260	$100-250	14	Halo SVOC, PCB	soil	Mare Island Naval	
	1,540	$42	26	PCE, TCE	glacial till	Delavan Munic. Well	
Elec. Resistive	600	$142	20	Halo VOC, Halo SVOC	soil, groundwater	Ag. Products, Newark, CA.	
	1,700	>$400	45	PCE, TCE, Halo VOCs	Soil	Savannah River site (Mfg Process) Field Demo.	
	1,800	$125	30	DNAPL	Groundwater	Dover AFB	
	2,150	$256	8	BTEX, Halo VOCs + Halo SVOCs	glacial till, alluvial clay	USAFB Niagara Falls	
	2,300	$201	20	PCE, Halo VOCs	soil, groundwater	Drycleane, Seattle	
	4,500	$115	30	TPH, nonhalo VOC	sandy clay, heterogeneous	Georgia Mfg	Steam inject, w/SVE, GW pumping
	4,900	$117	40	Halo VOCs, Pest/Herbicides	soil, groundwater	Poleline Road disposal Area, Ft Richardson, Ark.	
	5,555	$93	45	TCE, Halo VOCs	interbedded sand and clay	Launch Complex 34, Cape Canaveral	
	13,000	$120	30	PCE, Halo VOCs	tight clay	Electronics Mfg, Chicago	
	16,000	$57	18-36	MeCL2, Halo VOCs	Glacial till	Consumer Products, Waukegan	
	22,000	$80	58	TCE, Halo VOCs	soil, groundwater	Pharmaceutical Mfg, Portland	
	35,000	$32	24	TCE, 1,1-DEC, 1,1,1-TCA, halo VOCs	soil, groundwater	Electronics Mfg, Skokie	
Steam	22,500	$46	25	BTEX non-halo VOCs	fs w/silts, some clay bands	Holyoke Plastics Mfg.	Total cost (cap+O&M)
	375,000	$15	50	BTEX, Halo/nonHalo VOCs	glacial till, sand, silt	A.G. Communications, North Lake	
	NR	$75-100	75-105	VOC, SVOC, others	Groundwater	Visalia Pole Yard NPL	

Notes:

1) Conductive heating applies heat near surface that radiates downward. Limit to 30' bgs.
2) Electrically Resistive Heating generally applies six-phase electric power to heat the subsurface. GWRTAC reports economy of scale realized when treating greater than 10,000 cu yds.
3) Steam Heat application only applies where there are porous soils (ie. high permeability)

APPENDIX E

LABORATORY ANALYTICAL DATA: PILOT STUDY