TECHNICAL MEMORANDUM

TO: Mary Logan, USEPA
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March 11, 2008

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Project No.: 933-6154

RE: **STRIPPING/STABILIZATION/SOLIDIFICATION (S/S/S) TREATABILITY STUDY NEASE CHEMICAL SITE, SALEM, OHIO**

The purpose of this memorandum is to summarize the results of the Stripping/ Stabilization/Solidification (S/S/S) Laboratory Treatability Study conducted in connection with the above site, and to make recommendations for design of the full-scale operation. Comprehensive results for each of the study phases are provided in the report by the treatability laboratory (Kemron, 2007) that is appended hereto.

1.0 SCOPE/OBJECTIVES

The scope of the Treatability Study is described in the approved Pre-Design Investigation Work Plan (PDI Work Plan; Golder Associates, September 2006). The overall objective of the S/S/S technology is to reduce the chemical leachability of the treated material to mitigate future releases of chemicals to groundwater from the area of former Ponds 1 and 2 at the Nease Site. The primary objective of the S/S/S Treatability Study was to determine the most appropriate methods and admixtures for full-scale operation that will result in adequate strength (to support the construction of a geosynthetic cover) and a substantial reduction of chemical mass and leachability.

The treatability testing was conducted in four phases as detailed in the PDI Work Plan:

- Phase I – Field Sampling and Baseline Characterization;
- Phase II – Screening Tests;
- Phase III – Intermediate Tests; and
- Phase IV – Verification Tests.

2.0 RESULTS

2.1 Phase I – Field Sampling and Baseline Characterization

During Phase I, the area in former Pond 2 that exhibited the most highly elevated chemical impacts was identified and, with USEPA/Ohio EPA approval, samples were collected for use in the S/S/S treatability study. After receiving the samples, the laboratory homogenized the material (while seeking to minimize loss of volatiles) to create a "parent mixture" and then performed baseline physical, chemical, and leachability (SPLP) testing to define the characteristics of the untreated material and to confirm that it was representative of severe field conditions.

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2.2 Phase II - Screening Tests

In Phase II, the parent mixture was treated with 10 different stabilization/ solidification (S/S) admixture formulations to determine the strength properties of the mixtures. Based on these test results, and with the approval of the USEPA/Ohio EPA, the following two admixtures were selected for further evaluation:

- 7.5% Portland Cement / 15% Class "C" Fly ash; and
- 7.5% Portland Cement / 15% Lime Kiln Dust.

2.3 Phase III - Intermediate Tests

In Phase III, aliquots of the initial parent mixture were subjected to pre-treatment by air stripping and zero-valent iron (ZVI). Samples from these untreated aliquots were analyzed for TCL VOCs on a total constituent concentration basis and in the SPLP extract. The results were comparable to those for the initial analysis of the parent material. Samples from each aliquot were then subjected to pre-treatment by either air stripping or ZVI addition. VOC levels in off-gases were measured for various durations of air stripping.

Following pre-treatment, the samples were mixed with the selected stabilization agents (7.5% Portland Cement/15% Class C Fly Ash and 7.5% Portland Cement/15% Lime Kiln dust) and allowed to cure for 21 days. After 21 days, the samples were analyzed for concentrations of TCL VOCs on a total constituent concentration basis and in the SPLP extract.

The results of Phase III testing demonstrated the following:

- Both the air stripping and ZVI pre-treatment steps provided significant percent reductions in total VOCs; however, air stripping ultimately resulted in significantly greater percent reductions in leachability compared to the ZVI treatment;

- The Cement/Class C Fly Ash and the Cement/Lime Kiln Dust formulations provided similar percent reductions in total VOCs and leachable VOCs; and

- Air stripping along with either the Cement/Fly Ash or the Cement/Lime Kiln Dust formulation appears to provide the best treatment and stabilization formulation for meeting the remedials.

2.4 Phase IV - Verification Tests

Phase IV – Verification Tests were designed in consultation with USEPA and Ohio EPA to confirm and further evaluate the treatment effectiveness of the selected treatment train (air stripping/stabilization/solidification) and the selected admixture (7.5% Portland Cement / 15% Class "C" Fly ash). In addition, Phase IV also compared two air stripping durations (90 minutes and 135 minutes) in terms of overall achievement of the remedial goals.

Baseline Confirmation

Prior to Phase IV tests, rapid-turn-around TCL VOC analyses were performed on aliquots of untreated material, as a baseline confirmation, to ensure that the verification tests would be performed on representative samples. The results were compared to the initial TCL VOC results that were performed on the parent material at the beginning of the treatability study. The results showed reductions in both VOCs and SVOCs compared to the original baseline, particularly in the VOC fraction, however, the nature of the contamination was essentially the same.

Control Samples

Control samples were tested at Day 21 to identify the contaminant losses/reductions related to the sample storage/testing processes and not due to treatment. Review of VOC results showed 20% to 50% reductions in total VOC concentrations and 50% to 60% reductions in SPLP VOC concentrations, compared to the Phase IV baseline. Review of SVOC results showed consistent and sometimes apparently greater concentrations after 21 days. These "increases" likely reflect the heterogeneous nature of the samples. Reductions in VOC levels in the controls suggest that laboratory samples may overestimate the VOC reduction that might be achievable in the field.

Air Stripping

During air stripping, both samples showed decreasing VOC concentrations in soils throughout the first 90 minutes of the air stripping process. The sample that was treated for an additional 45 minutes showed less than 1 percent additional removal, a difference that was well within the natural variability of the results and therefore not material.

Stabilization/Solidification

Following addition of the prescribed admixture and 21 days of curing, the samples were tested for both physical parameters (volume expansion, unconfined compressive strength (UCS), and unit weight) and chemical parameters (Total and SPLP VOC and SVOC analyses). The results showed the following:

- Soil volume increases of between 15% to 18%;
- UCS results ranging from 640 - 705 pounds per square inch (psi);
- Unit weights ranged from 127.6 – 129.3 pounds per cubic feet (lbs/ft^3) substantially in excess of the strength required to support the proposed cover; and,
- There were further reductions in both total and SPLP VOC and SVOC concentrations associated with stabilization/solidification; with overall contaminant reductions greater than 95% when compared to the Phase IV baseline.

3.0 RECOMMENDED PERFORMANCE TARGETS

Based on the results of the S/S/S treatability study the following performance targets for full-scale implementation on-Site are recommended:

Parameter	Target Criteria
Reduction of Chemical Mass and/or Concentration	> 90% Reduction in the arithmetic mean total VOCs and total SVOCs compared to the arithmetic mean of the Phase I baseline samples collected for the treatability testing
Chemical Leachability	>90% Reduction in arithmetic mean total SPLP VOCs and total SPLP SVOCs compared to the arithmetic mean of the Phase I baseline samples collected for the treatability testing
Strength	Arithmetic mean Unconfined Compressive Strength (UCS) greater than or equal to 15 psi

4.0 RECOMMENDATIONS FOR FULL-SCALE USE

The selected treatment train for full-scale operation is air stripping followed by stabilization/ solidification with a Portland Cement/Class "C" Fly ash. Operational parameters are listed below:

Operational Parameter	
Air stripping duration	90 minutes
Reagents	Aqueous slurry of Portland Cement and Class "C" fly ash
Application Rate	7.5% Portland Cement / 15% Class "C" Fly ash, by weight
Performance Measurements	• Total VOCs & SVOCs • SPLP VOCs & SVOCs • Unconfined Compressive Strength

The following refinements to the performance and operational parameters are recommended based on the laboratory tests and experience with similar projects:

- Allow use of alternate additives, in addition to, or in place of, cement and fly ash, to permit remedial contractors some method flexibility in meeting the required goals;

- UCS compliance tests should be conducted on laboratory-prepared samples using the same quantities of additives. This is analogous to the testing of concrete cubes to verify the strength of concrete in construction projects and is much more efficient than taking post-treatment samples. Compliance with the standard should be based upon the arithmetic mean result from approximately 10 samples. If the laboratory-prepared samples indicate non-compliance then post–treatment field samples could be collected for verification;

- The reductions in total constituents and SPLP leachate concentrations, should be assessed on an arithmetic mean basis from at least 10 samples distributed throughout the target treatment zone and tested using the same methods as utilized in the treatability study; and,

- Field verification should be obtained by constructing a series of "test columns" as the first part of the remediation. Results from these columns would be used to verify the precise means and materials that will be applied in subsequent treatment.

5.0 REFERENCES

Golder Associates, 2006. Operable Unit 2 Pre-Design Investigation Work Plan, Nease Chemical Site, Salem Ohio.

Kemron Environmental Services, 2008. Treatability Evaluation In-Situ Stripping / Solidification / Stabilization; Nease Chemical Site, Salem Ohio, March 2008.

NEASE CHEMICAL SITE
SALEM, OHIO
TREATABILITY EVALUATION
IN-SITU STRIPPING / SOLIDIFICATION / STABILIZATION
GOLDER PROJECT #933-6154

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1.0 INTRODUCTION

KEMRON Environmental Services, Inc. (KEMRON) is pleased to present the results of bench-scale testing performed on material sampled from the Nease Chemical Site (hereafter the Site) located in Salem, Ohio. The treatability study was performed to evaluate in-situ treatment / solidification / stabilization technologies capable of remediating former pond materials located at the Site. Specifically, the primary objectives of the study are as follows:

- To evaluate the effectiveness of air stripping for reducing VOC concentrations prior to introduction of the various S/S agents;
- To identify formulations using cement- and clay-based S/S agents that will provide the desired bearing strength and physical characteristics;
- To evaluate the reduction in total constituent concentration achieved by the selected S/S agent formulations;
- To evaluate the reduction in constituent mobility provided by the selected S/S agent formulations; and
- To evaluate whether zero-valent iron amendments provide additional reduction in total constituent concentrations.

This project included a treated strength objective of 15 pounds per square inch (psi) as determined by UCS testing. The following is an outline of testing:

- Untreated Characterization
- Preliminary Solidification / Stabilization Strength Screenings
- Intermediate Testing
  - Batch Control Testing
  - ZVI Strength Evaluations
  - Air Stripping and Solidification / Stabilization VOC emissions, strength and leaching evaluations
  - Final ZVI strength and leaching evaluations
- Verification Testing
  - Batch Control Testing
  - Air Stripping and Solidification / Stabilization VOC emissions, strength and leaching evaluations

The following sections of this report include information regarding the protocols followed during each phase of the study and the results of testing performed.

2.0 UNTREATED MATERIAL CHARACTERIZATION

On September 14, 2006 KEMRON received materials from the site. Upon receipt, the samples were logged into KEMRON's sample tracking database and placed in refrigerated storage maintained at a temperature of 4 degrees Celsius (°C). A copy of the original chain of custody record is presented as Attachment A.

Upon authorization to proceed, KEMRON combined and homogenized the chilled site materials to form one material. Chilling the materials prior to homogenization minimizes the potential for volatilization of organic constituents that may be present in the site materials. Homogenization was performed by placing the contents of the containers into a stainless steel mixing pan and gently mixing with stainless steel utensils. Additionally, the material was sieved through a 0.5 inch sieve to remove particles and/or large debris facilitating bench-scale evaluations. Once homogenized, the untreated material was placed back into the original shipping containers and returned to refrigerated storage. The final homogenized material will be referred to as the "untreated material" in the remainder of this document.

KEMRON performed both chemical and physical characterization testing of the untreated material as outlined in the original scope of work. Characterization of the untreated material is an essential component of the treatability study. The establishment of the baseline characteristics of the untreated material is important for ensuring that the material is similar to those expected at the Site and for evaluating the effectiveness of treatment. The following chemical characterization analyses were conducted in triplicate on one aliquot of the untreated material in accordance with the referenced test methods:

PARAMETER	METHOD
Total Volatiles	EPA Methods 8260B
SPLP Volatiles	EPA Methods 1312/8260B
Total Semivolatiles	EPA Methods 8270C
SPLP Semivolatiles	EPA Methods 1312/8270C
Material pH	EPA Method 9045C

Geotechnical characterization testing was also performed by KEMRON. This data is used to prepare cost estimates and design specifications with regard to full-scale treatment. The following geotechnical characterization tests were conducted on one aliquot of the untreated composite material in accordance with the referenced test methods:

PARAMETER	METHOD
Moisture Content	ASTM D2216
Bulk Density	ASTM D2937
Specific Gravity	ASTM D854

The results of chemical and physical characterization testing performed on the untreated site materials are presented in **Tables 1 through 5**. Complete analytical and physical data reports of untreated material characterizations are included as **Attachments B and C.**

2.1. Untreated Physical Properties Review

The results of physical properties testing, including moisture content, bulk density, material pH, and specific gravity are included in **Table 1** attached to this text. Testing was conducted in triplicate in accordance with the appropriate American Society of Testing and Measures (ASTM) or EPA methods previously referenced. Review of **Table 1** indicates that the untreated material exhibited a moisture content of 31.63 percent (%), with a solids content of 76.07 %. Additionally the site material had a bulk unit weight of 118 pounds per cubic foot (lbs/ft^3), a material pH of 6.32 standard units (s.u.), and a soil specific gravity of 2.71.

2.2. Untreated Volatiles Review

The results of the untreated total volatile analyses are presented in **Table 2**. The following is a summary of the data presented in **Table 2**. Note that tables presented within the text of this report are merely summary presentations and may not include all of the information presented in the attachments of this report.

TABLE 2

TOTAL VOLATILES	UNTREATED RESULTS (µg/Kg)			
	A	B	C	Average
Benzene	51,400 J	43,900 J	48,500 J	47,933
Chlorobenzene	30,300 J	29,000 J	29,500 J	29,600
1,2-Dichlorobenzene	3,880,000	3,410,000	3,330,000	3,540,000
1,4-Dichlorobenzene	29,600 J	27,500 J	26,500 J	27,867
Hexachlorobutadiene (1)	< 13,500	< 14,100	18,600 J	15,400
1,1,2,2-Tetrachloroethane	241,000	202,000	192,000	211,667
Tetrachloroethene	966,000	874,000	888,000	909,333
Toluene	35,900 J	31,400 J	33,400 J	33,567
Trichloroethene	73,600 J	59,900 J	63,600 J	65,700
m, p -Xylene	30,200 J	26,300 J	29,700 J	28,733

Note that "J" values indicate that the analyte was positively identified at a concentration between the analytical reporting limit and the method detection limit.

Review of the total volatile organics data indicate that the organic compounds present in the highest concentrations include 1,2-Dichlorobenzene, tetrachloroethene, 1,1,2,2,-tetrachloroethane and trichloroethene. Concentrations of these compounds ranged from an average of 3,540,000 micrograms per kilogram (µg/Kg) to 65,700 µg/Kg based on three replicate analyses. Note that due to relatively elevated analytical method detection limits utilized for testing, sample dilutions were necessary. Additional compounds may be present in the untreated site material but at concentrations below the detection limits of the analytical equipment. In other words, the lower contaminant concentrations were "diluted out".

The results of leachable volatile organics as determined by the Synthetic Precipitation Leaching Procedure (SPLP) are presented in **Table 3**. A summary of data presented in **Table 3** is included below. Based on the data presented in this table, it is evident that while greatly diminished, all of the analytes present in the sample on a total basis were also detected in the SPLP leachate. The SPLP procedure has a 1:20 soil to leaching fluid requirement. This together with the selective leaching that occurs under inorganic acidic conditions accounts for the lower concentrations as compared to the totals analyses. Some compounds present in the SPLP leachate were not reported as detected on a total basis (i.e., chloroform, 1,2-dichloroethane, ethylbenzne, isopropylbenzene and o-xylene). The very high method detection limits; and therefore, the "diluted out" effect in the totals analyses are likely reason for the discrepancies.

TABLE 3

SPLP VOLATILES	RESULTS (µg/L)							
	UNTREATED – A		UNTREATED - B		UNTREATED - C		AVERAGE	
	Result	Detection Limit	Result	Detection Limit	Result	Detection Limit	Result	Detection Limit
Benzene	3,220	62.5	2,400 J	62.5	2,350 J	62.5	2,657	62.5
Chlorobenzene	1,380 J	62.5	1,280 J	62.5	1,250 J	62.5	1,303	62.5
Chloroform (1)	67.4 J	62.5	-	62.5	-	62.5	22	62.5
1,2-Dichlorobenzene	80,800	62.5	92,300	62.5	92,300	62.5	88,467	62.5
1,4-Dichlorobenzene	567 J	62.5	659 J	62.5	604 J	62.5	610	62.5
1,2-Dichloroethane	482 J	125	304 J	125	286 J	125	357	125
Ethylbenzene	265 J	125	273 J	125	268 J	125	269	125
Isopropylbenzene	388 J	125	397 J	125	395 J	125	393	125
1,1,2,2-Tetrachloroethane	13,000	62.5	10,300	62.5	10,600	62.5	11,300	62.5
Tetrachloroethene	27,000	125	30,600	125	29,000	125	28,867	125
Toluene	1,760 J	125	1,570 J	125	1,560 J	125	1,630	125
Trichloroethene	3,610	125	3,120	125	3,020	125	3,250	125
o-Xylene	161 J	125	162 J	125	137 J	125	153	125
m, p-Xylene	924 J	125	970 J	125	955 J	125	950	125

Note that, in calculating the average contaminant concentration, KEMRON applied a value of "0" if the contaminant was not detected during analyses. In some instances only one replicate analysis indicated a detectible concentration of a particular contaminant.

2.3. Untreated Semivolatiles Review

The results of the untreated total semivolatile analyses are presented in **Tables 4 and 5**. The following are summaries of **Tables 4 and 5**. Review of the untreated semivolatiles results indicate that 1,2,-dichlorobenzene and benzoic acid were the two semivolatile compounds detected at the highest concentrations on both a total and leachable basis. Additionally, the analytical results indicate significantly lower concentrations of leachable constituents when compared to concentrations determined on a total basis. As stated earlier the selective leaching and the 1:20 dilution account for the reduced concentrations observed in the SPLP data as compared with the totals results.

TABLE 4								
	RESULTS (µg/Kg)							
TOTAL	UNTREATED - A		UNTREATED - B		UNTREATED - C		AVERAGE	
SEMIVOLATILES	Result	DL	Result	DL	Result	DL	Result	DL
1,4-Dichlorobenzene	6,150	1,050	7,540	1,110	8,350	1,110	7,347	1,090
1,2-Dichlorobenzene	838,000	52,300	976,000	55,600	1,110,000	55,600	974,667	54,500
Hexachloroethane	6,220	1,050	9,780	1,110	11,000	1,110	9,000	1,090
Benzoic acid	58,100	4,180	68,700	4,450	61,500	4,450	62,767	4,360
Hexachlorobutadiene	1,370 J	1,050	2,630	1,110	2,790	1,110	2,263	1,090
Hexachlorobenzene	2,810	1,050	8,670	1,110	6,590	1,110	6,023	1,090

TABLE 5								
	RESULTS (µg/L)							
SPLP	UNTREATED - A		UNTREATED - B		UNTREATED - C		AVERAGE	
SEMIVOLATILES	Result	DL	Result	DL	Result	DL	Result	DL
1,4-Dichlorobenzene	272 J	255	274	25.5	229	25.5	258	25
1,2-Dichlorobenzene	37,100	2,550	37,600	2,550	31,800	2,550	35,500	25
Hexachloroethane	-	255	178	25.5	150	25.5	109	25
Benzoic acid	4,360	1,280	4,720	1,280	4,230	1,280	4,437	125
2,4-Dichlorophenol	-	255	33.9 J	25.5	31.2 J	25.5	22	25

3.0 PRELIMINARY SOLIDIFICATION / STABILIZATION STRENGTH SCREENINGS

3.1. Overview

Upon completion of the untreated material characterization testing and following discussions with Golder, KEMRON proceeded with preliminary stabilization treatment. KEMRON performed preliminary stabilization testing in order to evaluate a variety of mixture designs that may be capable of meeting the technical objectives for the project. All preliminary evaluations were performed using the homogenized untreated material. The following is a brief overview of the solidification / stabilization treatment process.

Solidification / Stabilization treatments can be utilized to remediate a wide range of materials and contaminants. Typically binding agents such as Portland cement, slag, kiln dusts, and fly ashes may be blended with soils, sludges and sediments to treat hazardous wastes through mechanisms such as binding excess moisture, macro and micro-encapsulation, hydraulic conductivity reduction and pH adjustment.

Solidification is the process of reducing the excess water in a waste sludge. Waste management laws generally prohibit waste sludge containing free water to be deposited in

landfills. Slag Cement, Portland Cement and other reagent combinations react and chemically bind excess water in a process called hydration.

Stabilization is the process of chemically changing a hazardous waste material into a less soluble or less toxic form. Slag Cement, Portland Cement and other reagent combinations accomplish this by raising the pH of the waste material. Many toxic metals found in waste sludge have their lowest solubility at higher pH levels and are therefore less likely to leach.

Encapsulation is the process of surrounding waste particles with a layer of material that is very low in hydraulic conductivity. This layer of material inhibits the leaching of the hazardous material. Slag Cement, Portland Cement and other combinations lower hydraulic conductivity, providing significant reductions in the mobility of toxic material.

3.2. Treatment Procedures

For preliminary stabilization treatment, KEMRON prepared a total of 10 mixtures to evaluate the effectiveness of some common binding additives. **Table 6** presents the mixture designs used in this phase of testing.

TABLE 6

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%)	WATER ADDITION (%)
SE0190-001	Type I Portland Cement / Hydrated Lime	7.5 / 10	20
SE0190-002	Cement / Lime	10 / 10	22
SE0190-003	Cement / Lime / Bentonite	7.5 / 10 / 2	20
SE0190-004	Cement / Lime / Bentonite	10 / 10 / 2	21
SE0190-005	Cement / Class "C" Fly Ash	7.5 / 15	9
SE0190-006	Cement / Class "C" Fly Ash	10 / 20	12
SE0190-007	Cement / Class "C" Fly Ash / Bentonite	10 / 20 / 2	24
SE0190-008	Cement / Lime Kiln Dust	7.5 / 15	8
SE0190-009	Cement / Lime Kiln Dust	10 / 20	10
SE0190-010	Cement / Lime Kiln Dust / Bentonite	10 / 20 / 2	23

Mix development entailed blending the reagents thoroughly with tap water followed by blending with the untreated material. In order to simulate in-situ treatment, the reagent combinations were mixed with potable water to form a pumpable reagent slurry. Mixing was accomplished using a bench-scale Hobart-type mixer equipped with a 4½ quart stainless steel mixing bowl and "flat beater" type paddles. Treatment utilizing this mixer is intended to simulate, to the extent possible on the bench-scale, potential full-scale remediation options. This approach is routinely utilized to simulate a wide range of potential full-scale remediation approaches, including both in situ and ex situ applications. Note that KEMRON's approach to performing bench-scale testing has been reviewed and is routinely accepted by EPA and full-scale solidification / stabilization contractors. Mixing was conducted at approximately 40 to 60 rotations per minute (rpm) for 60 to 90 seconds or until mixture is visually homogenous.

The following is provided as an example of the reagent and water quantity determination for a 100g sample of the untreated material. In a mixture with a 10% addition of Portland cement, 10% hydrated lime and 22% water, 10 grams of cement is blended dry with 10 grams of hydrated lime. This mixture is then slurried with 22 grams of water for every 100 grams of untreated composite material.

Immediately following mix development, each treated material was placed into plastic cylindrical curing molds and placed in a humid environment for curing. Throughout the curing process KEMRON evaluated each mixture for potential setting via pocket penetrometer testing. At the 7-day curing interval each treated material was subjected to UCS testing in accordance with ASTM D2166.

3.2.1. Review of Strength Data

The results of penetrometer and UCS testing performed on the treated mixtures are presented in **Tables 7 and 8**. Review of the penetrometer data indicated that each material exceeded a penetrometer strength of 4.5 tons per square foot (TSF) at the 7-day curing interval.

The following is a summary of the UCS data presented in **Table 8**:

TABLE 8

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%)	WATER ADDITION (%)	UCS (lbs/in^2)
SE0190-001	Type I Portland Cement / Hydrated Lime	7.5 / 10	20	28.9
SE0190-002	Cement / Hydrated Lime	10 / 10	22	32.4
SE0190-003	Cement / Hydrated Lime / Bentonite	7.5 / 10 / 2	20	19.2
SE0190-004	Cement / Hydrated Lime / Bentonite	10 / 10 / 2	21	23.7
SE0190-005	Cement / Class "C" Fly Ash	7.5 / 15	9	225.4
SE0190-006	Cement / Class "C" Fly Ash	10 / 20	12	312.0
SE0190-007	Cement / Class "C" Fly Ash / Bentonite	10 / 20 / 2	24	198.8
SE0190-008	Cement / Lime Kiln Dust	7.5 / 15	8	78.4
SE0190-009	Cement / Lime Kiln Dust	10 / 20	10	91.7
SE0190-010	Cement / Lime Kiln Dust / Bentonite	10 / 20 / 2	23	44.9

Review of UCS data indicates that the mixtures developed with reagent combinations including class "C" fly ash yielded the greatest strengths at the 7-day cure interval. Class "C" fly ash is a by product of lignite coal combustion and contains a relatively high percentage of calcium oxide (CaO), generally more than 20%. This relatively high lime component gives class "C" fly ash cementitous capabilities when hydrated.

In addition to the class "C" fly ash mixtures, those developed using combinations of cement and lime kiln dust (LKD) also yielded significant unconfined strengths. LKD is created from fine dust particles produced during the manufacture of lime from limestone. As the limestone is heated in a rotary kiln these fine particles are removed by air-pollution control systems. Depending on the initial limestone, specific LKD materials may contain significant percentages of CaO which, as previously mentioned, can aid in material solidification.

Based on the results of UCS testing performed on the preliminary mixture designs, KEMRON and Golder selected two of the preliminary mixture designs for additional testing in later phases of the study.

4.0 INTERMEDIATE TESTING: TREATMENT / SOLIDIFICATION / STABILIZATION EVALUATIONS

4.1. Intermediate Phase Batch Control Testing: Time "0" and "Day 21"

The control testing was established to bracket the testing that occurred during the Intermediate Phase of testing. The testing included totals and leachable volatiles analysis on a portion of the untreated material at both Day 0 and Day 21 corresponding to the start and end of Intermediate testing. Following Day 0 sampling, the untreated material was placed under the same environmental conditions as the treated materials (i.e., placement in curing mold under moist conditions). **Tables 14, 15, 20 and 21** present the data associated with the control testing.

4.1.1. Review of Batch Control Data

Day 0 and Day 21 total volatiles data is presented in **Tables 14 and 20**, respectively. The SPLP volatiles data for Day 0 and Day 21 is presented in **Tables 15 and 21**, respectively. The table presentations below compile the data for ease of discussion purposes (i.e., **Table 14 and 20** are presented together).

Review of the "21 Day" total volatiles control data presented in **Table 20**, indicate fairly significant reduction compared to the "Time 0" control presented in **Table 14**. Note the presence of "J" values indicates a detection between the method detection limit and the reporting limit emphasizing the results is a quantitative estimate. Review of the leachable analyses indicates much more consistent results between the Day 0 and Day 21 controls.

TOTAL VOLATILES	Table 14 Time "0" (µg/Kg)		Table 20 21 Day Control (µg/Kg)	
	Result	DL	Result	DL
Benzene	3600 J	2020	961 J	871
Chlorobenzene	3910 J	2020	-	871
1,2-Dichlorobenzene	892000	20200	231000	871
1,4-Dichlorobenzene	6840 J	2020	1580 J	871
Hexachlorobutadiene	6430 J	2020	1250 J	871
Isopropylbenzene	3650 J	2020	-	871
1,1,2,2-Tetrachloroethane	22600	2020	10100	871
Tetrachloroethene	161000	2020	18700	871
Toluene	3710 J	2020		871
Trichloroethene	7670 J	2020	1870 J	871
m, p -Xylene	5900 J	2020	-	871

SPLP VOLATILES	Table 15 Time "0" Control (µg/L)		Table 21 21 Day Control (µg/L)	
	Result	DL	Result	DL
Benzene	492 J	62.5	309 J	62.5
Chlorobenzene	474 J	62.5	380 J	62.5
1,2-Dichlorobenzene	56300	62.5	54000	62.5
1,4-Dichlorobenzene	412 J	62.5	411 J	62.5
Ethylbenzene	129 J	125	-	125
Isopropylbenzene	135 J	125	152 J	125
1,1,2,2-Tetrachloroethane	2540	62.5	2140 J	62.5
Tetrachloroethene	15300	125	11900	125
Toluene	474 J	125	395 J	125
Trichloroethene	826 J	125	721 J	125
m, p -Xylene	522 J	125	460 J	125

4.2. VOC Mass Reduction Evaluations

4.2.1. Preliminary ZVI Strength Evaluations

Based on preliminary testing two mixture designs were selected for further evaluations. Specifically combinations of cement and class "C" fly ash at addition rates of 7.5 and 15%, respectively, as well as cement and LKD at the same addition rates were utilized to evaluate the effect of zero valent iron (ZVI) on the untreated material. ZVI can be effective at degrading organic contaminants through reductive processes and is often utilized in permeable reactive barriers for the treatment of groundwater.

KEMRON evaluated two methods of ZVI introduction including adding the ZVI directly to the untreated material as a ZVI/water slurry prior to the stabilization reagent addition, and combining dry reagents with ZVI, slurrying, and then mixing with the untreated material. Note that the ZVI was introduced at an addition rate of approximately 1.1% on a by-weight basis relative to the weight of the untreated material aliquot. The ZVI addition rate was determined based on a stochiometric ratio of 5:1 iron to total organic contaminant concentration, outlined by Golder. **Table 9** summarizes the mixture designs utilized in this phase of testing. The following is a summary of the information presented in **Table 9**:

TABLE 9

KEMRON SAMPLE No.	REAGENT TYPE	ZVI ADDITION	REAGENT ADDITION (%)	WATER ADDITION (%)
SE0190-011	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9
SE0190-012	Cement / Class "C" Fly Ash	Added to S/S reagents	7.5 / 15	9
SE0190-013	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.5
SE0190-014	Cement / Lime Kiln Dust	Added to S/S reagents	7.5 / 15	8

Each mixture design was developed using protocol previously outlined. Immediately following mixture preparation each material was placed into plastic cylindrical molds for curing in a moist environment. Throughout a 7-day curing interval KEMRON evaluated each mixture for setting via penetrometer testing. The results of penetrometer testing are presented in **Table 10**. Review of **Table 10** indicates that all mixtures exceeded a penetrometer strength of 4.5 TSF at the 7-day cure interval.

4.2.1.1. ZVI Strength Results

Following 7 days of curing, each mixture was subjected to UCS testing in accordance with the previously referenced test method. The results of UCS testing performed on these mixtures are summarized in **Table 11**. The data presentation below facilitates UCS data discussion between the ZVI amended and unamended solidified materials pulled from **Table 11** and **Table 8**, respectively. The data demonstrates that the addition of ZVI slightly increases the UCS when compared to the same mixture without ZVI. Additionally, it appears that the method of ZVI introduction does not significantly affect the overall strength of the treated material.

KEMRON SAMPLE No.	REAGENT TYPE	ZVI Addition (2)	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	DQO UCS (lbs/in^2)	UCS (lbs/in^2)
SE0190-011	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9	15	246.2
SE0190-012	Cement / Class "C" Fly Ash	added to S/S reagents	7.5 / 15	9	15	291.3
SE0190-005	Cement / Class "C" Fly Ash	N/A	7.5 / 15	9	15	225.4
SE0190-013	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.55	15	83.1
SE0190-014	Cement / Lime Kiln Dust	added to S/S reagents	7.5 / 15	8	15	82.2
SE0190-008	Cement / Lime Kiln Dust	N/A	7.5 / 15	8	15	78.4

Data highlighted in red is pulled from Table 8

4.2.2. Air Stripping / Solidification / Stabilization Strength and Leaching Evaluations

4.2.2.1. Air Stripping Procedures

At the request of Golder, KEMRON evaluated the effects of air stripping activities conducted on two aliquots of the untreated site material. KEMRON evaluated air stripping by mixing each aliquot of the untreated material inside a glove box with a constant airflow over the surface of the mixing bowl. Throughout mixing activities KEMRON monitored the relative humidity, temperature and organic emissions (via a photoionization detector (PID)), of both the influent and effluent air.

Pressurized air was introduced into one side of the glove box at a height approximately the same as the top edge of the mixing container. An air-tight chamber containing a hygrometer, and ports for temperature and PID monitoring was attached to the air inlet line just prior to entering the glove box. This chamber allowed for equalization of air pressure which facilitated monitoring activities of the influent air. Air was introduced into the glove box at a flow rate of

approximately 65 milliliters per minute (ml/min) for a duration of approximately 135 minutes. Monitoring activities performed on the effluent air were conducted in the same manner as the influent air. At the end of the air stripping system KEMRON placed multiple carbon cartridges for off-gas analyses.

4.2.2.1.1. Monitoring Data Results

The results of air stripping monitoring activities are presented in **Tables 12 and 13** representing the two aliquots used for the subsequent solidification / stabilization evaluations. Review of the monitoring data indicates that the influent air contained organic emissions. It would be anticipated that little or no organics should be detected in the pre-glove box sample. KEMRON believes that these organic vapors may have been present in the influent air due to back pressure which may have forced air from inside the glove box into the monitoring chamber. This idea may be supported by the observation that over the duration of testing both the influent and effluent PID readings showed a general decreasing trend which indicates removal of organic vapors from the test material.

Additionally, while KEMRON measured an influent air flow of approximately 65 ml/min, only 35 ml/min were measured in the effluent air. KEMRON feels that this 30 ml/min air loss was due to the removal of air flow through the PID instrument.

4.2.2.1.2. Chemical Testing Results

Throughout air stripping activities, KEMRON sampled aliquots of the air stripped soil at the following intervals: 0, 10, 30, 60, and 135 minutes. In addition to intermediate soil sampling, KEMRON also collected the VOCs produced during air stripping on a carbon cartridge which was replaced with a new cartridge at the same intervals as the soil was sampled. All soil and carbon samples were then analyzed for total volatile organics in accordance with the previously referenced EPA test method. The results of intermediate analytical testing are presented in **Tables 16 through 19** and condensed below for discussion purposes.

Air Stripped Soils
Review of the air stripped soils, indicates, as would be anticipated, the site soils exhibited significant decreasing concentrations of volatile organics throughout the air stripping duration. For instance, the 1,2-Dichlorobenzene has a soil baseline result of 3,840,000 ppb and a 135 minute soil result of 690,000 ppb (for 0190-015). This trend was also observed with the aliquot 0190-016 which at this stage in the treatment evaluation is essentially a duplicate of 0190-015. For 0190-016, the 1,2-Dichlorobenzene has a soil baseline result of 3,840,000 ppb and a 135 minute soil result of 544,000 ppb.

TABLE 16: SE0190-015 (Soil)

TOTAL VOLATILES	AS Control (µg/Kg) Result	AS @ 10 minutes (µg/Kg) Result	AS @ 30 minutes (µg/Kg) Result	AS @ 60 minutes (µg/Kg) Result	AS @ 135 minutes (µg/Kg) Result
Benzene	46200 J	8830 J	-	-	5650J
Carbon tetrachloride	6640 J	-	-	-	-
Chlorobenzene	31200 J	12100 J	9010 J	-	-
1,2-Dichlorobenzene	3,840,000	1,970,000	1,680,000	1,860,000	690,000
1,4-Dichlorobenzene	30100 J	15800 J	15800 J	13400 J	5090 J
Ethylbenzene	10100 J	-	-	-	-
Hexachlorobutadiene	11900 J	8850 J	9200 J	10100 J	5930 J
Isopropylbenzene	15000 J	8120 J	7190 J	5890 J	-
Naphthalene	132000	-	-	-	-
1,1,2,2-Tetrachloroethane	197000	73900	71400	47200 J	35000
Tetrachloroethene	977000	427000	324000	181000	85000
Toluene	36400 J	11800 J	7390 J	-	-
Trichloroethene	69800	24100 J	9890 J	6580 J	10700 J
o-Xylene	7990 J	-	-	-	-
m, p -Xylene	39000 J	15700 J	12300 J	6730 J	-

TABLE 17: SE0190-016 (Soil)

TOTAL VOLATILES	AS Control (µg/Kg) Result	AS @ 10 minutes (µg/Kg) Result	AS @ 30 minutes (µg/Kg) Result	AS @ 60 minutes (µg/Kg) Result	AS @ 135 minutes (µg/Kg) Result
Benzene	46200 J	13600 J	-	-	-
Carbon tetrachloride	6640 J	-	-	-	-
Chlorobenzene	31200 J	17900 J	9570 J	-	-
1,2-Dichlorobenzene	3840000	3490000	2700000	1740000	544000
1,4-Dichlorobenzene	30100 J	22100 J	17700 J	12300 J	3500 J
Ethylbenzene	10100 J	5090 J	-	-	-
Hexachlorobutadiene	11900 J	10500 J	10600 J	9030 J	5570 J
Isopropylbenzene	15000 J	9390 J	7340 J	5280 J	-
Naphthalene	132000	-	-	-	-
1,1,2,2-Tetrachloroethane	197000	133000	87800	43200 J	15300 J
Tetrachloroethene	977000	590000	330000	135000	33000
Toluene	36400 J	17300 J	7220 J	-	-
Trichloroethene	69800	25700 J	10600 J	-	3410 J
o-Xylene	7990 J	-	-	-	-
m, p -Xylene	39000 J	21300 J	12700 J	5370 J	-

Off-gas from Air Stripping

When evaluating the carbon sample results, understanding the durations associated with each sample is helpful when discussing the analytical data. The following are the time durations that each carbon was exposed to the VOCs off-gas created during air stripping activities:

Sample Identifier	Duration of Exposure (minutes)
Control Carbon	0
10 min Carbon	10
30 min Carbon	20
60 min Carbon	30
135 min Carbon	75

There are generally three trends observed in the off-gas data. High concentrations of contaminants (i.e., 1,2-Dichlorobenzene) present in the soils showed increasing concentrations over the sampling interval. This is likely due to the continuous supply of stripped contamination over the 135 min period. As each off-gas collection interval increases by 10 minutes and then by 75 minutes, more contamination is trapped and therefore detected during analysis.

The second observed trend is from intermediate contaminants (i.e., 1,1,2,2-Tetrachloroethane for 0190-015) observed in the soil. The trend is reducing off-gas detections within the first three sampling event (i.e., 10, 30 and 60 minutes) and an increase back up to the concentrations observed at the 10 minute sampling event. This trend is suspected to be due to a slow decline in the off-gas emissions of the contaminant where the 75 minute collection time steadily accumulates contaminants.

The third observed trend is from lower contaminants observed in the soil. The trend is high off-gas detections within the first sampling event (i.e., 10 minutes) and reduction with each successive sampling (i.e., 1,2- dichloroethane) where some go to non-detect (i.e., chloroform).

Overall, the air stripping was demonstrated by the analytical results to be effective in stripping volatiles from the untreated materials.

TABLE 18: SE0190-015 (Carbon)

TOTAL VOLATILES	Carbon Control ug/Kg Result	AS @ 10 minutes ug/Kg Result	AS @ 30 minutes ug/Kg Result	AS @ 60 minutes ug/Kg Result	AS @ 135 minutes ug/Kg Result
Acetone	-	69900	16500	19100	46300
Benzene	-	11700	4280 J	2080 J	1770 J
Bromoform	-	1700 J	1430 J	2090 J	2360 J
2-Butanone	-	18200	2250 J	-	9290 J
Carbon tetrachloride	-	5530	3190 J	2340 J	1590 J
Chlorobenzene	-	637 J	556 J	1100 J	1760 J
Chloroform	-	4570	1210 J	-	-
1,2-Dichlorobenzene	-	3640 J	3360 J	28300	190000
Dichlorodifluoromethane	-	1050 J	-	-	-
1,2-Dichloroethane	-	22500	6420	2060 J	1420 J
cis-1,2-Dichloroethene	-	432 J	-	-	-
Ethylbenzene	-	-	529 J	-	1140 J

TABLE 18: SE0190-015 (Carbon)					
	Carbon Control	AS @ 10 minutes	AS @ 30 minutes	AS @ 60 minutes	AS @ 135 minutes
TOTAL	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
VOLATILES	Result	Result	Result	Result	Result
Isopropylbenzene	-	-	-	983 J	2120 J
Methylene chloride	-	4720	-	-	-
1,1,1,2-Tetrachloroethane	-	604 J	541 J	-	-
1,1,2,2-Tetrachloroethane	-	21500	17600	19700	35400
Tetrachloroethene	-	92500	87200	152000	224000
Toluene	-	2250 J	1510 J	1910 J	2470 J
1,1,2-Trichloroethane	-	465 J	-	-	-
Trichloroethene	-	68700	44000	52100	79100
Trichlorofluoromethane	-	1560 J	-	-	-
m, p -Xylene	-	-	726 J	1480 J	2320

TABLE 19: SE0190-016 (Carbon)					
	Carbon Control	AS @ 10 minutes	AS @ 30 minutes	AS @ 60 minutes	AS @ 135 minutes
TOTAL	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
VOLATILES	Result	Result	Result	Result	Result
Acetone	-	11800	14400	21200	40300
Benzene	-	10100	14300	4800	1570 J
Bromoform	-	1220 J	2050 J	2550 J	1890 J
2-Butanone	-	-	-	-	5900 J
Carbon tetrachloride	-	4010 J	5300	2740 J	952 J
Chlorobenzene	-	551 J	1940 J	2980 J	2220 J
Chlorodibromomethane	-	-	461 J	-	-
Chloroform	-	3780 J	2550 J	505 J	-
1,2-Dichlorobenzene	-	4060 J	21700	87200	204000
1,4-Dichlorobenzene	-	-	-	-	1010 J
1,2-Dichloroethane	-	18300	13700	3170 J	1100 J
Ethylbenzene	-	-	736 J	1380 J	1360 J
Hexachlorobutadiene	-	-	-	-	896 J
Isopropylbenzene	-	-	728 J	1510 J	2400 J
1,1,1,2-Tetrachloroethane	-	545 J	659 J	658 J	-
1,1,2,2-Tetrachloroethane	-	6550	25700	41800	36800
Tetrachloroethene	-	74600	192000	284000	219000
Toluene	-	1720 J	4530	4520	2250 J
Trichloroethene	-	51600	103000	101000	84800
o-Xylene	-	-	-	-	459 J
m, p -Xylene	-	-	1060 J	2430 J	2820 J

4.2.2.2. Solidification / Stabilization Procedures of Air Stripped Material

Immediately following air stripping activities KEMRON applied two mixture designs to aliquots of the air-stripped soil. The following is a presentation of the two mixture designs utilized:

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%)	WATER ADDITION (%)
SE0190-015	Cement / Class "C" Fly Ash	7.5 / 15	9
SE0190-016	Cement / Lime Kiln Dust	7.5 / 15	8

Development of each mixture was performed in accordance with the previously outlined protocol.

4.2.2.2.1. Chemical and Physical Property Testing Results

UCS Testing
Following a 21-day curing interval, each treated material was removed from the cylindrical curing mold and subjected to UCS testing. The results of UCS testing performed on mixtures 015 and 016 are included in **Table 22**.

The data presentation below facilitates UCS data discussion between the solidified samples with and without initial air stripping where data was pulled from **Tables 22 and 8**, respectively. Note that there can not be a direct comparison since the curing intervals differ; however, the observed strength increase may also reflect lower moisture in the pretreated samples.

In general, it can be noted that the fly ash mix designs continue to exhibit significantly higher strengths than the LKD mix designs.

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	DQO UCS (lbs/in^2)	UCS (lbs/in^2)
SE0190-015	Cement / Class "C" Fly Ash	7.5 / 15	9	15	383.6
SE0190-005	Cement / Class "C" Fly Ash	7.5 / 15	9	15	225.4
SE0190-016	Cement / Lime Kiln Dust	7.5 / 15	8	15	153.7
SE0190-008	Cement / Lime Kiln Dust	7.5 / 15	8	15	78.4

Data highlighted in red is pulled from Table 8 at a 7-day cure time and without air stripping.

Volatile Analysis
In addition to strength testing KEMRON subjected the air stripping pretreated solidified mixtures to total and SPLP volatile organic analyses following 21 days of curing. The results for these analyses are presented in **Tables 20 and 21**.

The data presentation below facilitates volatiles data discussion between controls and air stripped solidified materials. The data was pulled from **Tables 16 and 20** for the total volatiles presentation and **Tables 15 and 21** for the SPLP presentation.

A 21-day contaminant loss evaluation was a mini study set up to determine if study conditions would adversely affect testing results. This mini study included an aliquot of untreated material that was sampled at time "0" and at 21-days. The untreated material was allowed to sit under the same environmental conditions as the samples that were being tested during the 21-day interval.

The "AS Control" was an aliquot of the portion of untreated material that was slated to be air stripped. The "AS Control" was sampled prior to air stripping activities.

When comparing the Time "0" and the "AS Control" these samples were sampled at similar times but they were pulled from 2 different aliquots of untreated material.

Review of data pulled from **Tables 20 and 21** indicate that significant contaminant reductions were observed for both treated on a total and leachable basis compared to the 21-day control. Additionally, it appears that treatment utilizing LKD (0190-016) was slightly more effective at reducing contaminant concentrations than that seen in the treatment with class "C" fly ash (0910-015).

	Table 16		Table 20		
TOTAL VOLATILES	Time "0" Control (µg/Kg) Result	AS Control (µg/Kg) Result	21 Day Control (µg/Kg) Result	0190-15 AS (µg/Kg) Result	0190-016 AS (µg/Kg) Result
Benzene	3600 J	46200 J	961 J	497 J	311 J
Carbon tetrachloride	-	6640 J	-	-	-
Chlorobenzene	3910 J	31200 J	-	287 J	183 J
1,2-Dichlorobenzene	892,000	3,840,000	231000	75800	48700
1,4-Dichlorobenzene	6840 J	30100 J	1580 J	612 J	374 J
1,2-Dichloroethane	-	-	-	-	139 J
Ethylbenzene	-	10100 J	-	-	-
Hexachlorobutadiene	6430 J	11900 J	1250 J	1160 J	1220 J
Isopropylbenzene	3650 J	15000 J	-	-	-
Naphthalene	-	132000	-	-	-
Styrene	-		-	-	151 J
1,1,2,2-Tetrachloroethane	22600	197000	10100	-	-
Tetrachloroethene	161000	977000	18700	10400	6230
Toluene	3710 J	36400 J		291 J	159 J
1,2,4-Trichlorobenzene	-	-	-	-	172 J
Trichloroethene	7670 J	69800	1870 J	3730	1690
m, p -Xylene	5900 J	39000 J	-	-	145 J

	Table 15		Table 21		
SPLP VOLATILES	Time "0" (µg/L) Result	AS Control (µg/L) Result	21 Day Control (µg/L) Result	0190-15 AS (µg/L) Result	0190-016 AS (µg/L) Result
Acetone	-	-	-	130 J	-
Benzene	492 J	1410 J	309 J	-	8.61 J
Chlorobenzene	474 J	890 J	380 J	-	6.57 J
1,2-Dichlorobenzene	56300	67800	54000	4090	3360
1,4-Dichlorobenzene	412 J	522 J	411 J	20.7 J	19.3 J
1,2-Dichloroethane	-	166 J	-	-	5.07 J
Ethylbenzene	129 J	190 J	-	-	-
Hexachlorobutadiene	-	-	-	-	14.5 J
Isopropylbenzene	135 J	148 J	152 J	-	-
Naphthalene	-	-	-	-	5.42 J
1,1,2,2-Tetrachloroethane	2540	6250	2140 J	-	-
Tetrachloroethene	15300	23200	11900	74.9 J	128
Toluene	474 J	1020 J	395 J	-	5.45 J
1,2,4-Trichlorobenzene	-	-	-	-	7.96 J
Trichloroethene	826 J	2130 J	721 J	19.8 J	40.8 J
o-Xylene	-	144 J	-	-	-
m, p -Xylene	522 J	783 J	460 J	-	-

Review of **Tables 20 and 21** indicate that significant contaminant reductions were observed for both treated samples on a total and leachable basis compared to the controls. Additionally comparing the results with the 21-day control results, it is observed that the treated materials have lower detections indicating that the treatment is effective above and beyond what specimen processing contributes to the contaminant losses.

Additionally, it appears that treatment utilizing LKD (sample 0190-016) was slightly more effective at reducing contaminant concentrations than that observed in the treatment with class "C" fly ash. The concentrations observed for 1,2-Dichlorobenzene are 75,800 ppb and 48,700 ppb associated with the fly ash and LKD mixtures, respectively.

4.2 3. Final ZVI Strength and Leaching Evaluations

In order to compare the effectiveness of the air stripping pretreatment with ZVI treatment, Golder requested that KEMRON redevelop two of the previously tested ZVI mixtures for further analytical testing. Specifically KEMRON prepared the following two materials for additional testing:

KEMRON SAMPLE No.	REAGENT TYPE	ZVI ADDITION	REAGENT ADDITION (%)	WATER ADDITION (%)
SE0190-017	Cement / Class "C" Fly Ash	Slurry to Soil	7.5 / 15	9
SE0190-018	Cement / Lime Kiln Dust	Slurry to Soil	7.5 / 15	8

The quantity of reagents were determined as previously stated where the ZVI was introduced at an addition rate of approximately 1.1% on a by-weight basis relative to the weight of the untreated material aliquot. Again, the ZVI addition rate was determined based on a stochiometric ratio of 5:1 iron to total organic contaminant concentration, outlined by Golder. Finally the ZVI was slurried with the solidification/stabilization reagents prior to blending with the untreated material.

4.2.3.1. Chemical and Physical Property Testing Results

Strength Testing

Following 21 days of curing the ZVI solidified monoliths were subjected to UCS testing. The results of testing are included in **Table 11**. **Table 11** is presented below to facility discussion. Review of the data indicates that mixture 017 showed a moderate strength increase with a longer curing interval, while mixture 018 yielded a slight decrease in strength. While it is not expected that longer cure intervals would produce lower UCS values KEMRON believes that heterogeneous untreated aliquots may be responsible for the lower UCS results.

TABLE 11

KEMRON SAMPLE No.	REAGENT TYPE	ZVI Addition (2)	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	UCS (lbs/in^2)
Amendment Testing: UCS tested at 7-day cure					
SE0190-011	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9	246.2
SE0190-012	Cement / Class "C" Fly Ash	added to S/S reagents	7.5 / 15	9	291.3
SE0190-013	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.55	83.1
SE0190-014	Cement / Lime Kiln Dust	added to S/S reagents	7.5 / 15	8	82.2
Candidate ZVI Testing: UCS tested at 21-day cure					
SE0190-017	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9	305.0
SE0190-018	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.15	74.2

Volatile Analysis

In addition to strength testing KEMRON subjected both of the ZVI - reagent containing mixtures to total and SPLP volatile organic analyses following 21 days of curing. The results for these analyses are presented in **Tables 20 and 21**. The data presentation below facilitates volatiles data discussion between controls and ZVI-solidified materials. The data was pulled from **Tables 14 and 20** for the total volatiles presentation and **Tables 15 and 21** for the SPLP presentation.

Review of data from **Tables 20 and 21** indicate that significant contaminant reductions were observed for both treated on a total and leachable basis compared to the 21-day control. Additionally, it appears that treatment utilizing LKD (0190-018) was generally more effective at

reducing contaminant concentrations than that seen in the treatment with class "C" fly ash (0190-017) which is especially pronounced in the total volatiles results. The SPLP results are more similar between the fly ash and LKD mix designs.

	Table 14		Table 20		
TOTAL VOLATILES	Time "0" Control (µg/Kg) Result	ZVI Baseline (µg/Kg) Result	21 Day Control (µg/Kg) Result	0190-017 ZVI (µg/Kg) Result	0190-018 ZVI (µg/Kg) Result
Benzene	3600 J	31500 J	961 J	-	-
Carbon tetrachloride	-	4370 J	-	-	-
Chlorobenzene	3910 J	20400 J	-	-	-
1,2-Dichlorobenzene	892,000	2690000	231000	114000	56500
1,4-Dichlorobenzene	6840 J	19500 J	1580 J	934 J	432 J
Ethylbenzene	-	6250 J	-	-	-
Hexachlorobutadiene	6430 J	7940 J	1250 J	930 J	769 J
Isopropylbenzene	3650 J	9310 J	-	-	-
Naphthalene	-	5520 J	-	-	-
1,1,2,2-Tetrachloroethane	22600	126000	10100	-	-
Tetrachloroethene	161000	648000	18700	16800	6140
Toluene	3710 J	23700 J		-	-
Trichloroethene	7670 J	49600	1870 J	2150 J	1330 J
o-Xylene	-	4750 J	-	-	-
m, p -Xylene	5900 J	24500 J	-	519 J	-

	Table 15		Table 21		
SPLP VOLATILES	Time "0" (µg/L) Result	ZVI Control (µg/L) Result	21 Day Control (µg/L) Result	0190-017 ZVI (µg/L) Result	0190-018 ZVI (µg/L) Result
Benzene	492 J	1770 J	309 J	-	-
Chlorobenzene	474 J	1090 J	380 J	62.1 J	46.8 J
1,2-Dichlorobenzene	56300	69400	54000	30400	33900
1,4-Dichlorobenzene	412 J	530 J	411 J	202 J	230 J
1,2-Dichloroethane	-	208 J	-	-	-
Ethylbenzene	129 J	242 J	-	-	-
Isopropylbenzene	135 J	138 J	152 J	56.4 J	59.3 J
1,1,2,2-Tetrachloroethane	2540	9010	2140 J	-	-
Tetrachloroethene	15300	24000	11900	2220	1700
Toluene	474 J	1280 J	395 J	-	-
Trichloroethene	826 J	2600	721 J	76.1 J	-
o-Xylene	-	161 J	-	-	-
m, p -Xylene	522 J	842 J	460 J	115 J	109 J

4.2.4. Comparison of Air Stripping and ZVI Stabilized Materials

4.2.4.1. Strength Comparison

Presented below is a compilation of UCS data pulled from **Tables 11 and 22**. The air stripped solidification is observed to have higher strength. The LKD mix designs in both the air stripping and the ZVI amendments have demonstrated a lower strength than that for the fly ash mixes.

KEMRON SAMPLE No	REAGENT TYPE	Additional Treatment	REAGENT ADDITION (%)	WATER ADDITION (%)	DQO UCS (lbs/in^2)	UCS (lbs/in^2)
Air Stripping Pre-Treatment & S/S Evaluation						
SE0190-015	Cement / Class "C" Fly Ash	Air Stripping	7.5 / 15	9	15	383.6
SE0190-016	Cement / Lime Kiln Dust	Air Stripping	7.5 / 15	8	15	153.7
Candidate ZVI Testing: UCS tested at 21-day cure						
SE0190-017	Cement / Class "C" Fly Ash	ZVI - Slurry to soil	7.5 / 15	9	15	305.0
SE0190-018	Cement / Lime Kiln Dust	ZVI - Slurry to soil	7.5 / 15	8.15	15	74.2

4.2.4.2. Chemical Comparison

Presented below is data presented from **Tables 20 and 21**. Based on the data, the air stripping is more effective at reducing the mass of volatiles than the ZVI amendment. Furthermore, the LKD air stripped mix designs demonstrated greater volatile reduction than the fly ash mixes for the totals analyses. The results are more similar between the air stripped LKD and fly ash mixes for the SPLP analysis.

TABLE 20

TOTAL VOLATILES	0190-15 AS (µg/Kg)		0190-016 AS (µg/Kg)		0190-017 ZVI (µg/Kg)		0190-018 ZVI (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL
Benzene	497 J	252	311 J	138	-	502	-	294
Chlorobenzene	287 J	252	183 J	138	-	502	-	294
1,2-Dichlorobenzene	75800	252	48700	138	114000	502	56500	294
1,4-Dichlorobenzene	612 J	252	374 J	138	934 J	502	432 J	294
1,2-Dichloroethane	-	252	139 J	138	-	502	-	294
Hexachlorobutadiene	1160 J	252	1220 J	138	930 J	502	769 J	294
Styrene	-	252	151 J	138	-	502	-	294
Tetrachloroethene	10400	252	6230	138	16800	502	6140	294
Toluene	291 J	252	159 J	138	-	502	-	294
1,2,4-Trichlorobenzene	-	252	172 J	138	-	502	-	294
Trichloroethene	3730	252	1690	138	2150 J	502	1330 J	294
m, p -Xylene	-	252	145 J	138	519 J	502	-	294

TABLE 21

SPLP VOLATILES	0190-015 AS (µg/L)		0190-016 AS (µg/L)		0190-017 ZVI (µg/L)		0190-018 ZVI (µg/L)	
	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	130 J	125	-	50.0	-	500	-	500
Benzene	-	6.25	8.61 J	2.50	-	25.0	-	25.0
Chlorobenzene	-	6.25	6.57 J	2.50	62.1 J	25.0	46.8 J	25.0
1,2-Dichlorobenzene	4090	6.25	3360	2.50	30400	25.0	33900	25.0
1,4-Dichlorobenzene	20.7 J	6.25	19.3 J	2.50	202 J	25.0	230 J	25.0
1,2-Dichloroethane	-	12.5	5.07 J	5.00	-	50.0	-	50.0
Hexachlorobutadiene	-	12.5	14.5 J	5.00	-	50.0	-	50.0
Isopropylbenzene	-	12.5	-	5.00	56.4 J	50.0	59.3 J	50.0
Naphthalene	-	10.0	5.42 J	4.00	-	40.0	-	40.0
1,1,2,2-Tetrachloroethane	-	6.25	-	2.50	-	25.0	-	25.0
Tetrachloroethene	74.9 J	12.5	128	5.00	2220	50.0	1700	50.0
Toluene	-	12.5	5.45 J	5.00	-	50.0	-	50.0
1,2,4-Trichlorobenzene	-	10.0	7.96 J	4.00	-	40.0	-	40.0
Trichloroethene	19.8 J	12.5	40.8 J	5.00	76.1 J	50.0	-	50.0
m p -Xylene	-	12.5	-	5.00	115 J	50.0	109 J	50.0

4.3. Conclusions to the Intermediate Phase of Testing

Review of the results of intermediate testing indicate that those materials pre-treated by air-stripping resulted in significantly lower organics concentrations on a total, and to a lesser extent, on a leachable basis; and the UCS values were higher. Additional review indicates that the materials treated with cement and LKD exhibited lower total volatile concentrations, but very similar SPLP volatile concentrations compared to the materials treated with cement and class "C" fly ash. Overall the lowest total volatile organics concentrations were exhibited in sample 0190-016 AS. The greatest strength was observed to be with the air stripped cement and fly ash mix design (0190-015) followed by the air stripped cement and LKD mix design (0190-016).

5.0 VERIFICATION EVALUATION

KEMRON conducted verification evaluations on the untreated site soils in order to provide further assessment of treatment effectiveness of the air stripping pre-treatment and solidification / stabilization using the Cement and Class "C" fly ash mix design. This was the treatment design selected by Golder for this stage of the treatability evaluation. The time necessary to effectively remove volatile mass through air stripping was the variable tested at this phase of the study. Specifically, 90 and 135 minutes of air stripping were applied to the untreated material followed by solidification / stabilization. Both the pre-treatment and fully treated materials were evaluated. Specifically, off-gas and air-stripped soil were evaluated for volatile mass reduction following pre-treatment; and the air-stripped and solidified materials were evaluated for strength, leaching and total analyte content. The following is a summary of the mixtures developed in this phase of the treatability study:

KEMRON SAMPLE No.	PRETREATMENT STRIPPING TIME	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)
SE0190-019	90 minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15
SE0190-020	135 minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15

5.1. Material Contaminant Baseline Confirmation

Prior to initiating air stripping for this final phase of treatability evaluation, a follow-up chemical characterization was completed to ensure that that material had not significantly change from the initial phases of the study and to provide a new baseline of contamination upon which to evaluate verification treatment applications. The request was made by Golder to complete triplicate analyses on the untreated material for total volatiles analysis. This data is presented in **Table 22**. Additional chemical characterization was completed on the SPLP volatiles, total and SPLP semivolatiles which are presented in **Tables 24, 25 and 26**, respectively. The sample is identified as "Control Time 0".

5.1.1. Baseline Data Evaluations

To facilitate chemical comparison of untreated materials characterized at the onset of testing to untreated materials at the final verification phase of treatability evaluation a compilation of data

is presented in Tables in this section. Specifically, the following tables are presented in condensed versions:

	Untreated Characterization	Baseline Confirmation
Total Volatiles	Table 2	Table 23 (presented separately)
SPLP Volatiles	Table 3	Table 24
Total Semivolatiles	Table 4	Table 25
SPLP Semivolatiles	Table 5	Table 26

5.1.1.1. Total Volatiles Baseline Data Evaluation

Review of the data below indicates that significant reduction has occurred since the untreated material characterization completed at the onset of the treatability study. Approximately a third of the total volatile contaminants are still present in the untreated material as observed by comparison between **Table 2 and 23** data.

TOTAL VOLATILES	UNTREATED CHARACTERIZATION - TABLE 2							
	RESULTS (µg/Kg)							
	UNTREATED - A		UNTREATED - B		UNTREATED - C		Average	
	Result	DL	Result	DL	Result	DL	Result	DL
Benzene	51400 J	13,500	43900 J	14,100	48500 J	14,900	47,933	14,167
Chlorobenzene	30300 J	13,500	29000 J	14,100	29500 J	14,900	29,600	14,167
1,2-Dichlorobenzene	**3,880,000**	**13,500**	**3,410,000**	**14,100**	**3,330,000**	**14,900**	**3,540,000**	**14,167**
1,4-Dichlorobenzene	29600 J	13,500	27500 J	14,100	26500 J	14,900	27,867	14,167
Hexachlorobutadiene	-	13,500	-	14,100	18600 J	14,900	6,200	14,167
Isopropylbenzene	-	13,500	-	14,100	-	14,900	-	14,167
1,1,2,2-Tetrachloroethane	241,000	13,500	202,000	14,100	192,000	14,900	211,667	14,167
Tetrachloroethene	**966,000**	**13,500**	**874,000**	**14,100**	**888,000**	**14,900**	**909,333**	**14,167**
Toluene	35900 J	13,500	31400 J	14,100	33400 J	14,900	33,567	14,167
Trichloroethene	73600 J	13,500	59900 J	14,100	63600 J	14,900	65,700	14,167
m, p -Xylene	30200 J	13,500	26300 J	14,100	29700 J	14,900	28,733	14,167

TOTAL VOLATILES	VERIFICATION PHASE - TABLE 23							
	Control Time "0" (µg/Kg)		Duplicate (µg/Kg)		Triplicate (µg/Kg)		Average (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL
Benzene	-	9,800	-	3,010	-	4,800	-	5,870
Chlorobenzene	-	9,800	-	3,010	4,950 J	4,800	1,650	5,870
1,2-Dichlorobenzene	**2,190,000**	**9,800**	**851,000**	**3,010**	**1,580,000**	**4,800**	**1,540,333**	**5,870**
1,4-Dichlorobenzene	17,400 J	9,800	7,040 J	3,010	13,200 J	9,600	12,547	7,470
Hexachlorobutadiene	10,200 J	9,800	8,370 J	3,010	14,800 J	4,800	11,123	5,870
Isopropylbenzene	-	9,800	4,650 J	3,010	8,010 J	4,800	4,220	5,870
1,1,2,2-Tetrachloroethane	73,700 J	9,800	13,600 J	3,010	28,100 J	4,800	38,467	5,870
Tetrachloroethene	**346,000**	**9,800**	**108,000**	**3,010**	**201,000**	**4,800**	**218,333**	**5,870**
Toluene	-	9,800	-	3,010	-	4,800	-	5,870
Trichloroethene	-	9,800	-	3,010	-	4,800	-	5,870
m, p -Xylene	15,800 J	9,800	4,350 J	3,010	9,120 J	4,800	9,757	5,870

5.1.1.2. SPLP Volatiles Baseline Data Evaluation

Review of the data presented below in **Tables 3 and 24** indicates that significant reduction has occurred since the untreated material characterization completed at the onset of the treatability study. The SPLP leached volatile contaminants are still leaching from the untreated material but only at approximately a third or less of that from the untreated material characterization.

SPLP VOLATILES	TABLE 3 - UNTREATED				TABLE 24
	A (µg/L)	- B (µg/L)	- C (µg/L)	Average (µg/L)	Control Time "0" (µg/L)
	Result	Result	Result	Result	Result
Benzene	3220	2400 J	2350 J	2,657	136 J
Chlorobenzene	1380 J	1280 J	1250 J	1,303	349 J
Chloroform (1)	67.4 J	-	-	22	-
1,2-Dichlorobenzene	**80800**	**92300**	**92300**	**88,467**	58,900 I
1,4-Dichlorobenzene	567 J	659 J	604 J	610	384 J
1,2-Dichloroethane	482 J	304 J	286 J	357	-
Ethylbenzene	265 J	273 J	268 J	269	116 J
Isopropylbenzene	388 J	397 J	395 J	393	162 J
1,1,2,2-Tetrachloroethane	13000	10300	10600	11,300	3,020
Tetrachloroethene	**27000**	**30600**	**29000**	**28,867**	**10,300**
Toluene	1760 J	1570 J	1560 J	1,630	291 J
Trichloroethene	3610	3120	3020	3,250	448 J
Vinyl chloride	-	-	-	-	80.9 J
o-Xylene	161 J	162 J	137 J	153	97.4 J
m, p -Xylene	924 J	970 J	955 J	950	445 J

I = semiquantitative result, detection above the DL

5.1.1.3. Total Semivolatiles Baseline Data Evaluation

Review of the data below indicates that significant reduction has occurred since the untreated material characterization completed at the onset of the treatability study. Of the total semivolatiles detected, Benzoic Acid has the most closely reproducible concentration with an average of 63,000 ppb in the untreated material characterization verse 46,000 ppb for the verification phase of the study.

	TABLE 4								TABLE 25	
	RESULTS (µg/Kg)								Control Time "0"	
TOTAL	UNTREATED - A		UNTREATED - B		UNTREATED - C		AVERAGE		(µg/Kg)	
SEMIVOLATILES	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,4-Dichlorobenzene	6,150	1,050	7,540	1,110	8,350	1,110	7,347	1,090	2,080	495
1,2-Dichlorobenzene	**838,000**	**52,300**	**976,000**	**55,600**	**1,110,000**	**55,600**	**974,667**	**54,500**	**111,000**	**1,980**
Hexachloroethane	6,220	1,050	9,780	1,110	11,000	1,110	9,000	1,090	-	495
Benzoic acid	**58,100**	**4,180**	**68,700**	**4,450**	**61,500**	**4,450**	**62,767**	**4,360**	**45,800**	**7,910**
2,4-Dichlorophenol	-	1,050	-	1,110	-	1,110	-	1,090	773 J	495
Hexachlorobutadiene	1370 J	1,050	2,630	1,110	2,790	1,110	2,263	1,090	821 J	495
Hexachlorobenzene	2,810	1,050	8,670	1,110	6,590	1,110	6,023	1,090	2,950	495

5.1.1.4. SPLP Semivolatiles Baseline Data Evaluation

Review of the data below indicates that significant reduction has occurred since the untreated material characterization completed at the onset of the treatability study. The SPLP leached semivolatile contaminants are still leaching from the untreated material but only at approximately two-thirds of that from the untreated material characterization.

	TABLE 5								TABLE 26	
	RESULTS (µg/L)								Control Time "0"	
SPLP	UNTREATED - A		UNTREATED - B		UNTREATED - C		AVERAGE		(µg/L)	
SEMIVOLATILES	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,4-Dichlorobenzene	272 J	255	274	25.5	229	25.5	258	25	160	25.5
1,2-Dichlorobenzene	**37,100**	**2,550**	**37,600**	**2,550**	**31,800**	**2,550**	**35,500**	**25**	**22,700**	**1,280**
Hexachloroethane	-	255	178	25.5	150	25.5	109	25	186	25.5
Benzoic acid	4,360	1,280	4,720	1,280	4,230	1,280	4,437	125	6,340	1,280
2,4-Dichlorophenol	-	255	33.9 J	25.5	31.2 J	25.5	22	25	32.4	25.5

5.2. Contaminant Loss During Verification Processing

The verification phase of the study was bracketed by testing of control samples. The first control sample was untreated material sampled for chemical analysis at the initiation of the verification testing, day 0. The second control sample, Day 21, remained under the same conditions as the treated sample for the duration of the verification testing including sample curing. Following the completion of sample curing at 21- days, the control was sampled for chemical analysis. The Day 21 demonstrates the extent that treated samples may show contaminant loss due to testing processes and not the actual treatment.

5.2.1. Contaminant Loss Data Evaluations

The data associated with the Day 0 and Day 21 controls are presented in **Tables 23 through 26**. For the sake of discussion, condensed tables have been presented below.

5.2.1.1. Contaminant Loss Evaluation: Total Volatiles

Review of the total volatiles data below indicates reduction has occurred over the 21 days of verification testing. There is variability in the loss observed from reductions by 50% (i.e., 1,2-dichlorbenzene) to reductions down to 20% (i.e., Tetrachloroethene) from that observed at the Control Time "0" (Day 0).

TABLE 23

TOTAL VOLATILES	Control Time "0" (µg/Kg)		Duplicate (µg/Kg)		Triplicate (µg/Kg)		Average (µg/Kg)		Control Time "21 Day" (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Chlorobenzene	-	9,800	-	3,010	4,950 J	4,800	1,650	5,870	-	3,090
1,2-Dichlorobenzene	2,190,000	9,800	851,000	3,010	1,580,000	4,800	**1,540,333**	**5,870**	**854,000**	**3,090**
1,4-Dichlorobenzene	17,400 J	9,800	7,040 J	3,010	13,200 J	9,600	12,547	7,470	5120 J	3,090
Hexachlorobutadiene	10,200 J	9,800	8,370 J	3,010	14,800 J	4,800	11,123	5,870	3,240 J	3,090
Isopropylbenzene	-	9,800	4,650 J	3,010	8,010 J	4,800	4,220	5,870	3,190 J	3,090
1,1,2,2-Tetrachloroethane	73,700 J	9,800	13,600 J	3,010	28,100 J	4,800	**38,467**	**5,870**	**32,600**	**3,090**
Tetrachloroethene	346,000	9,800	108,000	3,010	201,000	4,800	**218,333**	**5,870**	**41,200**	**3,090**
m, p -Xylene	15,800 J	9,800	4,350 J	3,010	9,120 J	4,800	9,757	5,870	4,080 J	3,090

5.2.1.2. Contaminant Loss Evaluation: SPLP Volatiles

Review of the SPLP volatiles data below indicates reduction has occurred in contaminants leached at the 21 days following verification testing as compared to that at the onset of control testing. Reductions range from 50% to 60% as observed for 1,2-dichlorobenzene and tetrachloroethene, respectively. Note that there are more "J" flagged detections observed in the 21-day results. When comparing the detection limits between the two sets of data it is apparent that the Day 0 data was diluted since the detection limit values are higher. The dilution at Day 0 may be "diluting out" contaminants that are present in the material. For instance, if you review the data for 1,2,4-trichlorobenzene the Day 0 has a non-detect with a DL of 50 ppb but the Day 21 has a 23.4 J ppb detection. Any detection below 50 ppb for Day 0 will not be reported.

TABLE 24				
SPLP VOLATILES	Control Time "0" (µg/L)		Control Time "Day 21" (µg/L)	
	Result	DL	Result	DL
Benzene	136 J	31.3	48.6 J	1.25
Bromobenzene	-	31.3	11.2 J	1.25
Bromoform	-	125	15.9 J	5.00
Carbon tetrachloride	-	62.5	6.79 J	2.50
Chlorobenzene	349 J	31.3	172	1.25
Chloroform	-	31.3	1.45 J	1.25
2-Chlorotoluene	-	31.3	6.52 J	1.25
4-Chlorotoluene	-	62.5	3.05 J	2.50
1,2-Dibromo-3-chloropropane	-	250	12.1 J	10.0
1,2-Dichlorobenzene	58,900 I	**31.3**	**34,600**	**62.5**
1,3-Dichlorobenzene	-	62.5	15.9 J	2.50
1,4-Dichlorobenzene	384 J	31.3	269	1.25
1,2-Dichloroethane	-	62.5	4.42 J	2.50
Ethylbenzene	116 J	62.5	72	2.50
Hexachlorobutadiene	-	62.5	25.9 J	2.50
Isopropylbenzene	162 J	62.5	146	2.50
Naphthalene	-	50.0	22.5 J	2.00
n-Propylbenzene	-	31.3	1.43 J	1.25
1,1,2,2-Tetrachloroethane	**3,020**	**31.3**	**1,650**	**1.25**
Tetrachloroethene	**10,300**	**62.5**	**3,280**	**125**
Toluene	291 J	62.5	142	2.50
1,2,3-Trichlorobenzene	-	31.3	2.55 J	1.25
1,2,4-Trichlorobenzene	-	50.0	23.4 J	2.00
Trichloroethene	448 J	62.5	274	2.50
Vinyl chloride	80.9 J	62.5	-	2.50
o-Xylene	97.4 J	62.5	70.5	2.50
m-, p-Xylene	445 J	62.5	291	2.50

5.2.1.3. Contaminant Loss Evaluation: Total Semivolatiles

Review of the total semivolatiles data below indicates consistent and at times greater detections at the 21 day testing. This is expected since semivolatile compounds are not as conducive to volitalization. The increase in detection is likely due to sample heterogeneity.

TABLE 25				
TOTAL SEMIVOLATILES	Control Time "0" (µg/Kg)		Control Time "Day 21" (µg/Kg)	
	Result	DL	Result	DL
1,4-Dichlorobenzene	2,080	495	1,780	528
1,2-Dichlorobenzene	**111,000**	**1,980**	**340,000**	**5,280**
Hexachloroethane	-	495	2,570	528
Benzoic acid	**45,800**	**7,910**	**55,800**	**21,100**
2,4-Dichlorophenol	773 J	495	-	528
Hexachlorobutadiene	821 J	495	866 J	528
Hexachlorobenzene	2,950	495	2,950	528

5.2.1.4. Contaminant Loss Evaluation: SPLP Semivolatiles

Review of the SPLP semivolatiles data below indicates little reduction has occurred in contaminants leached at the 21 days following verification testing as compared to that at the onset of control testing. The highest concentration leached was for 1,2-Dichlorobenzene where the Time 0 was 22,700 ppb and the Day 21 was 25,500.

TABLE 26				
SPLP SEMIVOLATILES	Control Time "0" (µg/L)		Control Time "Day 21" (µg/L)	
	Result	DL	Result	DL
1,4-Dichlorobenzene	160	25.5	141	12.8
1,2-Dichlorobenzene	**22,700**	**1,280**	**25,500**	**1,280**
Hexachloroethane	186	25.5	201	12.8
Benzoic acid	6,340	1,280	-	63.8
2,4-Dichlorophenol	32.4	25.5	51.6	12.8
1,2,4-Trichlorobenzene	-	25.5	31.7	12.8
2,4,6-Trichlorophenol	-	25.5	37.4	12.8

5.2.1.5. Conclusion: Contaminant Loss

The greatest reductions observed were in the volatiles analyses for both the total and leachable evaluations.

5.3. Volatile Mass Removal by Air Stripping – Verification Testing

5.3.1. Air Stripping Procedures

The volatile mass reduction is compared at 90 and 135 minute air stripping durations during this phase of testing. Two aliquots of the untreated material were air stripped in a sealed glove box according to air stripping procedures described in the Intermediate phase of testing. One aliquot was pretreated for a period of approximately 90 minutes while the second aliquot was pretreated for a period of approximately 135 minutes. Throughout air stripping KEMRON performed monitoring activities to evaluate relative humidity, temperature and organic vapor content of both the influent and effluent air. Analytical testing was completed on air stripped soils and off-gas carbon traps at the following intervals:

90 Minute AS: 10, 30, 60 and 90
135 Minute AS: 10, 30, 60, 90 and 135

5.3.1.1. Monitoring Data Results

The results of air stripping monitoring activities are presented in **Tables 27 and 28** representing the two aliquots used for the subsequent solidification / stabilization evaluations. Review of these tables indicate similar conditions were observed in the activities performed during this phase of the study as were seen in the previous air stripping monitoring data.

5.3.1.2. Chemical Testing Results

Throughout air stripping activities, KEMRON sampled aliquots of the air stripped soil at the following intervals: 0, 10, 30, 60, and 135 minutes where the 90 min evaluation did not include sampling at the 135 minutes. In addition to soil sampling, KEMRON also collected the VOCs produced during air stripping on a carbon cartridge which was replaced with a new cartridge at the same intervals as the soil was sampled. All soil and carbon samples were then analyzed for total volatile organics in accordance with SW-846-8260. The VOC results of the verification air stripping phase of work are presented in **Tables 29, 30, 37 and 38** where a condensed version is located below for discussion purposes.

<u>Air Stripped Soils</u>
Review of the air stripped soils, indicates, the untreated materials exhibited decreasing concentrations of volatile organics throughout the air stripping duration with a few exceptions for the 135 min air stripping duration, specifically, 1,4-Dichlorobenzene, 1,1,2,2-Tetrachloroethane, Tetrachloroethene. At this point in the study the 2 aliquots duplicate each other up to the 90 minute air stripping duration. When reviewing the data in light of this, the exceptions in the 135 minute air stripping aliquot are likely due to sample heterogeneity.

TABLE 29 - Soil

TOTAL VOLATILES	Baseline (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Benzene	7,390	357	-	2,070	-	1,970	-	1,070	-	973
Bromobenzene	920 J	357	-	2,070	-	1,970	-	1,070	-	973
Bromoform	1,580 J	357	-	2,070	-	1,970	-	1,070	-	973
Carbon tetrachloride	976 J	357	-	2,070	-	1,970	-	1,070	-	973
Chlorobenzene	15,300	357	-	2,070	-	1,970	-	1,070	-	973
2-Chlorotoluene	659 J	357	-	2,070	-	1,970	-	1,070	-	973
1,2-Dichlorobenzene	3,320,000	17,800	786,000	2,070	516,000	1,970	267,000	1,070	161,000	973
1,3-Dichlorobenzene	1,580 J	357	-	2,070	-	1,970	-	1,070	-	973
1,4-Dichlorobenzene	23,200	357	5,960 J	2,070	4,290 J	1,970	1,990 J	1,070	1,340 J	973
1,2-Dichloroethane	544 J	357	-	2,070	-	1,970	-	1,070	-	973
Ethylbenzene	6,320	357	-	2,070	-	1,970	-	1,070	-	973
Hexachlorobutadiene	19,100	357	4,040 J	2,070	5,080 J	1,970	5,640 J	1,070	3,360 J	973
Isopropylbenzene	12,900	357	3,260 J	2,070	2,770 J	1,970	-	1,070	-	973
Naphthalene	1,620 J	357	12000 J	2,070	6,600 J	1,970	1,320 J	1,070	-	973
1,1,2,2-Tetrachloroethane	102,000	357	18000 J	2,070	12700 J	1,970	9,800 J	1,070	8,260 J	973
Tetrachloroethene	709,000	17,800	37,600	2,070	35,300	1,970	22,600	1,070	21,000	973
Toluene	13,400	357	-	2,070	-	1,970	-	1,070	-	973
1,2,4-Trichlorobenzene	3,320 J	357	-	2,070	-	1,970	-	1,070	-	973
Trichloroethene	19,800	357	-	2,070	2,010 J	1,970	1,800 J	1,070	2,430 J	973
o-Xylene	5,440	357.0	-	2,070	-	1,970	-	1,070	-	973
m, p -Xylene	25,000	357	3,250 J	2,070	2,130 J	1,970	-	1,070	-	973

TABLE 30 - Soil

TOTAL VOLATILES	Baseline (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS 135 min (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Benzene	5,670	381	625	47.8	-	2,240	2,290 J	2,280	-	460	1,220 J	426
Bromobenzene	731 J	381	162 J	47.8	-	2,240	-	2,280	-	460	-	426
Bromoform	1,450 J	381	161 J	47.8	-	2,240	-	2,280	-	460	-	426
Carbon tetrachloride	898 J	381	56.2 J	47.8	-	2,240	-	2,280	-	460	-	426
Chlorobenzene	12,800	381	1,570	47.8	-	2,240	4,730 J	2,280	-	460	728 J	426
2-Chlorotoluene	490 J	381	143 J	47.8	-	2,240	-	2,280	-	460	-	426
4-Chlorotoluene	-	381	61.3 J	47.8	-	2,240	-	2,280	-	460	-	426
1,2-D chlorobenzene	2,130,000	19,100	908,000	4,780	481,000	2,240	884,000	2,280	152,000	460	115,000	426
1,3-D chlorobenzene	1,290 J	381	428 J	47.8	-	2,240	-	2,280	-	460	-	426
1,4-D chlorobenzene	20,000	381	6,500	47.8	3,470 J	2,240	7,990 J	2,280	1,160 J	460	1,370 J	426
1,2-D chloroethane	-	381	245 J	47.8	-	2,240	-	2,280	-	460	-	426
Ethylbenzene	5,360	381	692	47.8	-	2,240	-	2,280	-	460	-	426
Hexachlorobutadiene	16,900	381	7,500	47.8	8,470 J	2,240	5,660 J	2,280	2,470 J	460	2,530 J	426
Isopropylbenzene	11,000	381	2,230	47.8	-	2,240	-	2,280	-	460	-	426
Naphthalene	1,330 J	381	1,020	47.8	-	2,240	-	2,280	576 J	460	-	426
n-Propylbenzene	-	381	54.9 J	47.8	-	2,240	-	2,280	-	460	-	426
1,1,2,2-Tetrachloroethane	81,400	381	18,300	47.8	8,790 J	2,240	57,300	2,280	6,890	460	7,290	426
Tetrachloroethene	433,000	19,100	69,000	4,780	24,900	2,240	151,000	2,280	7,480	460	25,500	426
Toluene	11,000	381	794	47.8	-	2,240	3,380 J	2,280	-	460	587 J	426
1,2,3-Trichlorobenzene	-	381	149 J	47.8	-	2,240	-	2,280	-	460	-	426
1,2,4-Trichlorobenzene	2,930 J	381	1,440	47.8	-	2,240	-	2,280	549 J	460	464 J	426
Trichloroethene	14,700	381	1,550	47.8	-	2,240	10,100 J	2,280	782 J	460	3,460 J	426
1,3,5-Trimethylbenzene	-	381	60.4 J	47.8	-	2,240	-	2,280	-	460	-	426
o-Xylene	4,490	381	754	47.8	-	2,240	-	2,280	-	460	-	426
m, p -Xylene	21,000	381	3,080	47.8	-	2,240	4,510 J	2,280	-	460	717 J	426

Off-gas from Air Stripping

When evaluating the carbon sample results, understanding the durations associated with each sample is helpful when discussing the analytical data. The following are the time durations that each carbon was exposed to the VOCs off-gas created during air stripping activities:

Sample Identifier	Duration of Exposure (minutes)
Control Carbon	0
10 min Carbon	10
30 min Carbon	20
60 min Carbon	30
135 min Carbon	75

The stark trends that were observed in the Intermediate phase of testing are generally reproducible; however, the contaminant concentrations are much lower. The difference may be due to the lower untreated material concentrations that were started with at the Verification phase.

The three trends observed in the off-gas data as described in the Intermediate phase of work correspond to high, medium and low concentrations of contaminants. High concentrations of contaminants (i.e., 2-Butanone) present in the soils showed increasing concentrations over the sampling interval. This is likely due to the continuous supply of stripped contamination over duration of air stripping.

The second trend observed during the intermediate phase of testing was not observed here. Recall that the trend was reducing off-gas detections within all sampling event except for the last one where there was an increase back up to the concentrations observed at the 10 minute sampling event.

The third observed trend is from lower contaminants observed in the soil. Recall that the trend is high off-gas detections within the first sampling event (i.e., 10 minutes) and reduction with each successive sampling where some go to non-detect. This trend was not very pronounced in the data as most of the detections are "J" flagged.

Generally, the air stripping was demonstrated by the analytical results to be effective in stripping volatiles from the untreated materials.

TABLE 37 - Carbon

TOTAL VOLATILES	Control (µg/Kg) Result	AS 10 min (µg/Kg) Result	AS 30 min (µg/Kg) Result	AS 60 min (µg/Kg) Result	AS 90 min (µg/Kg) Result
Acetone	-	**1,140**	**1,010**	**3,410**	**8,160**
Bromoform	-	73.9 J	91.2 J	-	-
Bromomethane	-	-	103 J	101 J	-
2-Butanone	-	353 J	461 J	1,090	3,080
Carbon tetrachloride	-	210 J	118 J	-	-
Chloromethane	415 J	445 J	664 J	606 J	610 J
1,2-Dichlorobenzene	-	**565**	**2,070**	**2,790**	**764**
Dichlorodifluoromethane	156 J	216 J	225 J	198 J	274 J
Ethylbenzene	154 J	150 J	388 J	168 J	192 J
Hexachlorobutadiene	-	-	-	341 J	262 J
Isopropylbenzene	-	58.8 J	93.8 J	102 J	-
p-Isopropyltoluene	-	-	184 J	-	-
1,1,2,2-Tetrachloroethane	-	3,080	1,780	495	324 J
Tetrachloroethene	-	9,330	13,400	2,130	431 J
Toluene	-	78.9 J	78.7 J	78.7 J	-
Trichloroethene	-	2,220	3,280	1,060	246 J
Trichlorofluoromethane	351 J	629 J	740 J	629 J	801 J
o-Xylene	91.9 J	61.1 J	164 J	106 J	110 J
m, p -Xylene	318 J	212 J	584	318 J	356 J

TABLE 38 - Carbon						
TOTAL VOLATILES	Control (µg/Kg) Result	AS 10 min (µg/Kg) Result	AS 30 min (µg/Kg) Result	AS 60 min (µg/Kg) Result	AS 90 min (µg/Kg) Result	AS 135 min (µg/Kg) Result
Acetone	-	2,820	3,830	4,990	7,040	15,000
Benzene	-	71.4 J	-	-	-	
Bromoform	-	130 J	113 J	-	-	
Bromomethane	102 J	103 J	-	-	-	
2-Butanone	-	**1010 J**	**1,230**	**1,460**	**2,420**	**4,600**
Carbon tetrachloride	-	291 J	86.1 J	-	-	
Chlorobenzene	-	68.3 J	60.5 J	-	-	
Chloromethane	437 J	474 J	444 J	412 J	376 J	360 J
1,2-Dichlorobenzene	-	**1,970**	**4,840**	**2,930**	**1,270**	**1,320**
Dichlorodifluoromethane	-	140 J	-	-	-	260 J
1,2-Dichloroethane	-	-	-	-	-	50.2 J
Ethylbenzene	124 J	361 J	745	129 J	423 J	182 J
2-Hexanone	-	-	-	-	-	389 J
Hexachlorobutadiene	-	177 J	322 J	320 J	309 J	573
Isopropylbenzene	-	223 J	320 J	82.4 J	69.1 J	
1,1,2,2-Tetrachloroethane	-	3,030	3,190	1,210	704	1,050
Tetrachloroethene	-	**17,500**	**13,300**	**1,890**	**571**	**602**
Toluene	-	123 J	78.1 J	-	-	
Trichloroethene	-	3,750	3,120	846	294 J	264 J
Trichlorofluoromethane	-	357 J	-	157 J	-	492 J
1,3,5-Trimethylbenzene	-	-	63.4 J	-	56.7 J	
o-Xylene	59.7 J	161 J	378 J	69.3 J	248 J	96.4 J
m, p -Xylene	244 J	580	1,250	216 J	782	314 J

5.4. Solidification / Stabilization of Air Stripped Material – Verification Testing

5.4.1. Solidification / Stabilization Procedures of Air Stripped Material

Immediately following air stripping activities KEMRON applied one mixture design to both aliquots of the air-stripped material. The following is a presentation of the two mixture designs utilized:

TABLE 42				
KEMRON SAMPLE No.	PRETREATMENT STRIPPING TIME	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)
SE0190-019	90 minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15
SE0190-020	135 minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15

Development of each mixture was performed in accordance with the previously outlined protocol Volumetric expansion and Penetrometer testing were complete on the treated materials where data is presented in **Tables 41 and 39**, respectively.

Volumetric Expansion

Volumetric expansion testing was completed to estimate the increase in material volume due to treatment. KEMRON measures volumetric expansion by determining the volume of an aliquot of untreated material. That material is then subjected to treatment and the volume is once again measured following 21 days of curing. KEMRON then calculates the change in volume by the following formula:

$((Volume_{final} - Volume_{initial}) / Volume_{initial}) * 100\%$

Volumetric expansion testing is summarized in **Table 41**. Review of **Table 41** indicates that an increase in volume ranging from 15 to 18% may be expected from treatment activities.

TESTING PARAMETER	RESULTS 0190-019	RESULTS 0190-020
Volumetric Expansion	17.77	15.09

Penetrometer Testing

During the curing process penetrometer testing indicated that both treated materials exhibited penetrometer strengths in excess of 4.5 TSF after only one day of curing. The results of pocket penetrometer testing are summarized in **Table 39**.

5.4.1.1. Chemical and Physical Property Testing Results

Following 21 days of curing each treated material was subjected to UCS testing and total and SPLP volatiles and semivolatiles in accordance with the previously referenced test method.

5.4.1.1.1. UCS Testing

Following a 21-day curing interval, each treated material was removed from the cylindrical curing mold and subjected to UCS testing. The results of UCS testing performed are included in **Table 40** where a condensed version is presented below.

TABLE 40				
KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	UCS (lbs/in^2)
SE0190-019	Cement / Class "C" Fly Ash	7.5 / 15	8.15	704.5
SE0190-020	Cement / Class "C" Fly Ash	7.5 / 15	8.15	640.0

A review of **Table 40** indicates that both treated materials exhibited unconfined strengths in excess of 600 psi. Additional review also shows that these mixtures contained less moisture than similar mixtures previously evaluated indicating that greater strengths may be attributed to lower moisture contents.

5.4.1.1.2. Unit Weight and Moisture Testing

Following a 21-day curing interval, each treated material was tested for unit weight and moisture. The results of testing performed are included in **Table 41** where a condensed version is presented below.

TABLE 41				
TESTING PARAMETER	TEST METHOD	UNIT	RESULTS 0190-019	RESULTS 0190-020
Unit Weight	ASTM D2937	lb/ft^3	129.3	127.6
Moisture Content	ASTM D2216	%	20.12	17.34
Percent Solids	EPA	%	83.25	85.22

5.4.1.1.3. Chemical Testing

In addition to UCS testing KEMRON subjected aliquots of each treated material to total and SPLP volatile and semivolatile organic analyses. The results are presented in **Tables 29 through 36**.

Total Volatiles

The total volatiles data is reported in **Tables 29 and 30**. The data presentations below are condensed versions of these reports with solidified results highlighted in red, facilitating volatiles data discussion. Review of total volatile organics analyses presented in **Tables 29 and 30** indicate that S/S treatment further reduced contamination as compared to the final air stripping data and the Baseline testing. Note that the baseline results for sample SE0190-019 presented in **Table 29** appear slightly higher than those reported for SE0190-020 found in **Table 30**. This point may be significant when comparing the contaminant reduction differences between a 90

minute and a 135 minute air stripping event. However, the end results are very similar. Specifically, it appears that significant treatment benefits may not be realized by extending the air stripping activities from 90 to 135 minutes.

TABLE 29 (0190-019)

TOTAL VOLATILES	Baseline (µg/Kg) Result	AS 10 min (µg/Kg) Result	AS 30 min (µg/Kg) Result	AS 60 min (µg/Kg) Result	AS 90 min (µg/Kg) Result	AS & SS (µg/Kg) Result
1,2-Dichlorobenzene	3,320,000	786,000	516,000	267,000	161,000	24,700 J
1,4-Dichlorobenzene	23,200	5,960 J	4,290 J	1,990 J	1,340 J	586 J
Hexachlorobutadiene	19,100	4,040 J	5,080 J	5,640 J	3,360 J	812 J
Tetrachloroethene	709,000	37,600	35,300	22,600	21,000	6,090
Trichloroethene	19,800	-	2,010 J	1,800 J	2,430 J	1,650

TABLE 30 (0190-020)

TOTAL VOLATILES	Baseline (µg/Kg) Result	AS 10 min (µg/Kg) Result	AS 30 min (µg/Kg) Result	AS 60 min (µg/Kg) Result	AS 90 min (µg/Kg) Result	AS 135 min (µg/Kg) Result	AS & SS (µg/Kg) Result
1,2-Dichlorobenzene	2,130,000	908,000	481,000	884,000	152,000	115,000	30,100 J
1,4-Dichlorobenzene	20,000	6,500	3,470 J	7,990 J	1,160 J	1,370 J	422 J
Hexachlorobutadiene	16,900	7,500	8,470 J	5,660 J	2,470 J	2,530 J	754 J
Tetrachloroethene	433,000	69,000	24,900	151,000	7,480	25,500	4,090
Trichloroethene	14,700	1,550	-	10,100 J	782 J	3,460 J	1,460

SPLP Volatiles

The SPLP volatiles data is reported in **Tables 31 and 32**. The data presentations below are condensed versions of these reports with solidified results highlighted in red, facilitating SPLP volatiles data discussion. Review of the SPLP volatile organics data presented in **Tables 31** and 32 indicate that analyses on both samples 019 and 020 resulted in very similar results in the baseline and the final treated data. This data indicates that longer air stripping treatment may not significantly increase the treatment effectiveness.

TABLE 31 - (0190-019)

SPLP VOLATILES	Baseline (µg/L) Result	Baseline (µg/L) DL	AS & SS 0190-019 (µg/L) Result	AS & SS 0190-019 (µg/L) DL
1,2-Dichlorobenzene	57,900 I	12.5	947	0.625
Tetrachloroethene	11,300	25.0	44.3	1.25
Trichloroethene	442 J	25.0	38.8	1.25

I Semiquantitative resutl (above instrument calibration range)

TABLE 32 – (0190-020)				
SPLP VOLATILES	Baseline (µg/L)		AS & SS 0190-020 (µg/L)	
	Result	DL	Result	DL
1,2-Dichlorobenzene	54,700 I	12.5	777	0.625
Tetrachloroethene	10,100	25.0	25.9	1.25
Trichloroethene	498 J	25.0	23.6 J	1.25

I Semiquantitative resutl (above instrument calibration range)

Total Semivolatiles

The results of total and SPLP semivolatile organic analyses presented in **Tables 33 through 36** indicate that both baseline samples exhibited similar analytical results. It appears that a longer air stripping retention may offer some benefit in some of the semivolatile analytes on a total contaminant basis. However leachable results indicate very little difference between the two treated samples.

TABLE 33 (0190-019)				
TOTAL SEMIVOLATILES	Baseline (µg/Kg)		AS & SS (0190-019) (µg/Kg)	
	Result	DL	Result	DL
1,4-Dichlorobenzene	1,970	488	-	820
1,2-Dichlorobenzene	101,000	1,950	28,300	820
Hexachloroethane	2,580	488	-	820
Benzoic acid	42,200	7,810	-	3,280
2,4-Dichlorophenol	713 J	488	-	820
Hexachlorobutadiene	701 J	488	-	820
Hexachlorobenzene	2,760	488	8,130	820

TABLE 34 (0190-020)				
TOTAL SEMIVOLATILES	Baseline (µg/Kg)		AS & SS (0190-020) (µg/Kg)	
	Result	DL	Result	DL
1,4-Dichlorobenzene	2,020	492	-	802
1,2-Dichlorobenzene	105,000	1,970	26,800	802
Hexachloroethane	2,690	492	-	802
Benzoic acid	40,300	7,880	-	3,210
2,4-Dichlorophenol	723 J	492	-	802
Hexachlorobutadiene	706 J	492	-	802
Hexachlorobenzene	2,360	492	5,260	802

TABLE 35 (0190-019)				
SPLP SEMIVOLATILES	Baseline (µg/L)		AS & SS (0190-019) (µg/L)	
	Result	DL	Result	DL
1,4-Dichlorobenzene	156	25.5	-	25.5
1,2-Dichlorobenzene	22,800	1,280	689	25.5
Hexachloroethane	178	25.5	-	25.5
Benzoic acid	6,220	1,280	3,910	638
2,4-Dichlorophenol	32.1 J	25.5	384	25.5

TABLE 36 (0190-020)				
SPLP SEMIVOLATILES	Baseline (µg/L)		AS & SS (0190-020) (µg/L)	
	Result	DL	Result	DL
1,4-Dichlorobenzene	142	25.5	-	25.5
1,2-Dichlorobenzene	20,700	1,280	503	25.5
Hexachloroethane	161	25.5	-	25.5
Benzoic acid	5,910	1,280	4,530	638
2,4-Dichlorophenol	29.5 J	25.5	409	25.5

5.5. Conclusions to the Verification Testing

Review of the results of verification testing indicate that in general the additional 45 minutes of air stripping is not greatly affecting the stabilized material in strength, total analyte concentrations, and leachable concentrations.

6.0 FINAL STUDY DISCUSSION

The objectives of this treatability study were as follows:

- To evaluate the effectiveness of air stripping for reducing VOC concentrations prior to introduction of the various S/S agents;
- To identify formulations using cement- and clay-based S/S agents that will provide the desired bearing strength and physical characteristics;
- To evaluate the reduction in total constituent concentration achieved by the selected S/S agent formulations;
- To evaluate the reduction in constituent mobility provided by the selected S/S agent formulations; and
- To evaluate whether zero-valent iron amendments provide additional reduction in total constituent concentrations.

The study objectives were met as treatment options were tested and either eliminated or re-evaluated at later phases of the study. The zero valent iron pretreatment was determined earlier in the study to exhibit lower strength than the air stripping pretreatment. Additionally, air stripping was more effective at reducing the mass of volatiles than the zero valent iron. Later phases of the study eliminated further testing of the zero valent iron pretreatment.

The Air Stripping demonstrated to be effective as a pretreatment for the untreated materials; however the increase in air stripping duration from 90 minutes to 135 minutes did not appear to change total or leachable results significantly (i.e., on orders of magnitude). The mix design tested in the verification phase of the study included Cement and Class "C" fly ash at an addition rate of 7.5% and 15%, respectively. The UCS determined for the testing in the verification phase exhibited very high strengths.

The chemical analyses for total and SPLP volatiles and semivolatiles exhibited significant reductions in contaminants. The design of the data collection allowed a progressive review of data over the duration of air stripping pretreatment for total volatiles. When comparing the soil results following the end of the air stripping pretreatment with the baseline and the solidified air stripped soil, there are significant volatile reductions.

For instance, 1,2-dichlorobenzene had a baseline concentration of 3,320,000 ug/kg, a 90 minutes air stripping pretreatment concentration of 161,000 ug/kg and a solidification / stabilization treatment result of 24,700 ug/Kg (J flagged result – quantitatively estimated). Furthermore, the 21-day contaminant loss evaluation, exhibited results for the time "0" and the Day 21 at 1,540,333 ug/Kg and 854,000 ug/Kg, respectively. This 21-day contaminant loss evaluation was the maximum loss expected over the duration of the verification testing. Since the final stabilized 1,2-dichlorobenzene detections demonstrate a loss much greater than that observed for the 21-day contaminant loss evaluation, the air stripping, solidification dual treatment is demonstrated to be effective.

Similar results are demonstrated for the SPLP volatiles where the baseline and air stripped solidified material have reported detections of 57,900 ug/L (I flagged results for over the calibration range) and 947 ug/L, respectively for 1,2-dichlorobenzene. Furthermore, the 21-day contaminant loss evaluation for SPLP 1,2-dichlorobenzene is observed to be 58,900 ug/L (I flagged results for over the calibration range) for the Time "0" and 34,600 ug/L for the Day 21. The loss found in the treatment samples is much greater, indicating that the treatment is effective and testing conditions were not adversely affecting the treatment evaluation.

The total and SPLP semivolatile data demonstrate similar effectiveness as the total and SPLP volatile data. Similarly, the 21-day contaminant loss evaluation for the semivolatiles analyses demonstrates reduced losses as compared to those observed in the corresponding dual treated semivolatiles analyses.

TABLES

Data contained on this sheet shall not be disclosed without prior approval from KEMRON Environmental Services, Inc. (Proprietary)

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TABLE 1
UNTREATED MATERIAL CHARACTERIZATION
MATERIAL pH AND PHYSICAL PROPERTY TESTING

TESTING PARAMETER	TEST METHOD	UNIT	RESULTS SB06-SLG-08-13
CHEMICAL PROPERTIES			
Material pH	EPA 9045	s.u.	6.32
PHYSICAL PROPERTIES			
Unit Weight	ASTM D2937	lb/ft^3	118.0
Moisture Content	ASTM D2216	%	31.63
Percent Solids	EPA	%	76.07
Specific Gravity	ASTM D854	-	2.71

E - samples are above the quantitiation limits of the instrument

s.u. - standard unit

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TABLE 2

Untreated Material Characterization
Summary of Total Volatile Analyses - EPA Method 8260B

TOTAL VOLATILES	RESULTS (µg/Kg)															
	UNTREATED - A			UNTREATED - B			UNTREATED - C			Average		MATRIX SPIKE		MATRIX SPK DUP		
	Result		DL	Result		DL	Result		DL	Result	DL	Result	DL	Result	DL	RPD
Acetone	-		135,000	-		141,000	-		149,000	-	141,667	772,000	136,000	838,000	153,000	8
Benzene	51400	J	13,500	43900	J	14,100	48500	J	14,900	47,933	14,167	602,000	13,600	650,000	15,300	8
Bromobenzene	-		13,500	-		14,100	-		14,900	-	14,167	566,000	13,600	624,000	15,300	10
Bromochloromethane	-		13,500	-		14,100	-		14,900	-	14,167	602,000	13,600	658,000	15,300	9
Bromodichloromethane	-		13,500	-		14,100	-		14,900	-	14,167	659,000	13,600	710,000	15,300	7
Bromoform	-		13,500	-		14,100	-		14,900	-	14,167	599,000	13,600	655,000	15,300	9
Bromomethane	-		26,900	-		28,100	-		29,800	-	28,267	566,000	27,100	598,000	30,500	5
2-Butanone	-		67,300	-		70,400	-		74,600	-	70,767	646,000	67,900	689,000	76,400	6
n-Butylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	567,000	13,600	613,000	15,300	8
sec-Butylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	577,000	13,600	622,000	15,300	8
tert-Butylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	521,000	13,600	579,000	15,300	11
Carbon disulfide	-		13,500	-		14,100	-		14,900	-	14,167	540,000	13,600	565,000	15,300	5
Carbon tetrachloride			13,500	-		14,100	-		14,900	-	14,167	686,000	13,600	717,000	15,300	4
Chlorobenzene	30300	J	13,500	29000	J	14,100	29500	J	14,900	29,600	14,167	572,000	13,600	629,000	15,300	9
Chlorodibromomethane	-		13,500	-		14,100	-		14,900	-	14,167	551,000	13,600	590,000	15,300	7
Chloroethane	-		26,900	-		28,100	-		29,800	-	28,267	580,000	27,100	628,000	30,500	8
2-Chloroethyl vinyl ether	-		53,800	-		56,300	-		59,700	-	56,600	591,000	54,300	604,000	61,100	2
Chloroform	-		13,500	-		14,100	-		14,900	-	14,167	624,000	13,600	663,000	15,300	6
Chloromethane	-		53,800	-		56,300	-		59,700	-	56,600	653,000	54,300	698,000	61,100	7
2-Chlorotoluene	-		13,500	-		14,100	-		14,900	-	14,167	590,000	13,600	658,000	15,300	11
4-Chlorotoluene	-		13,500	-		14,100	-		14,900	-	14,167	583,000	13,600	623,000	15,300	7
1,2-Dibromo-3-chloropropane	-		53,800	-		56,300	-		59,700	-	56,600	511,000	54,300	559,000	61,100	9
1,2-Dibromoethane	-		13,500	-		14,100	-		14,900	-	14,167	621,000	13,600	672,000	15,300	8
Dibromomethane	-		13,500	-		14,100	-		14,900	-	14,167	643,000	13,600	701,000	15,300	9
1,2-Dichlorobenzene	3,880,000		13,500	3,410,000		14,100	3,330,000		14,900	3,540,000	14,167	3,690,000	13,600	4,040,000	15,300	9
1,3-Dichlorobenzene	-		13,500	-		14,100	-		14,900	-	14,167	545,000	13,600	594,000	15,300	9
1,4-Dichlorobenzene	29,600	J	13,500	27,500	J	14,100	26,500	J	14,900	27,867	14,167	557,000	13,600	614,000	15,300	10
Dichlorodifluoromethane	-		26,900	-		28,100	-		29,800	-	28,267	599,000	27,100	615,000	30,500	3

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TABLE 2

Untreated Material Characterization
Summary of Total Volatile Analyses - EPA Method 8260B

TOTAL VOLATILES	RESULTS (µg/Kg)															
	UNTREATED - A			UNTREATED - B			UNTREATED - C			Average		MATRIX SPIKE		MATRIX SPK DUP		
	Result		DL	Result		DL	Result		DL	Result	DL	Result	DL	Result	DL	RPD
1,1-Dichloroethane	-		26,900	-		28,100	-		29,800	-	28,267	606,000	27,100	654,000	30,500	8
1,2-Dichloroethane	-		13,500	-		14,100	-		14,900	-	14,167	690,000	13,600	748,000	15,300	8
1,1-Dichloroethene	-		13,500	-		14,100	-		14,900	-	14,167	586,000	13,600	630,000	15,300	7
cis-1,2-Dichloroethene	-		13,500	-		14,100	-		14,900	-	14,167	577,000	13,600	631,000	15,300	9
trans-1,2-Dichloroethene	-		13,500	-		14,100	-		14,900	-	14,167	587,000	13,600	625,000	15,300	6
1,2-Dichloropropane	-		13,500	-		14,100	-		14,900	-	14,167	597,000	13,600	647,000	15,300	8
1,3-Dichloropropane	-		13,500	-		14,100	-		14,900	-	14,167	609,000	13,600	664,000	15,300	9
2,2-Dichloropropane	-		13,500	-		14,100	-		14,900	-	14,167	632,000	13,600	656,000	15,300	4
cis-1,3-Dichloropropene	-		13,500	-		14,100	-		14,900	-	14,167	619,000	13,600	669,000	15,300	8
trans-1,3-Dichloropropene	-		13,500	-		14,100	-		14,900	-	14,167	576,000	13,600	631,000	15,300	9
1,1-Dichloropropene	-		13,500	-		14,100	-		14,900	-	14,167	612,000	13,600	649,000	15,300	6
Ethylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	583,000	13,600	637,000	15,300	9
2-Hexanone	-		67,300	-		70,400	-		74,600	-	70,767	615,000	67,900	666,000	76,400	8
Hexachlorobutadiene (1)	-		13,500	-		14,100	18,600	J	14,900	6,200	14,167	568,000	13,600	637,000	15,300	11
Isopropylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	552,000	13,600	591,000	15,300	7
p-Isopropyltoluene	-		13,500	-		14,100	-		14,900	-	14,167	534,000	13,600	586,000	15,300	9
4-Methyl-2-pentanone	-		67,300	-		70,400	-		74,600	-	70,767	595,000	67,900	661,000	76,400	11
Methylene chloride	-		26,900	-		28,100	-		29,800	-	28,267	522,000	27,100	582,000	30,500	11
Naphthalene	-		13,500	-		14,100	-		14,900	-	14,167	528,000	13,600	600,000	15,300	13
n-Propylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	584,000	13,600	635,000	15,300	8
Styrene	-		13,500	-		14,100	-		14,900	-	14,167	534,000	13,600	572,000	15,300	7
1,1,1,2-Tetrachloroethane	-		13,500	-		14,100	-		14,900	-	14,167	624,000	13,600	673,000	15,300	8
1,1,2,2-Tetrachloroethane	241,000		13,500	202,000		14,100	192,000		14,900	211,667	14,167	809,000	13,600	899,000	15,300	11
Tetrachloroethene	966,000		13,500	874,000		14,100	888,000		14,900	909,333	14,167	1,410,000	13,600	1,510,000	15,300	7
Toluene	35,900	J	13,500	31,400	J	14,100	33,400	J	14,900	33,567	14,167	595,000	13,600	648,000	15,300	9

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TABLE 2

Untreated Material Characterization
Summary of Total Volatile Analyses - EPA Method 8260B

TOTAL VOLATILES	RESULTS (µg/Kg)															
	UNTREATED - A			UNTREATED - B			UNTREATED - C			Average		MATRIX SPIKE		MATRIX SPK DUP		
	Result		DL	Result		DL	Result		DL	Result	DL	Result	DL	Result	DL	RPD
1,2,3-Trichlorobenzene	-		13,500	-		14,100	-		14,900	-	14,167	516,000	13,600	581,000	15,300	12
1,2,4-Trichlorobenzene	-		13,500	-		14,100	-		14,900	-	14,167	528,000	13,600	576,000	15,300	9
1,1,1-Trichloroethane	-		13,500	-		14,100	-		14,900	-	14,167	675,000	13,600	699,000	15,300	3
1,1,2-Trichloroethane	-		13,500	-		14,100	-		14,900	-	14,167	603,000	13,600	684,000	15,300	13
Trichloroethene	73,600	J	13,500	59,900	J	14,100	63,600	J	14,900	65,700	14,167	641,000	13,600	687,000	15,300	7
Trichlorofluoromethane	-		26,900	-		28,100	-		29,800	-	28,267	577,000	27,100	599,000	30,500	4
1,2,3-Trichloropropane	-		26,900	-		28,100	-		29,800	-	28,267	611,000	27,100	662,000	30,500	8
1,2,4-Trimethylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	575,000	13,600	631,000	15,300	9
1,3,5-Trimethylbenzene	-		13,500	-		14,100	-		14,900	-	14,167	595,000	13,600	649,000	15,300	9
Vinyl acetate	-		26,900	-		28,100	-		29,800	-	28,267	158,000	27,100	173,000	30,500	9
Vinyl chloride	-		26,900	-		28,100	-		29,800	-	28,267	621,000	27,100	651,000	30,500	5
o-Xylene	-		13,500	-		14,100	-		14,900	-	14,167	578,000	13,600	628,000	15,300	8
m, p -Xylene	30,200	J	13,500	26,300	J	14,100	29,700	J	14,900	28,733	14,167	1,180,000	13,600	1,260,000	15,300	7
										4,900,600						

(1) Average result is based on less than 3 values
- Not detected above the analytical Method Detection Limit.
J The analyte was positively identified, but the quantitation was between the analytical Reporting Limit (RL) and the Method Detection Limit (DL).
DL Detection Limit

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TABLE 3

UNTREATED MATERIAL CHARACTERIZATION
Summary of SPLP Volatiles Analyses - EPA Method 1312 / 8260B

SPLP VOLATILES	RESULTS (µg/L)										
	UNTREATED - A			UNTREATED - B			UNTREATED - C			Average	
	Result		Detection Limit	Result		Detection Limit	Result		Detection Limit	Result	Detection Limit
Acetone	-		1250	-		1250	-		1250	-	1,250
Benzene	3220		62.5	2400	J	62.5	2350	J	62.5	2,657	63
Bromobenzene	-		62.5	-		62.5	-		62.5	-	63
Bromochloromethane	-		100	-		100	-		100	-	100
Bromodichloromethane	-		125	-		125	-		125	-	125
Bromoform	-		250	-		250	-		250	-	250
Bromomethane	-		250	-		250	-		250	-	250
2-Butanone	-		1250	-		1250	-		1250	-	1,250
n-Butylbenzene	-		125	-		125	-		125	-	125
sec-Butylbenzene	-		125	-		125	-		125	-	125
tert-Butylbenzene	-		125	-		125	-		125	-	125
Carbon disulfide	-		250	-		250	-		250	-	250
Carbon tetrachloride	-		125	-		125	-		125	-	125
Chlorobenzene	1380	J	62.5	1280	J	62.5	1250	J	62.5	1,303	63
Chlorodibromomethane	-		125	-		125	-		125	-	125
Chloroethane	-		250	-		250	-		250	-	250
2-Chloroethyl vinyl ether	-		5000	-		5000	-		5000	-	5,000
Chloroform (1)	67.4	J	62.5	-		62.5	-		62.5	22	63
Chloromethane	-		125	-		125	-		125	-	125
2-Chlorotoluene	-		62.5	-		62.5	-		62.5	-	63
4-Chlorotoluene	-		125	-		125	-		125	-	125
1,2-Dibromo-3-chloropropane	-		500	-		500	-		500	-	500
1,2-Dibromoethane	-		125	-		125	-		125	-	125
Dibromomethane	-		125	-		125	-		125	-	125
1,2-Dichlorobenzene	80800		62.5	92300		62.5	92300		62.5	88,467	63
1,3-Dichlorobenzene	-		125	-		125	-		125	-	125
1,4-Dichlorobenzene	567	J	62.5	659	J	62.5	604	J	62.5	610	63
Dichlorodifluoromethane	-		125	-		125	-		125	-	125
1,1-Dichloroethane	-		62.5	-		62.5	-		62.5	-	63
1,2-Dichloroethane	482	J	125	304	J	125	286	J	125	357	125
1,1-Dichloroethene	-		250	-		250	-		250	-	250
cis-1,2-Dichloroethene	-		125	-		125	-		125	-	125
trans-1,2-Dichloroethene	-		125	-		125	-		125	-	125
1,2-Dichloropropane	-		100	-		100	-		100	-	100
1,3-Dichloropropane	-		100	-		100	-		100	-	100
2,2-Dichloropropane	-		125	-		125	-		125	-	125

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL

TABLE 3

UNTREATED MATERIAL CHARACTERIZATION
Summary of SPLP Volatiles Analyses - EPA Method 1312 / 8260B

SPLP VOLATILES	RESULTS (µg/L)										
	UNTREATED - A			UNTREATED - B			UNTREATED - C			Average	
	Result		Detection Limit	Result		Detection Limit	Result		Detection Limit	Result	Detection Limit
cis-1,3-Dichloropropene	-		125	-		125	-		125	-	125
trans-1,3-Dichloropropene	-		250	-		250	-		250	-	250
1,1-Dichloropropene	-		125	-		125	-		125	-	125
Ethylbenzene	265	J	125	273	J	125	268	J	125	269	125
2-Hexanone	-		1250	-		1250	-		1250	-	1,250
Hexachlorobutadiene	-		125	-		125	-		125	-	125
Isopropylbenzene	388	J	125	397	J	125	395	J	125	393	125
p-Isopropyltoluene	-		125	-		125	-		125	-	125
4-Methyl-2-pentanone	-		1250	-		1250	-		1250	-	1,250
Methylene chloride	-		125	-		125	-		125	-	125
Naphthalene	-		100	-		100	-		100	-	100
n-Propylbenzene	-		62.5	-		62.5	-		62.5	-	63
Styrene	-		62.5	-		62.5	-		62.5	-	63
1,1,1,2-Tetrachloroethane	-		125	-		125	-		125	-	125
1,1,2,2-Tetrachloroethane	13000		62.5	10300		62.5	10600		62.5	11,300	63
Tetrachloroethene	27000		125	30600		125	29000		125	28,867	125
Toluene	1760	J	125	1570	J	125	1560	J	125	1,630	125
1,2,3-Trichlorobenzene	-		62.5	-		62.5	-		62.5	-	63
1,2,4-Trichlorobenzene	-		100	-		100	-		100	-	100
1,1,1-Trichloroethane	-		125	-		125	-		125	-	125
1,1,2-Trichloroethane	-		125	-		125	-		125	-	125
Trichloroethene	3610		125	3120		125	3020		125	3,250	125
Trichlorofluoromethane	-		125	-		125	-		125	-	125
1,2,3-Trichloropropane	-		250	-		250	-		250	-	250
1,2,4-Trimethylbenzene	-		125	-		125	-		125	-	125
1,3,5-Trimethylbenzene	-		125	-		125	-		125	-	125
Vinyl acetate	-		1250	-		1250	-		1250	-	1,250
Vinyl chloride	-		125	-		125	-		125	-	125
o-Xylene	161	J	125	162	J	125	137	J	125	153	125
m, p -Xylene	924	J	125	970	J	125	955	J	125	950	125

(1) Average result is based on less than 3 values

\- Not detected above the analytical Method Detection Limit.

J The analyte was positively identified, but the quantitation was between the analytical Reporting Limit (RL) and the Method Detection Limit (DL).

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 4
UNTREATED MATERIAL CHARACTERIZATION
Summary of Total Semivolatile Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	RESULTS (µg/Kg)												
	UNTREATED - A		UNTREATED - B		UNTREATED - C		AVERAGE		MATRIX SPIKE		MATRIX SPK DUP		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	RPD
Phenol	-	1,050	-	1,110	-	1,110	-	1,090	1,440	1,150	1,940	1,130	30
Bis (2-Chloroethyl) ether	-	1,050	-	1,110	-	1,110	-	1,090	1,420	1,150	1,790	1,130	23
2-Chlorophenol	-	1,050	-	1,110	-	1,110	-	1,090	1,200	1,150	1,550	1,130	25
1,3-Dichlorobenzene	-	1,050	-	1,110	-	1,110	-	1,090	1,630	1,150	2,010	1,130	21
1,4-Dichlorobenzene	6,150	1,050	7,540	1,110	8,350	1,110	7,347	1,090	10,200	1,150	12,300	1,130	19
Benzyl alcohol	-	1,050	-	1,110	-	1,110	-	1,090	1,390	1,150	1,940	1,130	33
1,2-Dichlorobenzene	######	52,300	976,000	55,600	1,110,000	55,600	974,667	54,500	602,000	1,150	683,000	1,130	13
2-Methylphenol	-	1,050	-	1,110	-	1,110	-	1,090	7,410	1,150	8,560	1,130	14
3-,4-Methylphenol	-	1,050	-	1,110	-	1,110	-	1,090	1,560	1,150	2,170	1,130	33
bis (2-Chloroisopropyl) ether (a)	-	1,050	-	1,110	-	1,110	-	1,090	-	1,150	1,280	1,130	N/A
N-Nitroso-di-n-propylamine	-	1,050	-	1,110	-	1,110	-	1,090	1,420	1,150	1,960	1,130	32
Hexachloroethane	6,220	1,050	9,780	1,110	11,000	1,110	9,000	1,090	12,900	1,150	17,100	1,130	28
Nitrobenzene	-	1,050	-	1,110	-	1,110	-	1,090	4,380	1,150	5,490	1,130	22
Isophorone	-	1,050	-	1,110	-	1,110	-	1,090	1,510	1,150	2,090	1,130	32
2-Nitrophenol (a)	-	1,050	-	1,110	-	1,110	-	1,090	-	1,150	1,370	1,130	N/A
2,4-Dimethylphenol	-	1,050	-	1,110	-	1,110	-	1,090	1,470	1,150	2,050	1,130	33
Benzoic acid	58,100	4,180	68,700	4,450	61,500	4,450	62,767	4,360	75,700	4,580	92,900	4,500	20
Bis (2-Chloroethoxy) Methane	-	1,050	-	1,110	-	1,110	-	1,090	1,360	1,150	1,930	1,130	35
2,4-Dichlorophenol	-	1,050	-	1,110	-	1,110	-	1,090	2,600	1,150	3,370	1,130	26
1,2,4-Trichlorobenzene	-	1,050	-	1,110	-	1,110	-	1,090	2,070	1,150	2,700	1,130	26
Naphthalene	-	1,050	-	1,110	-	1,110	-	1,090	1,750	1,150	2,310	1,130	28

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 4
UNTREATED MATERIAL CHARACTERIZATION
Summary of Total Semivolatile Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	RESULTS (µg/Kg)														
	UNTREATED - A			UNTREATED - B			UNTREATED - C			AVERAGE		MATRIX SPIKE		MATRIX SPK DUP		
	Result		DL	Result		DL	Result		DL	Result	DL	Result	DL	Result	DL	RPD
4-Chloroaniline	-		1,050	-		1,110	-		1,110	-	1,090	1,340	1,150	1,730	1,130	25
Hexachlorobutadiene	1,370	J	1,050	2,630		1,110	2,790		1,110	2,263	1,090	4,190	1,150	6,030	1,130	36
4-Chloro-3-methylphenol	-		1,050	-		1,110	-		1,110	-	1,090	2,130	1,150	2,610	1,130	20
2-Methylnaphthalene	-		1,050	-		1,110	-		1,110	-	1,090	1,470	1,150	2,010	1,130	31
Hexachlorocyclopentadiene	-		1,050	-		1,110	-		1,110	-	1,090	-	1,150	-	1,130	-
2,4,6-Trichlorophenol	-		1,050	-		1,110	-		1,110	-	1,090	2,000	1,150	2,550	1,130	24
2,4,5-Trichlorophenol	-		1,050	-		1,110	-		1,110	-	1,090	1,830	1,150	2,300	1,130	23
2-Chloronaphthalene	-		1,050	-		1,110	-		1,110	-	1,090	1,300	1,150	1,750	1,130	30
2-Nitroaniline (a)	-		4,180	-		4,450	-		4,450	-	4,360	-	4,580	5,630	4,500	N/A
Dimethylphthalate	-		1,050	-		1,110	-		1,110	-	1,090	2,220	1,150	2,650	1,130	18
Acenaphthylene	-		1,050	-		1,110	-		1,110	-	1,090	1,800	1,150	2,320	1,130	25
2,6-Dinitrotoluene	-		1,050	-		1,110	-		1,110	-	1,090	2,030	1,150	2,490	1,130	20
3-Nitroaniline	-		4,180	-		4,450	-		4,450	-	4,360	-	4,580	-	4,500	-
Acenaphthene	-		1,050	-		1,110	-		1,110	-	1,090	1,680	1,150	2,140	1,130	24
2,4-Dinitrophenol	-		4,180	-		4,450	-		4,450	-	4,360	-	4,580	-	4,500	-
4-Nitrophenol	-		4,180	-		4,450	-		4,450	-	4,360	-	4,580	-	4,500	-
Dibenzofuran	-		1,050	-		1,110	-		1,110	-	1,090	1,940	1,150	2,360	1,130	20
2,4-Dinitrotoluene	-		1,050	-		1,110	-		1,110	-	1,090	2,320	1,150	2,740	1,130	17
Diethylphthalate	-		1,050	-		1,110	-		1,110	-	1,090	2,230	1,150	2,630	1,130	16
4-Chlorophenyl-phenyl ether	-		1,050	-		1,110	-		1,110	-	1,090	1,850	1,150	2,280	1,130	21
Fluorene	-		1,050	-		1,110	-		1,110	-	1,090	1,960	1,150	2,370	1,130	19
4-Nitroaniline	-		4,180	-		4,450	-		4,450	-	4,360	-	4,580	-	4,500	-
4,6-Dinitro-2-methylphenol	-		4,180	-		4,450	-		4,450	-	4,360	27,100	4,580	26,400	4,500	-3

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 4
UNTREATED MATERIAL CHARACTERIZATION
Summary of Total Semivolatile Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	RESULTS (µg/Kg)												
	UNTREATED - A		UNTREATED - B		UNTREATED - C		AVERAGE		MATRIX SPIKE		MATRIX SPK DUP		
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	RPD
N-Nitrosodiphenylamine	-	1,050	-	1,110	-	1,110	-	1,090	1,730	1,150	2,040	1,130	16
4-Bromophenyl-phenylether	-	1,050	-	1,110	-	1,110	-	1,090	1,720	1,150	2,030	1,130	17
Hexachlorobenzene	2,810	1,050	8,670	1,110	6,590	1,110	6,023	1,090	12,300	1,150	14,900	1,130	19
Pentachlorophenol	-	4,180	-	4,450	-	4,450	-	4,360	-	4,580	-	4,500	-
Phenanthrene	-	1,050	-	1,110	-	1,110	-	1,090	2,260	1,150	2,670	1,130	17
Anthracene	-	1,050	-	1,110	-	1,110	-	1,090	2,090	1,150	2,420	1,130	15
Di-n-butylphthalate	-	1,050	-	1,110	-	1,110	-	1,090	2,300	1,150	2,750	1,130	18
Fluoranthene	-	1,050	-	1,110	-	1,110	-	1,090	2,250	1,150	2,640	1,130	16
Pyrene	-	1,050	-	1,110	-	1,110	-	1,090	2,320	1,150	2,720	1,130	16
Butylbenzylphthalate	-	1,050	-	1,110	-	1,110	-	1,090	1,670	1,150	2,180	1,130	26
3,3-Dichlorobenzidine	-	2,090	-	2,220	-	2,220	-	2,177	-	2,290	-	2,250	-
Benzo(a)anthracene	-	1,050	-	1,110	-	1,110	-	1,090	2,130	1,150	2,500	1,130	16
Chrysene	-	1,050	-	1,110	-	1,110	-	1,090	2,120	1,150	2,520	1,130	17
bis(2-Ethylhexyl)phthalate	-	1,050	-	1,110	-	1,110	-	1,090	2,360	1,150	2,930	1,130	22
Di-n-octylphthalate	-	1,050	-	1,110	-	1,110	-	1,090	2,910	1,150	3,410	1,130	16
Benzo(b)fluoranthene	-	1,050	-	1,110	-	1,110	-	1,090	2,060	1,150	2,510	1,130	20
Benzo(k)fluoranthene	-	1,050	-	1,110	-	1,110	-	1,090	2,300	1,150	2,570	1,130	11
Benzo(a)pyrene	-	1,050	-	1,110	-	1,110	-	1,090	2,000	1,150	2,410	1,130	19
Indeno(1,2,3-cd)pyrene (a)	-	1,050	-	1,110	-	1,110	-	1,090	-	1,150	1,440	1,130	N/A
Dibenzo(a,h)Anthracene (a)	-	1,050	-	1,110	-	1,110	-	1,090	-	1,150	1,400	1,130	N/A
Benzo(g,h,i)Perylene (a)	-	1,050	-	1,110	-	1,110	-	1,090	-	1,150	1,300	1,130	N/A

1,062,067

- Below Reporting Limit
J The analyte was positively identified, but the quantitation was between the analytical Reporting and the Method Detection Limit.
(a) RPD not applicable due to less than 2 data points

KEMRON ENVIRONMENTAL SERVICES

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NEASE CHEMICAL

TABLE 5
Untreated Material Characterization
Summary of SPLP Semivolatiles Analyses -EPA Methods 1312/ 8270C

SPLP SEMIVOLATILES	RESULTS (µg/L)									
	UNTREATED - A			UNTREATED - B			UNTREATED - C			AVERAGE	
	Result		DL	Result		DL	Result		DL	Result	DL
Phenol			255	-		25.5	-		25.5	-	25
Bis (2-Chloroethyl) ether			255	-		25.5	-		25.5	-	25
2-Chlorophenol			255	-		25.5	-		25.5	-	25
1,3-Dichlorobenzene			255	-		25.5	-		25.5	-	25
1,4-Dichlorobenzene	272	J	255	274		25.5	229		25.5	258	25
Benzyl alcohol			255	-		25.5	-		25.5	-	25
1,2-Dichlorobenzene	37,100		2,550	37,600		2,550	31,800		2,550	35,500	25
2-Methylphenol			255	-		25.5	-		25.5	-	25
3-,4-Methylphenol			255	-		25.5	-		25.5	-	25
bis (2-Chloroisopropyl) ether			255	-		25.5	-		25.5	-	25
N-Nitroso-di-n-propylamine			255	-		25.5	-		25.5	-	25
Hexachloroethane	0		255	178		25.5	150		25.5	109	25
Nitrobenzene			255	-		25.5	-		25.5	-	25
Isophorone			255	-		25.5	-		25.5	-	25
2-Nitrophenol			255	-		25.5	-		25.5	-	25
2,4-Dimethylphenol			255	-		25.5	-		25.5	-	25
Benzoic acid	4,360		1,280	4,720		1,280	4,230		1,280	4,437	125
Bis (2-Chloroethoxy) Methane			255	-		25.5	-		25.5	-	25
2,4-Dichlorophenol (1)	0		255	33.9	J	25.5	31.2	J	25.5	22	25
1,2,4-Trichlorobenzene			255	-		25.5	-		25.5	-	25
Naphthalene			255	-		25.5	-		25.5	-	25
4-Chloroaniline			255	-		25.5	-		25.5	-	25
Hexachlorobutadiene			255	-		25.5	-		25.5	-	25
4-Chloro-3-methylphenol			255	-		25.5	-		25.5	-	25
2-Methylnaphthalene			255	-		25.5	-		25.5	-	25
Hexachlorocyclopentadiene			255	-		25.5	-		25.5	-	25
2,4,6-Trichlorophenol			255	-		25.5	-		25.5	-	25
2,4,5-Trichlorophenol			255	-		25.5	-		25.5	-	25
2-Chloronaphthalene			255	-		25.5	-		25.5	-	25
2-Nitroaniline			1,280	-		128	-		128	-	125
Dimethylphthalate			255	-		25.5	-		25.5	-	25
Acenaphthylene			255	-		25.5	-		25.5	-	25
2,6-Dinitrotoluene			255	-		25.5	-		25.5	-	25

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL

TABLE 5
Untreated Material Characterization
Summary of SPLP Semivolatiles Analyses -EPA Methods 1312/ 8270C

SPLP SEMIVOLATILES	RESULTS (µg/L)									
	UNTREATED - A			UNTREATED - B		UNTREATED - C			AVERAGE	
	Result		DL	Result		DL	Result		DL	Result	DL
3-Nitroaniline			1,280	-		128	-		128	-	125
Acenaphthene			255	-		25.5	-		25.5	-	25
2,4-Dinitrophenol			1,280	-		128	-		128	-	125
4-Nitrophenol			1,280	-		128	-		128	-	125
Dibenzofuran			255	-		25.5	-		25.5	-	25
2,4-Dinitrotoluene			255	-		25.5	-		25.5	-	25
Diethylphthalate			255	-		25.5	-		25.5	-	25
4-Chlorophenyl-phenyl ether			255	-		25.5	-		25.5	-	25
Fluorene			255	-		25.5	-		25.5	-	25
4-Nitroaniline			1,280	-		128	-		128	-	125
4,6-Dinitro-2-methylphenol			1,280	-		128	-		128	-	125
N-Nitrosodiphenylamine			255	-		25.5	-		25.5	-	25
4-Bromophenyl-phenylether			255	-		25.5	-		25.5	-	25
Hexachlorobenzene			255	-		25.5	-		25.5	-	25
Pentachlorophenol			1,280	-		128	-		128	-	125
Phenanthrene			255	-		25.5	-		25.5	-	25
Anthracene			255	-		25.5	-		25.5	-	25
Di-n-butylphthalate			255	-		25.5	-		25.5	-	25
Fluoranthene			255	-		25.5	-		25.5	-	25
Pyrene			255	-		25.5	-		25.5	-	25
Butylbenzylphthalate			255	-		25.5	-		25.5	-	25
3,3-Dichlorobenzidine			255	-		25.5	-		25.5	-	25
Benzo(a)anthracene			255	-		25.5	-		25.5	-	25
Chrysene			255	-		25.5	-		25.5	-	25
bis(2-Ethylhexyl)phthalate			255	-		25.5	-		25.5	-	30
Di-n-octylphthalate			255	-		25.5	-		25.5	-	25
Benzo(b)fluoranthene			255	-		25.5	-		25.5	-	25
Benzo(k)fluoranthene			255	-		25.5	-		25.5	-	25
Benzo(a)pyrene			255	-		25.5	-		25.5	-	25
Indeno(1,2,3-cd)pyrene			255	-		25.5	-		25.5	-	25
Dibenzo(a,h)Anthracene			255	-		25.5	-		25.5	-	25
Benzo(g,h,i)Perylene			255	-		25.5	-		25.5	-	25

\- Below Reporting Limit

J The analyte was positively identified, but the quantitation was between the analytical Reporting and the Method Detection Limit.

DL Detection Limit

(1) Average result is based on less than 3 values

KEMRON ENVIRONMENTAL SERVICES

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TABLE 6

Preliminary Screening Evaluations
Mixture Development

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)
SE0190-001	Type I Portland Cement / Hydrated Lime	7.5 / 10	20
SE0190-002	Cement / Lime	10 / 10	22
SE0190-003	Cement / Lime / Bentonite	7.5 / 10 / 2	20
SE0190-004	Cement / Lime / Bentonite	10 / 10 / 2	21
SE0190-005	Cement / Class "C" Fly Ash	7.5 / 15	9
SE0190-006	Cement / Class "C" Fly Ash	10 / 20	12
SE0190-007	Cement / Class "C" Fly Ash / Bentonite	10 / 20 / 2	24
SE0190-008	Cement / Lime Kiln Dust	7.5 / 15	8
SE0190-009	Cement / Lime Kiln Dust	10 / 20	10
SE0190-010	Cement / Lime Kiln Dust / Bentonite	10 / 20 / 2	23

(1) Reagents will be combined together dry and blended. The reagent blend will then be slurried with a quantity of potable water. The water addition was be based on developing a pumpable reagent slurry to facilitate in-situ treatment.

Note that all addition rates will be on a by-weight basis based on the initial quantity of of untreated material utilized in the mixture. That is, for a mixture with a 10% addition of portland cement and 8% water, 10 grams of cement will be slurried with 8 grams of tap water. This slurry would then be blended with 100 grams of the untreated site material.

KEMRON ENVIRONMENTAL SERVICES

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TABLE 7

Preliminary Solidification / Stabilization Screening Evaluations
Mixture Development and Pocket Penetrometer Results

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%)	WATER ADDITION (%) (1)	PENETROMETER TESTING (tons/ft^2)						
				1 Day	2 Day	3 Day	4 Day	5 Day	6 Day	7 Day
SE0190-001	Type I Portland Cement / Hydrated Lime	7.5 / 10	20	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-002	Cement / Lime	10 / 10	22	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-003	Cement / Lime / Bentonite	7.5 / 10 / 2	20	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-004	Cement / Lime / Bentonite	10 / 10 / 2	21	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-005	Cement / Class "C" Fly Ash	7.5 / 15	9	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-006	Cement / Class "C" Fly Ash	10 / 20	12	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-007	Cement / Class "C" Fly Ash / Bentonite	10 / 20 / 2	24	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-008	Cement / Lime Kiln Dust	7.5 / 15	8	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-009	Cement / Lime Kiln Dust	10 / 20	10	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5
SE0190-010	Cement / Lime Kiln Dust / Bentonite	10 / 20 / 2	23	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5	> 4.5

KEMRON ENVIRONMENTAL SERVICES

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TABLE 8

Preliminary Screening Evaluations
Unconfined Compressive Strength @ 7-Day Cure - ASTM D2166

KEMRON SAMPLE No.	REAGENT TYPE	ZVI Addition (2)	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	DQO UCS (lbs/in^2)	UNCONFINED COMPRESSIVE STRENGTH			
						Moisture Content (%)	Bulk Density (lbs/ft^3)	Dry Density (lbs/ft^3)	UCS (lbs/in^2)
SE0190-001	Type I Portland Cement / Hydrated Lime	N/A	7.5 / 10	20	15	43.6	107.9	75.1	28.9
SE0190-002	Cement / Hydrated Lime	N/A	10 / 10	22	15	43.4	108.1	75.4	32.4
SE0190-003	Cement / Hydrated Lime / Bentonite	N/A	7.5 / 10 / 2	20	15	53.9	103.8	67.4	19.2
SE0190-004	Cement / Hydrated Lime / Bentonite	N/A	10 / 10 / 2	21	15	51.7	104.1	68.6	23.7
SE0190-005	Cement / Class "C" Fly Ash	N/A	7.5 / 15	9	15	29.8	117.1	90.2	225.4
SE0190-006	Cement / Class "C" Fly Ash	N/A	10 / 20	12	15	29.7	119.1	91.9	312.0
SE0190-007	Cement / Class "C" Fly Ash / Bentonite	N/A	10 / 20 / 2	24	15	42.2	111.9	78.7	198.8
SE0190-008	Cement / Lime Kiln Dust	N/A	7.5 / 15	8	15	29.8	118.3	91.1	78.4
SE0190-009	Cement / Lime Kiln Dust	N/A	10 / 20	10	15	30.0	118.1	90.9	91.7
SE0190-010	Cement / Lime Kiln Dust / Bentonite	N/A	10 / 20 / 2	23	15	40.6	110.8	78.8	44.9

(1) Reagents were combined together dry and blended. The reagent blend was then slurried with water. Note that for mixtures which included bentonite the bentonite was first hydrated with the entire quantity of water outlined and then blended with the remaining reagents. All addition rates were added on a by-weight basis according to the initial weight of the untreated material used in the mixture. That is for a mixture with a 10% addition of Portland cement, 10% hydrated lime, and 8% water, 10 grams of cement was blended with 10 grams of lime and then slurried with 8 grams of potable tap-water. This slurry was then mixed with 100 grams of the untreated site material.

(2) The ZVI was either slurried and added to the soil followed by the solidification/stabilization reagents (see note 1); or the ZVI was added to the solidification / stabilization reagents dry where the appropriate water addition was added as stated in note (1) then the entire slurry mixture was added to the soil material.

KEMRON ENVIRONMENTAL SERVICES

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TABLE 9

Intermediate ZVI Stabilization Screening Evaluations
Mixture Development

KEMRON SAMPLE No.	REAGENT TYPE	ZVI Addition (2)	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)
SE0190-011	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9
SE0190-012	Cement / Class "C" Fly Ash	added to S/S reagents	7.5 / 15	9
SE0190-013	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.55
SE0190-014	Cement / Lime Kiln Dust	added to S/S reagents	7.5 / 15	8

(1) Reagents were combined together dry and blended. The reagent blend was then slurried with water. All addition rates were added on a by-weight basis according to the initial weight of the untreated material used in the mixture. That is for a mixture with a 10% addition of Portland cement, 10% hydrated lime, and 8% water, 10 grams of cement was blended with 10 grams of lime and then slurried with 8 grams of potable tap-water. This slurry was then mixed with 100 grams of the untreated site material.

(2) The ZVI was either slurried and added to the soil followed by the solidification/stabilization reagents (see note 1); or the ZVI was added to the solidification / stabilization reagents dry where the appropriate water addition was added as stated in note (1) then the entire slurry mixture was added to the soil material.

KEMRON ENVIRONMENTAL SERVICES

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TABLE 10

Intermediate ZVI Solidification / Stabilization Evaluations
Mixture Development and Pocket Penetrometer Results

KEMRON SAMPLE No.	REAGENT TYPE	ZVI Addition (2)	REAGENT ADDITION (%)	WATER ADDITION (%) (1)	PENETROMETER TESTING (tons/ft^2)						
					1 Day	2 Day	3 Day	4 Day	5 Day	6 Day	7 Day
SE0190-011	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9	-	-	-	-	-	-	> 4.5
SE0190-012	Cement / Class "C" Fly Ash	added to S/S reagents	7.5 / 15	9	-	-	-	-	-	-	> 4.5
SE0190-013	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.55	-	-	-	-	-	-	> 4.5
SE0190-014	Cement / Lime Kiln Dust	added to S/S reagents	7.5 / 15	8	-	-	-	-	-	-	> 4.5

(1) Reagents were combined together dry and blended. The reagent blend was then slurried with water. All addition rates were added on a by-weight basis according to the initial weight of the untreated material used in the mixture. That is for a mixture with a 10% addition

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TABLE 11

Intermediate ZVI Solidification / Stabilization Evaluations
Unconfined Compressive Strength - ASTM D2166

KEMRON SAMPLE No.	REAGENT TYPE	ZVI Addition (2)	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	DQO UCS (lbs/in^2)	UNCONFINED COMPRESSIVE STRENGTH			
						Moisture Content (%)	Bulk Density (lbs/ft^3)	Dry Density (lbs/ft^3)	UCS (lbs/in^2)
Amendment Testing: UCS tested at 7-day cure									
SE0190-011	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9	15	27.3	119.9	94.2	246.2
SE0190-012	Cement / Class "C" Fly Ash	added to S/S reagents	7.5 / 15	9	15	27.5	118.6	93.0	291.3
SE0190-013	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.55	15	27.9	119.8	93.6	83.1
SE0190-014	Cement / Lime Kiln Dust	added to S/S reagents	7.5 / 15	8	15	28.4	119.5	93.1	82.2
Candidate ZVI Testing: UCS tested at 21-day cure									
SE0190-017	Cement / Class "C" Fly Ash	Slurry to soil	7.5 / 15	9	15	31.5	117.1	89.1	305.0
SE0190-018	Cement / Lime Kiln Dust	Slurry to soil	7.5 / 15	8.15	15	26.7	117.1	92.4	74.2

KEMRON ENVIRONMENTAL SERVICES

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Table 12
Summary of Air Stripping Analyses for 0190-015: Cement / Class "C" Fly Ash @ 7.5 / 15

Total	air flow (ml/min)		Humidity (%)		Temperature °C		PID (PPM)	
Minutes	In	out	in	out	in	out	in	out
Initial	65	35	0	0	62.0	54.1	3.3	3.4
3	65	35	0	24	62.3	56.1	81.9	136.0
6	65	35	0	27	62.4	54.2	98.3	154.0
9	65	35	0	31	61.7	54.2	109.0	157.0
12	65	35	0	32	61.3	54.3	76.3	89.2
15	65	35	0	33	61.0	54.6	97.3	140.0
18	65	35	0	33	60.3	54.8	103.0	148.0
21	65	35	0	33	60.7	54.8	107.0	146.0
24	65	35	0	34	61.3	55.0	107.0	147.0
27	65	35	0	35	61.3	54.5	108.0	125.0
30	65	35	0	40	61.3	54.9	109.0	125.0
33	65	35	0	38	61.6	55.0	89.1	102.0
36	65	35	0	38	62.7	55.3	99.2	128.0
39	65	35	0	37	62.0	54.7	105.0	135.0
42	65	35	0	38	61.7	55.0	103.0	136.0
45	65	35	0	39	61.4	54.5	107.0	137.0
48	65	35	0	40	60.5	54.8	105.0	137.0
51	65	35	0	40	60.5	55.4	102.0	134.0
54	65	35	0	40	60.8	55.4	99.1	133.0
57	65	35	0	39	61.1	54.9	98.6	130.0
60	65	35	0	40	61.7	55.1	98.4	129.0
63	65	35	0	40	60.6	54.5	74.2	88.9
66	65	35	0	41	61.4	55.0	89.1	108.0
69	65	35	0	42	60.7	55.0	92.2	114.0
72	65	35	0	43	61.1	55.1	91.4	112.0
75	65	35	0	43	61.4	55.4	91.2	110.0
78	65	35	0	43	61.7	55.3	89.5	106.0
81	65	35	0	43	60.7	55.4	87.1	103.0
84	65	35	0	42	61.0	56.0	85.0	98.8
87	65	35	0	42	61.7	55.0	82.9	97.1
90	65	35	0	43	61.3	54.4	81.4	91.9
93	65	35	0	44	61.7	54.8	78.8	89.1
96	65	35	0	43	61.4	55.6	71.4	83.2
99	65	35	0	42	62.6	55.4	74.3	79.5
102	65	35	0	43	62.4	55.3	73.4	82.4
105	65	35	0	43	62.4	55.0	70.8	77.8
108	65	35	0	45	62.0	55.0	71.4	81.6
111	65	35	0	45	61.4	55.6	70.9	82.4
114	65	35	0	44	62.7	55.7	69.9	77.3
117	65	35	0	44	62.7	55.4	68.6	76.9
120	65	35	0	44	62.7	55.7	67.4	72.9
123	65	35	0	45	61.7	54.8	65.5	68.9
126	65	35	0	44	61.4	55.3	64.1	67.9
129	65	35	0	43	61.3	55.7	62.1	63.2
132	65	35	0	43	62.6	55.7	60.4	61.3
135	65	35	0	43	62.7	55.3	58.9	59.6

KEY

ml - milliliters
ppm - parts per million
% - percent
min - minutes
°C - celsius

KEMRON ENVIRONMENTAL SERVICES

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Table 13
Summary of Air Stripping Analyses for 0190-016: Cement / Lime Kiln Dust @ 7.5 / 15

Total	air flow (ml/min)		Humidity (%)		Temperature °C		PID (PPM)	
Minutes	In	out	in	out	in	out	in	out
Initial	65	35	0	17	59.2	55.4	13.7	6.9
3	65	35	0	30	60.0	56.1	81.5	148
6	65	35	0	32	60.4	56.4	99.8	164
9	65	35	0	33	59.7	56.4	114.0	179
12	65	35	0	33	59.7	56.4	86.3	146
15	65	35	0	33	60.0	56.4	92.1	152
18	65	35	0	33	60.0	56.1	101.0	147
21	65	35	0	33	60.0	56.3	117.0	163
24	65	35	0	33	60.1	56.3	122.0	170
27	65	35	0	33	60.7	56.7	119.0	166
30	65	35	0	34	60.8	56.4	117.0	169
33	65	35	0	35	60.8	56.8	92.8	130
36	65	35	0	37	60.1	56.1	95.4	149
39	65	35	0	39	60.1	55.8	99.0	137
42	65	35	0	40	59.7	56.1	93.0	128
45	65	35	0	39	60.4	56.1	110.0	133
48	65	35	0	40	60.7	55.8	109.0	127
51	65	35	0	40	59.8	55.8	92.9	118
54	65	35	0	40	59.6	56.4	93.3	121
57	65	35	0	40	60.1	56.6	91.6	121
60	65	35	0	40	60.4	56.5	91.6	124
63	65	35	0	41	60.4	56.1	82.8	98.3
66	65	35	0	41	59.7	56.4	83.3	108
69	65	35	0	41	59.8	56.7	84.8	107
72	65	35	0	41	60.1	56.4	83.1	104
75	65	35	0	42	60.4	56.5	82.2	99.7
78	65	35	0	42	59.7	56.8	81.6	99.5
81	65	35	0	41	59.7	56.4	78.5	96.1
84	65	35	0	43	60.1	56.4	78.4	92.6
87	65	35	0	44	60.1	56.4	83.7	90.5
90	65	35	0	43	59.8	56.0	82.6	88.3
93	65	35	0	43	59.8	56.4	81.6	85.0
96	65	35	0	47	60.8	56.1	81.8	97.2
99	65	35	0	48	60.1	55.8	83.3	93.9
102	65	35	0	49	59.8	55.8	83.2	92.3
105	65	35	0	49	59.8	56.4	83.1	88.4
108	65	35	0	48	60.4	56.4	78.1	81.8
111	65	35	0	48	60.8	56.1	76.1	75.2
114	65	35	0	48	60.5	56.7	71.3	67.6
117	65	35	0	47	60.1	56.1	70.0	68.8
120	65	35	0	45	60.4	56.4	67.5	68.5
123	65	35	0	45	60.8	56.7	52.3	54.5
126	65	35	0	45	59.8	56.7	47.1	48.3
129	65	35	0	44	60.4	56.4	37.1	47.4
132	65	35	0	44	61.1	56.8	23.2	50.1
135	65	35	0	45	60.8	56.7	19.3	44.6

KEY

ml - milliliters

ppm - parts per million

% - percent

min - minutes

°C - celsius

KEMRON ENVIRONMENTAL SERVICES

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TABLE 14

INTERMEDIATE TREATMENT EVALUATIONS: TIME "0" AND BASELINE TESTING FOR ZVI AND AS

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" (µg/Kg)		AS Baseline (µg/Kg)		ZVI Baseline (µg/Kg)	
	Result	DL	Result	DL	Result	DL
Acetone	-	20200	-	50000	-	33000
Benzene	3600 J	2020	46200 J	5000	31500 J	3300
Bromobenzene	-	2020	-	5000	-	3300
Bromochloromethane	-	2020	-	5000	-	3300
Bromodichloromethane	-	2020	-	5000	-	3300
Bromoform	-	2020	-	5000	-	3300
Bromomethane	-	4040	-	10000	-	6600
2-Butanone	-	10100	-	25000	-	16500
n-Butylbenzene	-	2020	-	5000	-	3300
sec-Butylbenzene	-	2020	-	5000	-	3300
tert-Butylbenzene	-	2020	-	5000	-	3300
Carbon disulfide	-	2020	-	5000	-	3300
Carbon tetrachloride	-	2020	6640 J	5000	4370 J	3300
Chlorobenzene	3910 J	2020	31200 J	5000	20400 J	3300
Chlorodibromomethane	-	2020	-	5000	-	3300
Chloroethane	-	4040	-	10000	-	6600
2-Chloroethyl vinyl ether	-	8080	-	20000	-	13200
Chloroform	-	2020	-	5000	-	3300
Chloromethane	-	8080	-	20000	-	13200
2-Chlorotoluene	-	2020	-	5000	-	3300
4-Chlorotoluene	-	2020	-	5000	-	3300
1,2-Dibromo-3-chloropropane	-	8080	-	20000	-	13200
1,2-Dibromoethane	-	2020	-	5000	-	3300
Dibromomethane	-	2020	-	5000	-	3300
1,2-Dichlorobenzene	892000	20200	3840000	12500	2690000	8250
1,3-Dichlorobenzene	-	2020	-	5000	-	3300
1,4-Dichlorobenzene	6840 J	2020	30100 J	5000	19500 J	3300
Dichlorodifluoromethane	-	4040	-	10000	-	6600
1,1-Dichloroethane	-	4040	-	10000	-	6600
1,2-Dichloroethane	-	2020	-	5000	-	3300
1,1-Dichloroethene	-	2020	-	5000	-	3300
cis-1,2-Dichloroethene	-	2020	-	5000	-	3300
trans-1,2-Dichloroethene	-	2020	-	5000	-	3300
1,2-Dichloropropane	-	2020	-	5000	-	3300
1,3-Dichloropropane	-	2020	-	5000	-	3300
2,2-Dichloropropane	-	2020	-	5000	-	3300
cis-1,3-Dichloropropene	-	2020	-	5000	-	3300
trans-1,3-Dichloropropene	-	2020	-	5000	-	3300
1,1-Dichloropropene	-	2020	-	5000	-	3300
Ethylbenzene	-	2020	10100 J	5000	6250 J	3300
2-Hexanone	-	10100	-	2500	-	16500
Hexachlorobutadiene	6430 J	2020	11900 J	5000	7940 J	3300
Isopropylbenzene	3650 J	2020	15000 J	5000	9310 J	3300
p-Isopropyltoluene	-	2020	-	5000	-	3300

KEMRON ENVIRONMENTAL SERVICES

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TABLE 14

INTERMEDIATE TREATMENT EVALUATIONS: TIME "0" AND BASELINE TESTING FOR ZVI AND AS

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" (µg/Kg)		AS Baseline (µg/Kg)		ZVI Baseline (µg/Kg)	
	Result	DL	Result	DL	Result	DL
4-Methyl-2-pentanone	-	10100	-	2500	-	16500
Methylene chloride	-	4040	-	10000	-	6600
Naphthalene	-	2020	132000	5000	5520 J	3300
n-Propylbenzene	-	2020	-	5000	-	3300
Styrene	-	2020		5000	-	3300
1,1,1,2-Tetrachloroethane	-	2020	-	5000	-	3300
1,1,2,2-Tetrachloroethane	22600	2020	197000	5000	126000	3300
Tetrachloroethene	161000	2020	977000	5000	648000	3300
Toluene	3710 J	2020	36400 J	5000	23700 J	3300
1,2,3-Trichlorobenzene	-	2020	-	5000	-	3300
1,2,4-Trichlorobenzene	-	2020	-	5000	-	3300
1,1,1-Trichloroethane	-	2020	-	5000	-	3300
1,1,2-Trichloroethane	-	2020	-	5000	-	3300
Trichloroethene	7670 J	2020	69800	5000	49600	3300
Trichlorofluoromethane	-	4040	-	10000	-	6600
1,2,3-Trichloropropane	-	4040	-	5000	-	6600
1,2,4-Trimethylbenzene	-	2020	-	5000	-	3300
1,3,5-Trimethylbenzene	-	2020	-	5000	-	3300
Vinyl acetate	-	4040	-	10000	-	6600
Vinyl chloride	-	4040	-	10000	-	6600
o-Xylene	-	2020	7990 J	5000	4750 J	3300
m, p -Xylene	5900 J	2020	39000 J	5000	24500 J	3300

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

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TABLE 15

INTERMEDIATE TREATMENT EVALUATIONS: TIME "0" AND BASELINE TESTING FOR ZVI AND AS

Summary of SPLP Volatiles Analyses - EPA Methods 1312 / 8260B

SPLP VOLATILES	Time "0" (µg/L)		AS Control (µg/L)		ZVI Control (µg/L)	
	Result	DL	Result	DL	Result	DL
Acetone	-	1250	-	1250	-	1250
Benzene	492 J	62.5	1410 J	62.5	1770 J	62.5
Bromobenzene	-	62.5	-	62.5	-	62.5
Bromochloromethane	-	100	-	100	-	100
Bromodichloromethane	-	125	-	125	-	125
Bromoform	-	250	-	250	-	250
Bromomethane	-	250	-	250	-	250
2-Butanone	-	1250	-	1250	-	1250
n-Butylbenzene	-	125	-	125	-	125
sec-Butylbenzene	-	125	-	125	-	125
tert-Butylbenzene	-	125	-	125	-	125
Carbon disulfide	-	250	-	250	-	250
Carbon tetrachloride	-	125	-	125	-	125
Chlorobenzene	474 J	62.5	890 J	62.5	1090 J	62.5
Chlorodibromomethane	-	125	-	125	-	125
Chloroethane	-	250	-	250	-	250
2-Chloroethyl vinyl ether	-	5000	-	5000	-	5000
Chloroform	-	62.5	-	62.5	-	62.5
Chloromethane	-	125	-	125	-	125
2-Chlorotoluene	-	62.5	-	62.5	-	62.5
4-Chlorotoluene	-	125	-	125	-	125
1,2-Dibromo-3-chloropropane	-	500	-	500	-	500
1,2-Dibromoethane	-	125	-	125	-	125
Dibromomethane	-	125	-	125	-	125
1,2-Dichlorobenzene	56300	62.5	67800	62.5	69400	62.5
1,3-Dichlorobenzene	-	125	-	125	-	125
1,4-Dichlorobenzene	412 J	62.5	522 J	62.5	530 J	62.5
Dichlorodifluoromethane	-	125	-	125	-	125
1,1-Dichloroethane	-	62.5	-	62.5	-	62.5
1,2-Dichloroethane	-	125	166 J	125	208 J	125
1,1-Dichloroethene	-	250	-	250	-	250
cis-1,2-Dichloroethene	-	125	-	125	-	125
trans-1,2-Dichloroethene	-	125	-	125	-	125
1,2-Dichloropropane	-	100	-	100	-	100
1,3-Dichloropropane	-	100	-	100	-	100
2,2-Dichloropropane	-	125	-	125	-	125
cis-1,3-Dichloropropene	-	125	-	125	-	125
trans-1,3-Dichloropropene	-	250	-	250	-	250
1,1-Dichloropropene	-	125	-	125	-	125
Ethylbenzene	129 J	125	190 J	125	242 J	125
2-Hexanone	-	1250	-	1250	-	1250
Hexachlorobutadiene	-	125	-	125	-	125
Isopropylbenzene	135 J	125	148 J	125	138 J	125
p-Isopropyltoluene	-	125	-	125	-	125

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TABLE 15

INTERMEDIATE TREATMENT EVALUATIONS: TIME "0" AND BASELINE TESTING FOR ZVI AND AS

Summary of SPLP Volatiles Analyses - EPA Methods 1312 / 8260B

SPLP VOLATILES	Time "0" (µg/L)		AS Control (µg/L)		ZVI Control (µg/L)	
	Result	DL	Result	DL	Result	DL
4-Methyl-2-pentanone	-	1250	-	1250	-	1250
Methylene chloride	-	125	-	125	-	125
Naphthalene	-	100	-	100	-	100
n-Propylbenzene	-	62.5	-	62.5	-	62.5
Styrene	-	62.5	-	62.5	-	62.5
1,1,1,2-Tetrachloroethane	-	125	-	125	-	125
1,1,2,2-Tetrachloroethane	2540	62.5	6250	62.5	9010	62.5
Tetrachloroethene	15300	125	23200	125	24000	125
Toluene	474 J	125	1020 J	125	1280 J	125
1,2,3-Trichlorobenzene	-	62.5	-	62.5	-	62.5
1,2,4-Trichlorobenzene	-	100	-	100	-	100
1,1,1-Trichloroethane	-	125	-	125	-	125
1,1,2-Trichloroethane	-	125	-	125	-	125
Trichloroethene	826 J	125	2130 J	125	2600	125
Trichlorofluoromethane	-	125	-	125	-	125
1,2,3-Trichloropropane	-	250	-	250	-	250
1,2,4-Trimethylbenzene	-	125	-	125	-	125
1,3,5-Trimethylbenzene	-	125	-	125	-	125
Vinyl acetate	-	1250	-	1250	-	1250
Vinyl chloride	-	125	-	125	-	125
o-Xylene	-	125	144 J	125	161 J	125
m, p -Xylene	522 J	125	783 J	125	842 J	125

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

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TABLE 16

INTERMEDIATE PHASE: PRETREATMENT AIR STRIPPING OF UNTREATED SOIL SE0190-015

(Post-treatment will be 7.5% Portland Cement, 15% Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" Control (µg/Kg)		AS Control (µg/Kg)		AS @ 10 minutes (µg/Kg)		AS @ 30 minutes (µg/Kg)		AS @ 60 minutes (µg/Kg)		AS @ 135 minutes (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	20200	-	50000	-	50000	-	50000	-	50000	-	34400
Benzene	3600 J	2020	46200 J	5000	8830 J	5000	-	5000	-	5000	5650J	3440
Bromobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Bromochloromethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Bromodichloromethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Bromoform	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Bromomethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
2-Butanone	-	10100	-	25000	-	25000	-	25000	-	25000	-	17200
n-Butylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
sec-Butylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
tert-Butylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Carbon disulfide	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Carbon tetrachloride	-	2020	6640 J	5000	-	5000	-	5000	-	5000	-	3440
Chlorobenzene	3910 J	2020	31200 J	5000	12100 J	5000	9010 J	5000	-	5000	-	3440
Chlorodibromomethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Chloroethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
2-Chloroethyl vinyl ether	-	8080	-	20000	-	20000	-	20000	-	20000	-	13800
Chloroform	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Chloromethane	-	8080	-	20000	-	20000	-	20000	-	20000	-	13800
2-Chlorotoluene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
4-Chlorotoluene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,2-Dibromo-3-chloropropane	-	8080	-	20000	-	20000	-	20000	-	20000	-	13800
1,2-Dibromoethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Dibromomethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,2-Dichlorobenzene	892,000	20200	3,840,000	12500	1,970,000	5000	1,680,000	25000	1,860,000	5000	690,000	3440
1,3-Dichlorobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,4-Dichlorobenzene	6840 J	2020	30100 J	5000	15800 J	5000	15800 J	5000	13400 J	5000	5090 J	3440
Dichlorodifluoromethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
1,1-Dichloroethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
1,2-Dichloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440

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TABLE 16

INTERMEDIATE PHASE: PRETREATMENT AIR STRIPPING OF UNTREATED SOIL SE0190-015

(Post-treatment will be 7.5% Portland Cement, 15% Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" Control (µg/Kg)		AS Control (µg/Kg)		AS @ 10 minutes (µg/Kg)		AS @ 30 minutes (µg/Kg)		AS @ 60 minutes (µg/Kg)		AS @ 135 minutes (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,1-Dichloroethene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
cis-1,2-Dichloroethene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
trans-1,2-Dichloroethene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,2-Dichloropropane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,3-Dichloropropane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
2,2-Dichloropropane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
cis-1,3-Dichloropropene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
trans-1,3-Dichloropropene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,1-Dichloropropene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Ethylbenzene	-	2020	10100 J	5000	-	5000	-	5000	-	5000	-	3440
2-Hexanone	-	10100	-	2500	-	25000	-	25000	-	25000	-	17200
Hexachlorobutadiene	6430 J	2020	11900 J	5000	8850 J	5000	9200 J	5000	10100 J	5000	5930 J	3440
Isopropylbenzene	3650 J	2020	15000 J	5000	8120 J	5000	7190 J	5000	5890 J	5000	-	3440
p-Isopropyltoluene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
4-Methyl-2-pentanone	-	10100	-	2500	-	25000	-	25000	-	25000	-	17200
Methylene chloride	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
Naphthalene	-	2020	132000	5000	-	5000	-	5000	-	5000	-	3440
n-Propylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Styrene	-	2020		5000	-	5000	-	5000	-	5000	-	3440
1,1,1,2-Tetrachloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,1,2,2-Tetrachloroethane	22600	2020	197000	5000	73900	5000	71400	5000	47200 J	5000	35000	3440
Tetrachloroethene	161000	2020	977000	5000	427000	5000	324000	5000	181000	5000	85000	3440
Toluene	3710 J	2020	36400 J	5000	11800 J	5000	7390 J	5000	-	5000	-	3440
1,2,3-Trichlorobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,2,4-Trichlorobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,1,1-Trichloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,1,2-Trichloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Trichloroethene	7670 J	2020	69800	5000	24100 J	5000	9890 J	10000	6580 J	5000	10700 J	3440
Trichlorofluoromethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
1,2,3-Trichloropropane	-	4040	-	5000	-	10000	-	5000	-	10000	-	6890

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TABLE 16

INTERMEDIATE PHASE: PRETREATMENT AIR STRIPPING OF UNTREATED SOIL SF0190-015

(Post-treatment will be 7.5% Portland Cement, 15% Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" Control (µg/Kg)		AS Control (µg/Kg)		AS @ 10 minutes (µg/Kg)		AS @ 30 minutes (µg/Kg)		AS @ 60 minutes (µg/Kg)		AS @ 135 minutes (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,2,4-Trimethylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
1,3,5-Trimethylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	3440
Vinyl acetate	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
Vinyl chloride	-	4040	-	10000	-	10000	-	10000	-	10000	-	6890
o-Xylene	-	2020	7990 J	5000	-	5000	-	5000	-	5000	-	3440
m, p -Xylene	5900 J	2020	39000 J	5000	15700 J	5000	12300 J	5000	6730 J	5000	-	3440

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

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ENVIRONMENTAL SERVICES

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TABLE 17

INTERMEDIATE PHASE: PRETREATMENT AIR STRIPPING OF UNTREATED SOIL SE0190-016

(Post-treatment will be 7.5% Portland Cement, 15% Lime Klin Dust)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" Control (µg/Kg)		AS Control (µg/Kg)		AS @ 10 minutes (µg/Kg)		AS @ 30 minutes (µg/Kg)		AS @ 60 minutes (µg/Kg)		AS @ 135 minutes (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	20200	-	50000	-	50000	-	50000	-	50000	-	21400
Benzene	3600 J	2020	46200 J	5000	13600 J	5000	-	5000	-	5000	-	2140
Bromobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Bromochloromethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Bromodichloromethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Bromoform	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Bromomethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
2-Butanone	-	10100	-	25000	-	25000	-	25000	-	25000	-	10700
n-Butylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
sec-Butylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
tert-Butylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Carbon disulfide	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Carbon tetrachloride	-	2020	6640 J	5000	-	5000	-	5000	-	5000	-	2140
Chlorobenzene	3910 J	2020	31200 J	5000	17900 J	5000	9570 J	5000	-	5000	-	2140
Chlorodibromomethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Chloroethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
2-Chloroethyl vinyl ether	-	8080	-	20000	-	20000	-	20000	-	20000	-	8550
Chloroform	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Chloromethane	-	8080	-	20000	-	20000	-	20000	-	20000	-	8550
2-Chlorotoluene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
4-Chlorotoluene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,2-Dibromo-3-chloropropane	-	8080	-	20000	-	20000	-	20000	-	20000	-	8550
1,2-Dibromoethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Dibromomethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,2-Dichlorobenzene	892000	20200	3840000	12500	3490000	25000	2700000	25000	1740000	5000	544000	2140
1,3-Dichlorobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,4-Dichlorobenzene	6840 J	2020	30100 J	5000	22100 J	5000	17700 J	5000	12300 J	5000	3500 J	2140

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TABLE 17

INTERMEDIATE PHASE: PRETREATMENT AIR STRIPPING OF UNTREATED SOIL SE0190-016

(Post-treatment will be 7.5% Portland Cement, 15% Lime Klin Dust)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" Control (µg/Kg)		AS Control (µg/Kg)		AS @ 10 minutes (µg/Kg)		AS @ 30 minutes (µg/Kg)		AS @ 60 minutes (µg/Kg)		AS @ 135 minutes (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Dichlorodifluoromethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
1,1-Dichloroethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
1,2-Dichloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,1-Dichloroethene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
cis-1,2-Dichloroethene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
trans-1,2-Dichloroethene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,2-Dichloropropane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,3-Dichloropropane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
2,2-Dichloropropane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
cis-1,3-Dichloropropene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
trans-1,3-Dichloropropene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,1-Dichloropropene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Ethylbenzene	-	2020	10100 J	5000	5090 J	5000	-	5000	-	5000	-	2140
2-Hexanone	-	10100	-	2500	-	25000	-	25000	-	25000	-	10700
Hexachlorobutadiene	6430 J	2020	11900 J	5000	10500 J	5000	10600 J	5000	9030 J	5000	5570 J	2140
Isopropylbenzene	3650 J	2020	15000 J	5000	9390 J	5000	7340 J	5000	5280 J	5000	-	2140
p-Isopropyltoluene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
4-Methyl-2-pentanone	-	10100	-	2500	-	25000	-	25000	-	25000	-	10700
Methylene chloride	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
Naphthalene	-	2020	132000	5000	-	5000	-	5000	-	5000	-	2140
n-Propylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Styrene	-	2020		5000	-	5000	-	5000	-	5000	-	2140
1,1,1,2-Tetrachloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,1,2,2-Tetrachloroethane	22600	2020	197000	5000	133000	5000	87800	5000	43200 J	5000	15300 J	2140
Tetrachloroethene	161000	2020	977000	5000	590000	5000	330000	5000	135000	5000	33000	2140
Toluene	3710 J	2020	36400 J	5000	17300 J	5000	7220 J	5000	-	5000	-	2140
1,2,3-Trichlorobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,2,4-Trichlorobenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140

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TABLE 17

INTERMEDIATE PHASE: PRETREATMENT AIR STRIPPING OF UNTREATED SOIL SE0190-016

(Post-treatment will be 7.5% Portland Cement, 15% Lime Klin Dust)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Time "0" Control (µg/Kg)		AS Control (µg/Kg)		AS @ 10 minutes (µg/Kg)		AS @ 30 minutes (µg/Kg)		AS @ 60 minutes (µg/Kg)		AS @ 135 minutes (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,1,1-Trichloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,1,2-Trichloroethane	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Trichloroethene	7670 J	2020	69800	5000	25700 J	5000	10600 J	5000	-	5000	3410 J	2140
Trichlorofluoromethane	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
1,2,3-Trichloropropane	-	4040	-	5000	-	10000	-	10000	-	10000	-	4270
1,2,4-Trimethylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
1,3,5-Trimethylbenzene	-	2020	-	5000	-	5000	-	5000	-	5000	-	2140
Vinyl acetate	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
Vinyl chloride	-	4040	-	10000	-	10000	-	10000	-	10000	-	4270
o-Xylene	-	2020	7990 J	5000	-	5000	-	5000	-	5000	-	2140
m, p -Xylene	5900 J	2020	39000 J	5000	21300 J	5000	12700 J	5000	5370 J	5000	-	2140

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON
ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

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TABLE 18

INTERMEDIATE PHASE: CARBON SAMPLING OF AIR STRIPPING PRETREATMENT OF SOIL SE0190-015

(Post-treatment will be 7.5% Portland Cement, 15% Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Carbon Control ug/Kg		AS @ 10 minutes ug/Kg		AS @ 30 minutes ug/Kg		AS @ 60 minutes ug/Kg		AS @ 135 minutes ug/Kg	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	430	69900	4300	16500	4290	19100	8470	46300	8400
Benzene	-	43.0	11700	430	4280 J	429	2080 J	847	1770 J	840
Bromobenzene	-	43.0	-	430	-	429	-	847	-	840
Bromochloromethane	-	43.0	-	430	-	429	-	847	-	840
Bromodichloromethane	-	43.0	-	430	-	429	-	847	-	840
Bromoform	-	43.0	1700 J	430	1430 J	429	2090 J	847	2360 J	840
Bromomethane	-	86.0	-	861	-	858	-	1690	-	1680
2-Butanone	-	215	18200	2150	2250 J	2150	-	4240	9290 J	4200
n-Butylbenzene	-	43.0	-	430	-	429	-	847	-	840
sec-Butylbenzene	-	43.0	-	430	-	429	-	847	-	840
tert-Butylbenzene	-	43.0	-	430	-	429	-	847	-	840
Carbon disulfide	-	43.0	-	430	-	429	-	847	-	840
Carbon tetrachloride	-	43.0	5530	430	3190 J	429	2340 J	847	1590 J	840
Chlorobenzene	-	43.0	637 J	430	556 J	429	1100 J	847	1760 J	840
Chlorodibromomethane	-	43.0	-	430	-	429	-	847	-	840
Chloroethane	-	86.0	-	861	-	858	-	1690	-	1680
2-Chloroethyl vinyl ether	-	172	-	1720	-	1720	-	3390	-	3360
Chloroform	-	43.0	4570	430	1210 J	429	-	847	-	840
Chloromethane	-	172	-	1720	-	1720	-	3390	-	3360
2-Chlorotoluene	-	43.0	-	430	-	429	-	847	-	840
4-Chlorotoluene	-	43.0	-	430	-	429	-	847	-	840
1,2-Dibromo-3-chloropropane	-	172	-	1720	-	1720	-	3390	-	3360
1,2-Dibromoethane	-	43.0	-	430	-	429	-	847	-	840
Dibromomethane	-	43.0		430	-	429	-	847	-	840
1,2-Dichlorobenzene	-	43.0	3640 J	430	3360 J	429	28300	847	190000	840
1,3-Dichlorobenzene	-	43.0	-	430	-	429	-	847	-	840
1,4-Dichlorobenzene	-	43.0		430	-	429	-	847	-	840

KEMRON
ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 18
INTERMEDIATE PHASE: CARBON SAMPLING OF AIR STRIPPING PRETREATMENT OF SOIL SE0190-015
(Post-treatment will be 7.5% Portland Cement, 15% Fly Ash)
Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Carbon Control ug/Kg		AS @ 10 minutes ug/Kg		AS @ 30 minutes ug/Kg		AS @ 60 minutes ug/Kg		AS @ 135 minutes ug/Kg	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Dichlorodifluoromethane	-	86.0	1050 J	861	-	858	-	1690	-	1680
1,1-Dichloroethane	-	86.0	-	861	-	858	-	1690	-	1680
1,2-Dichloroethane	-	43.0	22500	430	6420	429	2060 J	847	1420 J	840
1,1-Dichloroethene	-	43.0	-	430	-	429	-	847	-	840
cis-1,2-Dichloroethene	-	43.0	432 J	430	-	429	-	847	-	840
trans-1,2-Dichloroethene	-	43.0	-	430	-	429	-	847	-	840
1,2-Dichloropropane	-	43.0	-	430	-	429	-	847	-	840
1,3-Dichloropropane	-	43.0	-	430	-	429	-	847	-	840
2,2-Dichloropropane	-	43.0	-	430	-	429	-	847	-	840
cis-1,3-Dichloropropene	-	43.0	-	430	-	429	-	847	-	840
trans-1,3-Dichloropropene	-	43.0	-	430	-	429	-	847	-	840
1,1-Dichloropropene	-	43.0	-	430	-	429	-	847	-	840
Ethylbenzene	-	43.0	-	430	529 J	429	-	847	1140 J	840
2-Hexanone	-	215	-	2150	-	2150	-	4240	-	4200
Hexachlorobutadiene	-	43.0	-	430	-	429	-	847	-	840
Isopropylbenzene	-	43.0	-	430	-	429	983 J	847	2120 J	840
p-Isopropyltoluene	-	43.0	-	430	-	429	-	847	-	840
4-Methyl-2-pentanone	-	215	-	2150	-	2150	-	4240	-	4200
Methylene chloride	-	86.0	4720	861	-	858	-	1690	-	1680
Naphthalene	-	43.0	-	430	-	429	-	847	-	840
n-Propylbenzene	-	43.0	-	430	-	429	-	847	-	840
Styrene	-	43.0	-	430	-	429	-	847	-	840
1,1,1,2-Tetrachloroethane	-	43.0	604 J	430	541 J	429	-	847	-	840
1,1,2,2-Tetrachloroethane	-	43.0	21500	430	17600	429	19700	847	35400	840
Tetrachloroethene	-	43.0	92500	430	87200	429	152000	847	224000	840
Toluene	-	43.0	2250 J	430	1510 J	429	1910 J	847	2470 J	840
1,2,3-Trichlorobenzene	-	43.0	-	430	-	429	-	847	-	840

KEMRON
ENVIRONMENTAL SERVICES

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TABLE 18

INTERMEDIATE PHASE: CARBON SAMPLING OF AIR STRIPPING PRETREATMENT OF SOIL SE0190-015

(Post-treatment will be 7.5% Portland Cement, 15% Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Carbon Control ug/Kg		AS @ 10 minutes ug/Kg		AS @ 30 minutes ug/Kg		AS @ 60 minutes ug/Kg		AS @ 135 minutes ug/Kg	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,2,4-Trichlorobenzene	-	43.0	-	430	-	429	-	847	-	840
1,1,1-Trichloroethane	-	43.0	-	430	-	429	-	847	-	840
1,1,2-Trichloroethane	-	43.0	465 J	430	-	429	-	847	-	840
Trichloroethene	-	43.0	68700	430	44000	429	52100	847	79100	840
Trichlorofluoromethane	-	86.0	1560 J	861	-	858	-	1690	-	1680
1,2,3-Trichloropropane	-	86.0	-	861	-	858	-	1690	-	1680
1,2,4-Trimethylbenzene	-	43.0	-	430	-	429	-	847	-	840
1,3,5-Trimethylbenzene	-	43.0	-	430	-	429	-	847	-	840
Vinyl acetate	-	86.0	-	861	-	858	-	1690	-	1680
Vinyl chloride	-	86.0	-	861	-	858	-	1690	-	1680
o-Xylene	-	43.0	-	430	-	429	-	847	-	840
m, p -Xylene	-	43.0	-	430	726 J	429	1480 J	847	2320	840

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON
ENVIRONMENTAL SERVICES

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NEASE CHEMICAL

TABLE 19

INTERMEDIATE PHASE: CARBON SAMPLING OF AIR STRIPPING PRETREATMENT OF SOIL SE0190-016

(Post-treatment will be 7.5% Portland Cement, 15% Lime Kiln Dust)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Carbon Control ug/Kg		AS @ 10 minutes ug/Kg		AS @ 30 minutes ug/Kg		AS @ 60 minutes ug/Kg		AS @ 135 minutes ug/Kg	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	430	11800	4310	14400	4270	21200	4210	40300	4150
Benzene	-	43.0	10100	431	14300	427	4800	421	1570 J	415
Bromobenzene	-	43.0	-	431	-	427	-	421	-	415
Bromochloromethane	-	43.0	-	431	-	427	-	421	-	415
Bromodichloromethane	-	43.0	-	431	-	427	-	421	-	415
Bromoform	-	43.0	1220 J	431	2050 J	427	2550 J	421	1890 J	415
Bromomethane	-	86.0	-	863	-	855	-	842	-	831
2-Butanone	-	215	-	2160	-	2140	-	2110	5900 J	2080
n-Butylbenzene	-	43.0	-	431	-	427	-	421	-	415
sec-Butylbenzene	-	43.0	-	431	-	427	-	421	-	415
tert-Butylbenzene	-	43.0	-	431	-	427	-	421	-	415
Carbon disulfide	-	43.0	-	431	-	427	-	421	-	415
Carbon tetrachloride	-	43.0	4010 J	431	5300	427	2740 J	421	952 J	415
Chlorobenzene	-	43.0	551 J	431	1940 J	427	2980 J	421	2220 J	415
Chlorodibromomethane	-	43.0	-	431	461 J	427	-	421	-	415
Chloroethane	-	86.0	-	863	-	855	-	842	-	831
2-Chloroethyl vinyl ether	-	172	-	1730	-	1710	-	1680	-	1660
Chloroform	-	43.0	3780 J	431	2550 J	427	505 J	421	-	415
Chloromethane	-	172	-	1730	-	1710	-	1680	-	1660
2-Chlorotoluene	-	43.0	-	431	-	427	-	421	-	415
4-Chlorotoluene	-	43.0	-	431	-	427	-	421	-	415
1,2-Dibromo-3-chloropropane	-	172	-	1730	-	1710	-	1680	-	1660
1,2-Dibromoethane	-	43.0	-	431	-	427	-	421	-	415
Dibromomethane	-	43.0	-	431	-	427	-	421	-	415
1,2-Dichlorobenzene	-	43.0	4060 J	431	21700	427	87200	421	204000	4150
1,3-Dichlorobenzene	-	43.0	-	431	-	427	-	421	-	415
1,4-Dichlorobenzene	-	43.0	-	431	-	427	-	421	1010 J	415

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TABLE 19

INTERMEDIATE PHASE: CARBON SAMPLING OF AIR STRIPPING PRETREATMENT OF SOIL SE0190-016

(Post-treatment will be 7.5% Portland Cement, 15% Lime Kiln Dust)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Carbon Control ug/Kg		AS @ 10 minutes ug/Kg		AS @ 30 minutes ug/Kg		AS @ 60 minutes ug/Kg		AS @ 135 minutes ug/Kg	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Dichlorodifluoromethane	-	86.0	-	863	-	855	-	842	-	831
1,1-Dichloroethane	-	86.0	-	863	-	855	-	842	-	831
1,2-Dichloroethane	-	43.0	18300	431	13700	427	3170 J	421	1100 J	415
1,1-Dichloroethene	-	43.0	-	431	-	427	-	421	-	415
cis-1,2-Dichloroethene	-	43.0	-	431	-	427	-	421	-	415
trans-1,2-Dichloroethene	-	43.0	-	431	-	427	-	421	-	415
1,2-Dichloropropane	-	43.0	-	431	-	427	-	421	-	415
1,3-Dichloropropane	-	43.0	-	431	-	427	-	421	-	415
2,2-Dichloropropane	-	43.0	-	431	-	427	-	421	-	415
cis-1,3-Dichloropropene	-	43.0	-	431	-	427	-	421	-	415
trans-1,3-Dichloropropene	-	43.0	-	431	-	427	-	421	-	415
1,1-Dichloropropene	-	43.0	-	431	-	427	-	421	-	415
Ethylbenzene	-	43.0	-	431	736 J	427	1380 J	421	1360 J	415
2-Hexanone	-	215	-	2160	-	2140	-	2110	-	2080
Hexachlorobutadiene	-	43.0	-	431	-	427	-	421	896 J	415
Isopropylbenzene	-	43.0	-	431	728 J	427	1510 J	421	2400 J	415
p-Isopropyltoluene	-	43.0	-	431	-	427	-	421	-	415
4-Methyl-2-pentanone	-	215	-	2160	-	2140	-	2110	-	2080
Methylene chloride	-	86.0	-	863	-	855	-	842	-	831
Naphthalene	-	43.0	-	431	-	427	-	421	-	415
n-Propylbenzene	-	43.0	-	431	-	427	-	421	-	415
Styrene	-	43.0	-	431	-	427	-	421	-	415
1,1,1,2-Tetrachloroethane	-	43.0	545 J	431	659 J	427	658 J	421	-	415
1,1,2,2-Tetrachloroethane	-	43.0	6550	431	25700	427	41800	421	36800	415
Tetrachloroethene	-	43.0	74600	431	192000	4270	284000	4210	219000	4150
Toluene	-	43.0	1720 J	431	4530	427	4520	421	2250 J	415
1,2,3-Trichlorobenzene	-	43.0	-	431	-	427	-	421	-	415

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TABLE 19

INTERMEDIATE PHASE: CARBON SAMPLING OF AIR STRIPPING PRETREATMENT OF SOIL SE0190-016

(Post-treatment will be 7.5% Portland Cement, 15% Lime Kiln Dust)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Carbon Control		AS @ 10 minutes		AS @ 30 minutes		AS @ 60 minutes		AS @ 135 minutes	
	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,2,4-Trichlorobenzene	-	43.0	-	431	-	427	-	421	-	415
1,1,1-Trichloroethane	-	43.0	-	431	-	427	-	421	-	415
1,1,2-Trichloroethane	-	43.0	-	431	-	427	-	421	-	415
Trichloroethene	-	43.0	51600	431	103000	427	101000	421	84800	415
Trichlorofluoromethane	-	86.0	-	863	-	855	-	842	-	831
1,2,3-Trichloropropane	-	86.0	-	863	-	855	-	842	-	831
1,2,4-Trimethylbenzene	-	43.0	-	431	-	427	-	421	-	415
1,3,5-Trimethylbenzene	-	43.0	-	431	-	427	-	421	-	415
Vinyl acetate	-	86.0	-	863	-	855	-	842	-	831
Vinyl chloride	-	86.0	-	863	-	855	-	842	-	831
o-Xylene	-	43.0	-	431	-	427	-	421	459 J	415
m, p -Xylene	-	43.0	-	431	1060 J	427	2430 J	421	2820 J	415

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

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TABLE 20

INTERMEDIATE PHASE: AIR STRIPPING & ZERO VALENT IRON: 21 Day Cure

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	21 Day Control (µg/Kg)		0190-15 AS (µg/Kg)		0190-016 AS (µg/Kg)		0190-017 ZVI (µg/Kg)		0190-018 ZVI (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	8710	-	2520	-	1380	-	5020	-	2940
Benzene	961 J	871	497 J	252	311 J	138	-	502	-	294
Bromobenzene	-	871	-	252	-	138	-	502	-	294
Bromochloromethane	-	871	-	252	-	138	-	502	-	294
Bromodichloromethane	-	871	-	252	-	138	-	502	-	294
Bromoform	-	871	-	252	-	138	-	502	-	294
Bromomethane	-	1740	-	504	-	276	-	1000	-	587
2-Butanone	-	4360	-	1260	-	690	-	2510	-	1470
n-Butylbenzene	-	871	-	252	-	138	-	502	-	294
sec-Butylbenzene	-	871	-	252	-	138	-	502	-	294
tert-Butylbenzene	-	871	-	252	-	138	-	502	-	294
Carbon disulfide	-	871	-	252	-	138	-	502	-	294
Carbon tetrachloride	-	871	-	252	-	138	-	502	-	294
Chlorobenzene	-	871	287 J	252	183 J	138	-	502	-	294
Chlorodibromomethane	-	871	-	252	-	138	-	502	-	294
Chloroethane	-	1740	-	504	-	276	-	1000	-	587
2-Chloroethyl vinyl ether	-	3480	-	1010	-	552	-	2010	-	1170
Chloroform	-	871	-	252	-	138	-	502	-	294
Chloromethane	-	3480	-	1010	-	552	-	2010	-	1170
2-Chlorotoluene	-	871	-	252	-	138	-	502	-	294
4-Chlorotoluene	-	871	-	252	-	138	-	502	-	294
1,2-Dibromo-3-chloropropane	-	3480	-	1010	-	552	-	2010	-	1170
1,2-Dibromoethane	-	871	-	252	-	138	-	502	-	294
Dibromomethane	-	871	-	252	-	138	-	502	-	294
1,2-Dichlorobenzene	231000	871	75800	252	48700	138	114000	502	56500	294
1,3-Dichlorobenzene	-	871	-	252	-	138	-	502	-	294
1,4-Dichlorobenzene	1580 J	871	612 J	252	374 J	138	934 J	502	432 J	294
Dichlorodifluoromethane	-	1740	-	504	-	276	-	1000	-	587
1,1-Dichloroethane	-	1740	-	504	-	276	-	1000	-	587
1,2-Dichloroethane	-	871	-	252	139 J	138	-	502	-	294

KEMRON
ENVIRONMENTAL SERVICES

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NEASE CHEMICAL

TABLE 20

INTERMEDIATE PHASE: AIR STRIPPING & ZERO VALENT IRON: 21 Day Curc

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	21 Day Control (µg/Kg)		0190-15 AS (µg/Kg)		0190-016 AS (µg/Kg)		0190-017 ZVI (µg/Kg)		0190-018 ZVI (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,1-Dichloroethene	-	871	-	252	-	138	-	502	-	294
cis-1,2-Dichloroethene	-	871	-	252	-	138	-	502	-	294
trans-1,2-Dichloroethene	-	871	-	252	-	138	-	502	-	294
1,2-Dichloropropane	-	871	-	252	-	138	-	502	-	294
1,3-Dichloropropane	-	871	-	252	-	138	-	502	-	294
2,2-Dichloropropane	-	871	-	252	-	138	-	502	-	294
cis-1,3-Dichloropropene	-	871	-	252	-	138	-	502	-	294
trans-1,3-Dichloropropene	-	871	-	252	-	138	-	502	-	294
1,1-Dichloropropene	-	871	-	252	-	138	-	502	-	294
Ethylbenzene	-	871	-	252	-	138	-	502	-	294
2-Hexanone	-	4360	-	1260	-	690	-	2510	-	1470
Hexachlorobutadiene	1250 J	871	1160 J	252	1220 J	138	930 J	502	769 J	294
Isopropylbenzene	-	871	-	252	-	138	-	502	-	294
p-Isopropyltoluene	-	871	-	252	-	138	-	502	-	294
4-Methyl-2-pentanone	-	4360	-	1260	-	690	-	2510	-	1470
Methylene chloride	-	1740	-	504	-	276	-	1000	-	587
Naphthalene	-	871	-	252	-	138	-	502	-	294
n-Propylbenzene	-	871	-	252	-	138	-	502	-	294
Styrene	-	871	-	252	151 J	138	-	502	-	294
1,1,1,2-Tetrachloroethane	-	871	-	252	-	138	-	502	-	294
1,1,2,2-Tetrachloroethane	10100	871	-	252	-	138	-	502	-	294
Tetrachloroethene	18700	871	10400	252	6230	138	16800	502	6140	294
Toluene		871	291 J	252	159 J	138	-	502	-	294
1,2,3-Trichlorobenzene	-	871	-	252	-	138	-	502	-	294
1,2,4-Trichlorobenzene	-	871	-	252	172 J	138	-	502	-	294
1,1,1-Trichloroethane	-	871	-	252	-	138	-	502	-	294
1,1,2-Trichloroethane	-	871	-	252	-	138	-	502	-	294
Trichloroethene	1870 J	871	3730	252	1690	138	2150 J	502	1330 J	294
Trichlorofluoromethane	-	1740	-	504	-	276	-	1000	-	587
1,2,3-Trichloropropane	-	1740	-	504	-	276	-	1000	-	587

KEMRON
ENVIRONMENTAL SERVICES

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NEASE CHEMICAL

TABLE 20

INTERMEDIATE PHASE: AIR STRIPPING & ZERO VALENT IRON: 21 Day Cure

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	21 Day Control (µg/Kg)		0190-15 AS (µg/Kg)		0190-016 AS (µg/Kg)		0190-017 ZVI (µg/Kg)		0190-018 ZVI (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,2,4-Trimethylbenzene	-	871	-	252	-	138	-	502	-	294
1,3,5-Trimethylbenzene	-	871	-	252	-	138	-	502	-	294
Vinyl acetate	-	1740	-	504	-	276	-	1000	-	587
Vinyl chloride	-	1740	-	504	-	276	-	1000	-	587
o-Xylene	-	871	-	252	-	138	-	502	-	294
m, p -Xylene	-	871	-	252	145 J	138	519 J	502	-	294

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit

KEMRON
ENVIRONMENTAL SERVICES

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TABLE 21

INTERMEDIATE PHASE: AIR STRIPPING & ZERO VALENT IRON: 21 Day Cure

Summary of SPLP Analyses - EPA Method 1312/8260B

SPLP VOLATILES	21 Day Control (µg/L)		0190-15 AS (µg/L)		0190-016 AS (µg/L)		0190-017 ZVI (µg/L)		0190-018 ZVI (µg/L)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	1250	130 J	125	-	50.0	-	500	-	500
Benzene	309 J	62.5	-	6.25	8.61 J	2.50	-	25.0	-	25.0
Bromobenzene	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
Bromochloromethane	-	100	-	10.0	-	4.00	-	40.0	-	40.0
Bromodichloromethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Bromoform	-	250	-	25.0	-	10.0	-	100	-	100
Bromomethane	-	250	-	25.0	-	10.0	-	100	-	100
2-Butanone	-	1250	-	125	-	50.0	-	500	-	500
n-Butylbenzene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
sec-Butylbenzene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
tert-Butylbenzene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Carbon disulfide	-	250	-	25.0	-	10.0	-	100	-	100
Carbon tetrachloride	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Chlorobenzene	380 J	62.5	-	6.25	6.57 J	2.50	62.1 J	25.0	46.8 J	25.0
Chlorodibromomethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Chloroethane	-	62.5	-	25.0	-	10.0	-	100	-	100
2-Chloroethyl vinyl ether	-	5000	-	500	-	200	-	2000	-	2000
Chloroform	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
Chloromethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
2-Chlorotoluene	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
4-Chlorotoluene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,2-Dibromo-3-chloropropane	-	500	-	50.0	-	20.0	-	200	-	200
1,2-Dibromoethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Dibromomethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,2-Dichlorobenzene	54000	62.5	4090	6.25	3360	2.50	30400	25.0	33900	25.0
1,3-Dichlorobenzene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,4-Dichlorobenzene	411 J	62.5	20.7 J	6.25	19.3 J	2.50	202 J	25.0	230 J	25.0
Dichlorodifluoromethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,1-Dichloroethane	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
1,2-Dichloroethane	-	125	-	12.5	5.07 J	5.00	-	50.0	-	50.0

KEMRON
ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 21

INTERMEDIATE PHASE: AIR STRIPPING & ZERO VALENT IRON: 21 Day Cure

Summary of SPLP Analyses - EPA Method 1312/8260B

SPLP VOLATILES	21 Day Control (µg/L)		0190-15 AS (µg/L)		0190-016 AS (µg/L)		0190-017 ZVI (µg/L)		0190-018 ZVI (µg/L)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
1,1-Dichloroethene	-	250	-	25.0	-	10.0	-	100	-	100
cis-1,2-Dichloroethene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
trans-1,2-Dichloroethene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,2-Dichloropropane	-	100	-	10.0	-	4.00	-	40.0	-	40.0
1,3-Dichloropropane	-	100	-	10.0	-	4.00	-	40.0	-	40.0
2,2-Dichloropropane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
cis-1,3-Dichloropropene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
trans-1,3-Dichloropropene	-	250	-	25.0	-	10.0	-	100	-	100
1,1-Dichloropropene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Ethylbenzene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
2-Hexanone	-	1250	-	125	-	50.0	-	500	-	500
Hexachlorobutadiene	-	125	-	12.5	14.5 J	5.00	-	50.0	-	50.0
Isopropylbenzene	152 J	125	-	12.5	-	5.00	56.4 J	50.0	59.3 J	50.0
p-Isopropyltoluene	-	125	-	12.5	-	5.00	-	50.0	-	50.0
4-Methyl-2-pentanone	-	1250	-	125	-	50.0	-	500	-	500
Methylene chloride	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Naphthalene	-	100	-	10.0	5.42 J	4.00	-	40.0	-	40.0
n-Propylbenzene	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
Styrene	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
1,1,1,2-Tetrachloroethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,1,2,2-Tetrachloroethane	2140 J	62.5	-	6.25	-	2.50	-	25.0	-	25.0
Tetrachloroethene	11900	125	74.9 J	12.5	128	5.00	2220	50.0	1700	50.0
Toluene	395 J	125	-	12.5	5.45 J	5.00	-	50.0	-	50.0
1,2,3-Trichlorobenzene	-	62.5	-	6.25	-	2.50	-	25.0	-	25.0
1,2,4-Trichlorobenzene	-	100	-	10.0	7.96 J	4.00	-	40.0	-	40.0
1,1,1-Trichloroethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,1,2-Trichloroethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
Trichloroethene	721 J	125	19.8 J	12.5	40.8 J	5.00	76.1 J	50.0	-	50.0
Trichlorofluoromethane	-	125	-	12.5	-	5.00	-	50.0	-	50.0
1,2,3-Trichloropropane	-	250	-	25.0	-	10.0	-	100	-	100

KEMRON
ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
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TABLE 22

INTERMEDIATE PHASE: Air Stripping and Solidification / Stabilization Evaluations
Unconfined Compressive Strength @ 21 Day Cure - ASTM D2166

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	DQO UCS (lbs/in^2)	UNCONFINED COMPRESSIVE STRENGTH			
					Moisture Content (%)	Bulk Density (lbs/ft^3)	Dry Density (lbs/ft^3)	UCS (lbs/in^2)
Air Stripping Pre-Treatment & S/S Evaluation								
SE0190-015	Cement / Class "C" Fly Ash	7.5 / 15	9	15	24.0	122.7	98.9	383.6
SE0190-016	Cement / Lime Kiln Dust	7.5 / 15	8	15	23.3	121.3	98.4	153.7

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 23
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME 0 and Day 21
Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Control Time "0" (µg/Kg)		Duplicate (µg/Kg)		Triplicate (µg/Kg)		Average (µg/Kg)		Control Time "21 Day" (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	98,000	-	30,100	-	48,000	-	58,700	-	30,900
Benzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Bromobenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Bromochloromethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Bromodichloromethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Bromoform	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Bromomethane	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
2-Butanone	-	49,000	-	15,000	-	24,000	-	29,333	-	15,500
n-Butylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
sec-Butylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
tert-Butylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Carbon disulfide	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Carbon tetrachloride	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Chlorobenzene	-	9,800	-	3,010	4,950 J	4,800	1,650	5,870	-	3,090
Chlorodibromomethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Chloroethane	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
2-Chloroethyl vinyl ether	-	39,200	-	12,000	-	19,200	-	23,467	-	12,400
Chloroform	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Chloromethane	-	39,200	-	12,000	-	19,200	-	23,467	-	12,400
2-Chlorotoluene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
4-Chlorotoluene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,2-Dibromo-3-chloropropane	-	39,200	-	12,000	-	19,200	-	23,467	-	12,400
1,2-Dibromoethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Dibromomethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,2-Dichlorobenzene	2,190,000	9,800	851,000	3,010	1,580,000	4,800	#######	5,870	854,000	3,090
1,3-Dichlorobenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,4-Dichlorobenzene	17,400 J	9,800	7,040 J	3,010	13,200 J	9,600	12,547	7,470	5120 J	3,090
Dichlorodifluoromethane	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
1,1-Dichloroethane	-	19,600	-	6,020	-	4,800	-	10,140	-	6,190
1,2-Dichloroethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,1-Dichloroethene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
cis-1,2-Dichloroethene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
trans-1,2-Dichloroethene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,2-Dichloropropane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,3-Dichloropropane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
2,2-Dichloropropane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
cis-1,3-Dichloropropene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
trans-1,3-Dichloropropene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,1-Dichloropropene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Ethylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
2-Hexanone	-	49,000	-	15,000	-	24,000	-	29,333	-	15,500
Hexachlorobutadiene	10,200 J	9,800	8,370 J	3,010	14,800 J	4,800	11,123	5,870	3,240 J	3,090
Isopropylbenzene	-	9,800	4,650 J	3,010	8,010 J	4,800	4,220	5,870	3,190 J	3,090
p-Isopropyltoluene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 23
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME 0 and Day 21
Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Control Time "0" (µg/Kg)		Duplicate (µg/Kg)		Triplicate (µg/Kg)		Average (µg/Kg)		Control Time "21 Day" (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
4-Methyl-2-pentanone	-	49,000	-	15,000	-	24,000	-	29,333	-	15,500
Methylene chloride	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
Naphthalene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
n-Propylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Styrene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,1,1,2-Tetrachloroethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,1,2,2-Tetrachloroethane	73,700 J	9,800	13,600 J	3,010	28,100 J	4,800	38,467	5,870	32,600	3,090
Tetrachloroethene	346,000	9,800	108,000	3,010	201,000	4,800	218,333	5,870	41,200	3,090
Toluene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,2,3-Trichlorobenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,2,4-Trichlorobenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,1,1-Trichloroethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,1,2-Trichloroethane	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Trichloroethene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Trichlorofluoromethane	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
1,2,3-Trichloropropane	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
1,2,4-Trimethylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
1,3,5-Trimethylbenzene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
Vinyl acetate	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
Vinyl chloride	-	19,600	-	6,020	-	9,600	-	11,740	-	6,190
o-Xylene	-	9,800	-	3,010	-	4,800	-	5,870	-	3,090
m, p -Xylene	15,800 J	9,800	4,350 J	3,010	9,120 J	4,800	9,757	5,870	4,080 J	3,090

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 24
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME "0" and "Day 21"
Summary of SPLP Volatiles Analyses - EPA Methods 1312/8260B

SPLP VOLATILES	Control Time "0" (µg/L)		Control Time "Day 21" (µg/L)	
	Result	DL	Result	DL
Acetone	-	625	-	25.0
Benzene	136 J	31.3	48.6 J	1.25
Bromobenzene	-	31.3	11.2 J	1.25
Bromochloromethane	-	50.0	-	2.00
Bromodichloromethane	-	62.5	-	2.50
Bromoform	-	125	15.9 J	5.00
Bromomethane	-	125	-	5.00
2-Butanone	-	625	-	25.0
n-Butylbenzene	-	62.5	-	2.50
sec-Butylbenzene	-	62.5	-	2.50
tert-Butylbenzene	-	62.5	-	2.50
Carbon disulfide	-	125	-	5.00
Carbon tetrachloride	-	62.5	6.79 J	2.50
Chlorobenzene	349 J	31.3	172	1.25
Chlorodibromomethane	-	62.5	-	2.50
Chloroethane	-	125	-	5.00
2-Chloroethyl vinyl ether	-	2,500	-	100
Chloroform	-	31.3	1.45 J	1.25
Chloromethane	-	62.5	-	2.50
2-Chlorotoluene	-	31.3	6.52 J	1.25
4-Chlorotoluene	-	62.5	3.05 J	2.50
1,2-Dibromo-3-chloropropane	-	250	12.1 J	10.0
1,2-Dibromoethane	-	62.5	-	2.50
Dibromomethane	-	62.5	-	2.50
1,2-Dichlorobenzene	58,900 I	31.3	34,600	62.5
1,3-Dichlorobenzene	-	62.5	15.9 J	2.50
1,4-Dichlorobenzene	384 J	31.3	269	1.25
Dichlorodifluoromethane	-	62.5	-	2.50
1,1-Dichloroethane	-	31.3	-	1.25
1,2-Dichloroethane	-	62.5	4.42 J	2.50
1,1-Dichloroethene	-	125	-	5.00
cis-1,2-Dichloroethene	-	62.5	-	2.50
trans-1,2-Dichloroethene	-	62.5	-	2.50
1,2-Dichloropropane	-	50.0	-	2.00
1,3-Dichloropropane	-	50.0	-	2.00
2,2-Dichloropropane	-	62.5	-	2.50
cis-1,3-Dichloropropene	-	62.5	-	2.50
trans-1,3-Dichloropropene	-	125	-	5.00
1,1-Dichloropropene	-	62.5	-	2.50
Ethylbenzene	116 J	62.5	72	2.50
2-Hexanone	-	625	-	25.0
Hexachlorobutadiene	-	62.5	25.9 J	2.50
Isopropylbenzene	162 J	62.5	146	2.50
p-Isopropyltoluene	-	63	-	2.50

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL

TABLE 24

AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME "0" and "Day 21"

Summary of SPLP Volatiles Analyses - EPA Methods 1312/8260B

SPLP VOLATILES	Control Time "0" (µg/L)		Control Time "Day 21" (µg/L)	
	Result	DL	Result	DL
4-Methyl-2-pentanone	-	625	-	25.0
Methylene chloride	-	63	-	2.50
Naphthalene	-	50.0	22.5 J	2.00
n-Propylbenzene	-	31.3	1.43 J	1.25
Styrene	-	31.3	-	1.25
1,1,1,2-Tetrachloroethane	-	62.5	-	2.50
1,1,2,2-Tetrachloroethane	3,020	31.3	1,650	1.25
Tetrachloroethene	10,300	62.5	3,280	125
Toluene	291 J	62.5	142	2.50
1,2,3-Trichlorobenzene	-	31.3	2.55 J	1.25
1,2,4-Trichlorobenzene	-	50.0	23.4 J	2.00
1,1,1-Trichloroethane	-	62.5	-	2.50
1,1,2-Trichloroethane	-	62.5	-	2.50
Trichloroethene	448 J	62.5	274	2.50
Trichlorofluoromethane	-	62.5	-	2.50
1,2,3-Trichloropropane	-	125	-	5.00
1,2,4-Trimethylbenzene	-	62.5	-	2.50
1,3,5-Trimethylbenzene	-	62.5	-	2.50
Vinyl acetate	-	625	-	25.0
Vinyl chloride	80.9 J	62.5	-	2.50
o-Xylene	97.4 J	62.5	70.5	2.50
m, p -Xylene	445 J	62.5	291	2.50

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit
I Semiquantitative resutl (above instrument calibration range)

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 25
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME "0" AND "DAY 21"
Summary of Total Semivolatiles Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	Control Time "0" (µg/Kg)		Control Time "Day 21" (µg/Kg)	
	Result	DL	Result	DL
Phenol	-	495	-	528
Bis (2-Chloroethyl) ether	-	495	-	528
2-Chlorophenol	-	495	-	528
1,3-Dichlorobenzene	-	495	-	528
1,4-Dichlorobenzene	2,080	495	1,780	528
Benzyl alcohol	-	495	-	528
1,2-Dichlorobenzene	111,000	1,980	340,000	5,280
2-Methylphenol	-	495	-	528
3-,4-Methylphenol	-	495	-	528
bis (2-Chloroisopropyl) ether	-	495	-	528
N-Nitroso-di-n-propylamine	-	495	-	528
Hexachloroethane	-	495	2,570	528
Nitrobenzene	-	495	-	528
Isophorone	-	495	-	528
2-Nitrophenol	-	495	-	528
2,4-Dimethylphenol	-	495	-	528
Benzoic acid	45,800	7,910	55,800	21,100
Bis (2-Chloroethoxy) Methane	-	495	-	528
2,4-Dichlorophenol	773 J	495	-	528
1,2,4-Trichlorobenzene	-	495	-	528
Naphthalene	-	495	-	528
4-Chloroaniline	-	495	-	528
Hexachlorobutadiene	821 J	495	866 J	528
4-Chloro-3-methylphenol	-	495	-	528
2-Methylnaphthalene	-	495	-	528
Hexachlorocyclopentadiene	-	495	-	528
2,4,6-Trichlorophenol	-	495	-	528
2,4,5-Trichlorophenol	-	495	-	528
2-Chloronaphthalene	-	495	-	528
2-Nitroaniline	-	1,980	-	2,110
Dimethylphthalate	-	495	-	528
Acenaphthylene	-	495	-	528
2,6-Dinitrotoluene	-	495	-	528
3-Nitroaniline	-	1,980	-	2,110
Acenaphthene	-	495	-	528
2,4-Dinitrophenol	-	1,980	-	2,110
4-Nitrophenol	-	1,980	-	2,110
Dibenzofuran	-	495	-	528
2,4-Dinitrotoluene	-	495	-	528
Diethylphthalate	-	495	-	528
4-Chlorophenyl-phenyl ether	-	495	-	528
Fluorene	-	495	-	528
4-Nitroaniline	-	1,980	-	2,110

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 25
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME "0" AND "DAY 21"
Summary of Total Semivolatiles Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	Control Time "0" (µg/Kg)		Control Time "Day 21" (µg/Kg)	
	Result	DL	Result	DL
4,6-Dinitro-2-methylphenol	-	1,980	-	2,110
N-Nitrosodiphenylamine	-	495	-	528
4-Bromophenyl-phenylether	-	495	-	528
Hexachlorobenzene	2,950	495	2,950	528
Pentachlorophenol	-	1,980	-	2,110
Phenanthrene	-	495	-	528
Anthracene	-	495	-	528
Di-n-butylphthalate	-	495	-	528
Fluoranthene	-	495	-	528
Pyrene	-	495	-	528
Butylbenzylphthalate	-	495	-	528
3,3-Dichlorobenzidine	-	989	-	1,060
Benzo(a)anthracene	-	495	-	528
Chrysene	-	495	-	528
bis(2-Ethylhexyl)phthalate	-	495	-	528
Di-n-octylphthalate	-	495	-	528
Benzo(b)fluoranthene	-	495	-	528
Benzo(k)fluoranthene	-	495	-	528
Benzo(a)pyrene	-	495	-	528
Indeno(1,2,3-cd)pyrene	-	495	-	528
Dibenzo(a,h)Anthracene	-	495	-	528
Benzo(g,h,i)Perylene	-	495	-	528

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 26
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME "0" and "Day 21"
Summary of SPLP Semivolatiles Analyses - EPA Methods 1312/8270C

SPLP SEMIVOLATILES	Control Time "0" (µg/L)		Control Time "Day 21" (µg/L)	
	Result	DL	Result	DL
Phenol	-	25.5	-	12.8
Bis (2-Chloroethyl) ether	-	25.5	-	12.8
2-Chlorophenol	-	25.5	-	12.8
1,3-Dichlorobenzene	-	25.5	-	12.8
1,4-Dichlorobenzene	160	25.5	141	12.8
Benzyl alcohol	-	25.5	-	12.8
1,2-Dichlorobenzene	22,700	1,280	25,500	1,280
2-Methylphenol	-	25.5	-	12.8
3-,4-Methylphenol	-	25.5	-	12.8
bis (2-Chloroisopropyl) ether	-	25.5	-	12.8
N-Nitroso-di-n-propylamine	-	25.5	-	12.8
Hexachloroethane	186	25.5	201	12.8
Nitrobenzene	-	25.5	-	12.8
Isophorone	-	25.5	-	12.8
2-Nitrophenol	-	25.5	-	12.8
2,4-Dimethylphenol	-	25.5	-	12.8
Benzoic acid	6,340	1,280	-	63.8
Bis (2-Chloroethoxy) Methane	-	25.5	-	12.8
2,4-Dichlorophenol	32.4	25.5	51.6	12.8
1,2,4-Trichlorobenzene	-	25.5	31.7	12.8
Naphthalene	-	25.5	-	12.8
4-Chloroaniline	-	25.5	-	12.8
Hexachlorobutadiene	-	25.5	-	12.8
4-Chloro-3-methylphenol	-	25.5	-	12.8
2-Methylnaphthalene	-	25.5	-	12.8
Hexachlorocyclopentadiene	-	25.5	-	12.8
2,4,6-Trichlorophenol	-	25.5	37.4	12.8
2,4,5-Trichlorophenol	-	25.5	-	12.8
2-Chloronaphthalene	-	25.5	-	12.8
2-Nitroaniline	-	128	-	63.8
Dimethylphthalate	-	25.5	-	12.8
Acenaphthylene	-	25.5	-	12.8
2,6-Dinitrotoluene	-	25.5	-	12.8
3-Nitroaniline	-	128	-	63.8
Acenaphthene	-	25.5	-	12.8
2,4-Dinitrophenol	-	128	-	63.8
4-Nitrophenol	-	128	-	63.8
Dibenzofuran	-	25.5	-	12.8
2,4-Dinitrotoluene	-	25.5	-	12.8
Diethylphthalate	-	25.5	-	12.8
4-Chlorophenyl-phenyl ether	-	25.5	-	12.8
Fluorene	-	25.5	-	12.8
4-Nitroaniline	-	128	-	63.8

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 26
AIR STRIPPING S/S VERIFICATION TESTING: CONTROL TIME "0" and "Day 21"
Summary of SPLP Semivolatiles Analyses - EPA Methods 1312/8270C

SPLP SEMIVOLATILES	Control Time "0" (µg/L)		Control Time "Day 21" (µg/L)	
	Result	DL	Result	DL
4,6-Dinitro-2-methylphenol	-	128	-	63.8
N-Nitrosodiphenylamine	-	25.5	-	12.8
4-Bromophenyl-phenylether	-	25.5	-	12.8
Hexachlorobenzene	-	25.5	-	12.8
Pentachlorophenol	-	128	-	63.8
Phenanthrene	-	25.5	-	12.8
Anthracene	-	25.5	-	12.8
Di-n-butylphthalate	-	25.5	-	12.8
Fluoranthene	-	25.5	-	12.8
Pyrene	-	25.5	-	12.8
Butylbenzylphthalate	-	25.5	-	12.8
3,3-Dichlorobenzidine	-	25.5	-	12.8
Benzo(a)anthracene	-	25.5	-	12.8
Chrysene	-	25.5	-	12.8
bis(2-Ethylhexyl)phthalate	-	25.5	-	12.8
Di-n-octylphthalate	-	25.5	-	12.8
Benzo(b)fluoranthene	-	25.5	-	12.8
Benzo(k)fluoranthene	-	25.5	-	12.8
Benzo(a)pyrene	-	25.5	-	12.8
Indeno(1,2,3-cd)pyrene	-	25.5	-	12.8
Dibenzo(a,h)Anthracene	-	25.5	-	12.8
Benzo(g,h,i)Perylene	-	25.5	-	12.8

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL

Table 27
Summary of Air Stripping Analyses for 0190-019
90 Minute Air Stripping & Cement / Class "C" Fly Ash @ 7.5 / 15 Stabilization

Total	air flow (ml/min)		Humidity (%)		Temperature °C		PID (PPM)	
Minutes	In	out	in	out	in	out	in	out
Initial	65	25	0	37	25.5	18.3	1.7	1.7
3	65	25	0	59	24.6	19.4	102.0	1.7
0	65	25	0	38	24.4	19.4	104.0	1.7
9	65	25	0	43	24.3	18.9	117.0	2.0
12	65	25	0	43	24.3	18.3	86.0	2.0
15	65	18	0	47	24.3	17.2	88.5	11.5
18	65	18	0	46	24.7	16.7	83.5	16.6
21	65	18	0	51	24.3	16.7	86.6	15.4
24	65	18	0	51	24.6	16.7	70.3	22.5
27	65	18	0	54	24.4	16.7	80.4	21.8
30	65	18	0	54	24.4	16.7	82.8	22.2
33	65	18	0	54	24.4	16.7	68.7	23.0
36	65	18	0	54	24.4	16.7	65.2	23.3
39	65	18	0	58	24.1	16.7	70.8	23.2
42	65	18	0	58	24.3	17.2	64.8	23.5
45	65	18	0	61	24.1	16.7	64.1	23.8
48	65	18	0	61	24.1	16.7	60.0	23.6
51	65	18	0	62	24.4	16.7	58.6	23.6
54	65	18	0	65	24.3	16.7	51.8	23.7
57	65	18	0	62	24.3	17.2	47.3	23.3
60	65	18	0	62	24.3	16.1	42.3	22.5
63	65	18	0	58	24.3	16.7	36.4	21.7
66	65	18	0	57	24.3	16.7	35.6	21.0
69	65	18	0	56	24.3	16.7	30.9	20.3
72	65	18	0	56	24.3	16.7	28.2	19.6
75	65	18	0	54	24.1	16.7	26.9	19.3
78	65	18	0	53	24.3	16.7	25.3	18.6
81	65	18	0	51	24.3	16.7	24.1	18.0
84	65	18	0	52	24.3	16.7	23.7	17.5
87	65	18	0	53	24.3	16.7	22.8	17.2
90	65	18	0	51	24.3	16.7	21.1	16.8

KEY

ml - milliliters
ppm - parts per million
% - percent
min - minutes
°C - celsius

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL

Table 28
Summary of Air Stripping Analyses for 0190-020
135 Minute Air Stripping & Cement / Class "C" Fly Ash @ 7.5 / 15 Stabilization

Total	air flow (ml/min)		Humidity (%)		Temperature °C		PID (PPM)	
Minutes	In	out	in	out	in	out	in	out
Initial	65	18	0	39	24.5	19.4	5.3	5.3
3	65	18	0	47	23.9	16.1	131.0	22.8
0	65	18	0	52	23.7	16.1	160.0	36.3
9	65	18	0	54	23.8	16.1	146.0	38.3
12	65	18	0	56	23.8	16.7	80.6	37.4
15	65	18	0	57	23.6	16.7	124.0	36.8
18	65	18	0	57	23.6	16.7	108.0	37.5
21	65	18	0	56	23.6	16.7	85.0	37.5
24	65	18	0	58	23.9	16.7	97.5	37.7
27	65	18	0	61	23.7	16.7	107.0	39.5
30	65	18	0	63	23.7	16.7	102.0	38.8
33	65	18	0	60	23.7	16.7	86.9	38.9
36	65	18	0	62	23.7	16.7	83.3	38.7
39	65	18	0	66	23.6	16.7	80.7	38.3
42	65	18	0	67	23.6	16.7	72.3	37.9
45	65	18	0	68	23.6	16.7	67.6	37.7
48	65	18	0	68	23.6	16.7	60.7	36.8
51	65	18	0	68	23.6	16.1	54.0	35.7
54	65	18	0	66	23.7	16.1	47.0	34.1
57	65	18	0	62	23.6	16.1	43.3	32.1
60	65	18	0	60	23.6	16.1	38.2	30.6
63	65	18	0	57	23.6	16.1	34.3	28.2
66	65	18	0	56	23.6	16.1	33.1	26.8
69	65	18	0	57	23.7	16.1	31.7	25.8
72	65	18	0	55	23.9	16.7	28.3	25.8
75	65	18	0	55	23.8	16.7	28.3	24.7
78	65	18	0	55	23.8	16.7	26.4	24.2
81	65	18	0	54	23.7	17.2	25.5	23.7
84	65	18	0	53	23.9	17.2	23.7	23.1
87	65	18	0	52	23.7	17.2	22.5	22.4
90	65	18	0	50	23.7	17.2	21.6	21.8
93	65	18	0	50	23.7	16.7	20.1	21.2
96	65	18	0	50	23.7	16.7	20.1	19.9
99	65	18	0	49	23.7	16.7	19.8	19.2
102	65	18	0	50	23.6	16.7	19.6	18.9
105	65	18	0	50	23.7	16.7	18.7	18.9
108	65	18	0	50	23.7	16.7	17.3	17.9
111	65	18	0	49	23.7	16.7	17.0	17.6
114	65	18	0	48	23.7	16.1	15.6	17.0
117	65	18	0	48	23.7	16.1	16.1	16.7
120	65	18	0	48	23.7	16.1	16.0	16.3
123	65	18	0	50	23.7	16.1	5.3	16.0
126	65	18	0	49	23.7	16.1	14.8	15.7
129	65	18	0	49	23.7	16.1	14.1	15.3
132	65	18	0	49	23.7	16.1	14.1	15.1
135	65	18	0	47	23.7	16.1	13.5	14.9

KEY

ml - milliliters
ppm - parts per million
% - percent
min - minutes
°C - celsius

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 29

VERIFICATION PHASE: 90 MINUTE AIR STRIPPING OF UNTREATED SOIL SE0190-019 & FINAL TREATMENT

(S/S Treatment: 7.5% Portland Cement, 15% Class "C" Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Baseline (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS & SS (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone		3,570	-	20,700	-	19,700	-	10,700	-	9,730	-	1,000
Benzene	7,390	357	-	2,070	-	1,970	-	1,070	-	973	167 J	100
Bromobenzene	920 J	357	-	2,070	-	1,970	-	1,070	-	973	-	100
Bromochloromethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Bromodichloromethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Bromoform	1,580 J	357	-	2,070	-	1,970	-	1,070	-	973	-	100
Bromomethane		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
2-Butanone		1,780	-	10,400	-	9,870	-	5,330	-	4,860	-	501
n-Butylbenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
sec-Butylbenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
tert-Butylbenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Carbon disulfide		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Carbon tetrachloride	976 J	357	-	2,070	-	1,970	-	1,070	-	973	-	100
Chlorobenzene	15,300	357	-	2,070	-	1,970	-	1,070	-	973	206 J	100
Chlorodibromomethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Chloroethane		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
2-Chloroethyl vinyl ether		1,430	-	8,300	-	7,890	-	4,260	-	3,890	-	401
Chloroform		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Chloromethane		1,430	-	8,300	-	7,890	-	4,260	-	3,890	-	401
2-Chlorotoluene	659 J	357	-	2,070	-	1,970	-	1,070	-	973	-	100
4-Chlorotoluene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,2-Dibromo-3-chloropropane		1,430	-	8,300	-	7,890	-	4,260	-	3,890	-	401
1,2-Dibromoethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Dibromomethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,2-Dichlorobenzene	3,320,000	17,800	786,000	2,070	516,000	1,970	267,000	1,070	161,000	973	24,700 J	100
1,3-Dichlorobenzene	1,580 J	357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,4-Dichlorobenzene	23,200	357	5,960 J	2,070	4,290 J	1,970	1,990 J	1,070	1,340 J	973	586 J	100
Dichlorodifluoromethane		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
1,1-Dichloroethane		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
1,2-Dichloroethane	544 J	357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,1-Dichloroethene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
cis-1,2-Dichloroethene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
trans-1,2-Dichloroethene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,2-Dichloropropane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,3-Dichloropropane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
2,2-Dichloropropane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
cis-1,3-Dichloropropene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
trans-1,3-Dichloropropene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,1-Dichloropropene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Ethylbenzene	6,320	357	-	2,070	-	1,970	-	1,070	-	973	-	100
2-Hexanone		1,780	-	10,400	-	9,870	-	5,330	-	4,860	-	501
Hexachlorobutadiene	19,100	357	4,040 J	2,070	5,080 J	1,970	5,640 J	1,070	3,360 J	973	812 J	100
Isopropylbenzene	12,900	357	3,260 J	2,070	2,770 J	1,970	-	1,070	-	973	132 J	100
p-Isopropyltoluene		357	-	2,070	-	1,970	-	1,070	-	973	-	100

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 29

VERIFICATION PHASE: 90 MINUTE AIR STRIPPING OF UNTREATED SOIL SE0190-019 & FINAL TREATMENT

(S/S Treatment: 7.5% Portland Cement, 15% Class "C" Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Baseline (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS & SS (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
4-Methyl-2-pentanone		1,780	-	10,400	-	9,870	-	5,330	-	4,860	-	501
Methylene chloride		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
Naphthalene	1,620 J	357	12,000 J	2,070	6,600 J	1,970	1,320 J	1,070	-	973	108 J	100
n-Propylbenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Styrene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,1,1,2-Tetrachloroethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,1,2,2-Tetrachloroethane	102,000	357	18,000 J	2,070	12,700 J	1,970	9,800 J	1,070	8,260 J	973	-	100
Tetrachloroethene	709,000	17,800	37,600	2,070	35,300	1,970	22,600	1,070	21,000	973	6,090	100
Toluene	13,400	357	-	2,070	-	1,970	-	1,070	-	973	136 J	100
1,2,3-Trichlorobenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,2,4-Trichlorobenzene	3,320 J	357	-	2,070	-	1,970	-	1,070	-	973	134 J	100
1,1,1-Trichloroethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,1,2-Trichloroethane		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Trichloroethene	19,800	357	-	2,070	2,010 J	1,970	1,800 J	1,070	2,430 J	973	1,650	100
Trichlorofluoromethane		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
1,2,3-Trichloropropane		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
1,2,4-Trimethylbenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
1,3,5-Trimethylbenzene		357	-	2,070	-	1,970	-	1,070	-	973	-	100
Vinyl acetate		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
Vinyl chloride		713	-	4,150	-	3,950	-	2,130	-	1,950	-	200
o-Xylene	5,440	357.0	-	2,070	-	1,970	-	1,070	-	973	-	100
m, p -Xylene	25,000	357	3,250 J	2,070	2,130 J	1,970	-	1,070	-	973	205 J	100

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 30

VERIFICATION PHASE: 135 MINUTE AIR STRIPPING OF UNTREATED SOIL SE0190-020 & FINAL TREATMENT

(Post-treatment will be 7.5% Portland Cement, 15% Class "C" Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Baseline (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS 135 min (µg/Kg)		AS & SS (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	3,810	-	478	-	22,400	-	22,800	-	4,600	-	4,260	-	1,060
Benzene	5,670	381	625	47.8	-	2,240	2,290 J	2,280	-	460	1,220 J	426	133 J	106
Bromobenzene	731 J	381	162 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Bromochloromethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Bromodichloromethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Bromoform	1,450 J	381	161 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Bromomethane	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
2-Butanone	-	1,910	-	239	-	11,200	-	11,400	-	2,300	-	2,130	-	531
n-Butylbenzene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
sec-Butylbenzene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
tert-Butylbenzene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Carbon disulfide	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Carbon tetrachloride	898 J	381	56.2 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Chlorobenzene	12,800	381	1,570	47.8	-	2,240	4,730 J	2,280	-	460	728 J	426	169 J	106
Chlorodibromomethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Chloroethane	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
2-Chloroethyl vinyl ether	-	1,530	-	191	-	8,960	-	9,110	-	1,840	-	1,710	-	425
Chloroform	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Chloromethane	-	1,530	-	191	-	8,960	-	9,110	-	1,840	-	1,710	-	425
2-Chlorotoluene	490 J	381	143 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
4-Chlorotoluene	-	381	61.3 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,2-Dibromo-3-chloropropane	-	1,530	-	191	-	8,960	-	9,110	-	1,840	-	1,710	-	425
1,2-Dibromoethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Dibromomethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,2-Dichlorobenzene	2,130,000	19,100	908,000	4,780	481,000	2,240	884,000	2,280	152,000	460	115,000	426	30,100 J	106
1,3-Dichlorobenzene	1,290 J	381	428 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,4-Dichlorobenzene	20,000	381	6,500	47.8	3,470 J	2,240	7,990 J	2,280	1,160 J	460	1,370 J	426	422 J	106
Dichlorodifluoromethane	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
1,1-Dichloroethane	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
1,2-Dichloroethane	-	381	245 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,1-Dichloroethene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
cis-1,2-Dichloroethene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
trans-1,2-Dichloroethene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,2-Dichloropropane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,3-Dichloropropane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
2,2-Dichloropropane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
cis-1,3-Dichloropropene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
trans-1,3-Dichloropropene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,1-Dichloropropene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Ethylbenzene	5,360	381	692	47.8	-	2,240	-	2,280	-	460	-	426	-	106
2-Hexanone	-	1,910	-	239	-	11,200	-	11,400	-	2,300	-	2,130	-	531
Hexachlorobutadiene	16,900	381	7,500	47.8	8,470 J	2,240	5,660 J	2,280	2,470 J	460	2,530 J	426	754 J	106

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 30

VERIFICATION PHASE: 135 MINUTE AIR STRIPPING OF UNTREATED SOIL SE0190-020 & FINAL TREATMENT

(Post-treatment will be 7.5% Portland Cement, 15% Class "C" Fly Ash)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Baseline (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS 135 min (µg/Kg)		AS & SS (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Isopropylbenzene	11,000	381	2,230	47.8	-	2,240	-	2,280	-	460	-	426	-	106
p-Isopropyltoluene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
4-Methyl-2-pentanone	-	1,910	-	239	-	11,200	-	11,400	-	2,300	-	2,130	-	531
Methylene chloride	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
Naphthalene	1,330 J	381	1,020	47.8	-	2,240	-	2,280	576 J	460	-	426	-	106
n-Propylbenzene	-	381	54.9 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Styrene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,1,1,2-Tetrachloroethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,1,2,2-Tetrachloroethane	81,400	381	18,300	47.8	8,790 J	2,240	57,300	2,280	6,890	460	7,290	426	-	106
Tetrachloroethene	433,000	19,100	69,000	4,780	24,900	2,240	151,000	2,280	7,480	460	25,500	426	4,090	106
Toluene	11,000	381	794	47.8	-	2,240	3,380 J	2,280	-	460	587 J	426	-	106
1,2,3-Trichlorobenzene	-	381	149 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,2,4-Trichlorobenzene	2,930 J	381	1,440	47.8	-	2,240	-	2,280	549 J	460	464 J	426	111 J	106
1,1,1-Trichloroethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,1,2-Trichloroethane	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Trichloroethene	14,700	381	1,550	47.8	-	2,240	10,100 J	2,280	782 J	460	3,460 J	426	1,460	106
Trichlorofluoromethane	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
1,2,3-Trichloropropane	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
1,2,4-Trimethylbenzene	-	381	-	47.8	-	2,240	-	2,280	-	460	-	426	-	106
1,3,5-Trimethylbenzene	-	381	60.4 J	47.8	-	2,240	-	2,280	-	460	-	426	-	106
Vinyl acetate	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
Vinyl chloride	-	763	-	95.7	-	4,480	-	4,560	-	920	-	853	-	212
o-Xylene	4,490	381	754	47.8	-	2,240	-	2,280	-	460	-	426	-	106
m, p -Xylene	21,000	381	3,080	47.8	-	2,240	4,510 J	2,280	-	460	717 J	426	122 J	106

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 31
VERIFICATION TESTING
PRETREATMENT: 90 MINUTE AIR STRIPPING
POST-TREATMENT: 7.5% PORTLAND CEMENT / 15% CLASS "C" FLY ASH (0190-019)
Summary of SPLP Volatiles Analyses - EPA Methods 1312/ 8260B

SPLP VOLATILES	Baseline (µg/L)		Treated 0190-019 (µg/L)	
	Result	DL	Result	DL
Acetone	-	250	-	12.5
Benzene	146 J	12.5	2.36 J	0.625
Bromobenzene	18.2 J	12.5	-	0.625
Bromochloromethane	-	20.0	-	1.00
Bromodichloromethane	-	25.0	-	1.25
Bromoform	-	50.0	-	2.50
Bromomethane	-	50.0	-	2.50
2-Butanone	-	250	-	12.5
n-Butylbenzene	-	25.0	-	1.25
sec-Butylbenzene	-	25.0	-	1.25
tert-Butylbenzene	-	25.0	-	1.25
Carbon disulfide	-	50.0	-	2.50
Carbon tetrachloride	55.0 J	25.0	-	1.25
Chlorobenzene	323 J	12.5	2.50 J	0.625
Chlorodibromomethane	-	25.0	-	1.25
Chloroethane	-	50.0	-	2.50
2-Chloroethyl vinyl ether	-	1,000	-	50.0
Chloroform	-	12.5	-	0.625
Chloromethane	-	25.0	-	1.25
2-Chlorotoluene	18.9 J	12.5	-	0.625
4-Chlorotoluene	-	25.0	-	1.25
1,2-Dibromo-3-chloropropane	-	100	-	5.00
1,2-Dibromoethane	-	25.0	-	1.25
Dibromomethane	-	25.0	-	1.25
1,2-Dichlorobenzene	57,900 I	12.5	947	0.625
1,3-Dichlorobenzene	-	25.0	-	1.25
1,4-Dichlorobenzene	416 J	12.5	5.78 J	0.625
Dichlorodifluoromethane	-	25.0	-	1.25
1,1-Dichloroethane	-	12.5	-	0.625
1,2-Dichloroethane	-	25.0	2.08 J	1.25
1,1-Dichloroethene	-	50.0	-	2.50
cis-1,2-Dichloroethene	-	25.0	-	1.25
trans-1,2-Dichloroethene	-	25.0	-	1.25
1,2-Dichloropropane	-	20.0	-	1.00
1,3-Dichloropropane	-	20.0	-	1.00
2,2-Dichloropropane	-	25.0	-	1.25
cis-1,3-Dichloropropene	-	25.0	-	1.25
trans-1,3-Dichloropropene	-	50.0	-	2.50
1,1-Dichloropropene	-	25.0	-	1.25
Ethylbenzene	130 J	25.0	-	1.25
2-Hexanone	-	250	-	12.5
Hexachlorobutadiene	-	25.0	2.19 J	1.25
Isopropylbenzene	186 J	25.0	2.22 J	1.25
p-Isopropyltoluene	-	25.0	-	1.25

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 31
VERIFICATION TESTING
PRETREATMENT: 90 MINUTE AIR STRIPPING
POST-TREATMENT: 7.5% PORTLAND CEMENT / 15% CLASS "C" FLY ASH (0190-019)
Summary of SPLP Volatiles Analyses - EPA Methods 1312/ 8260B

SPLP VOLATILES	Baseline (µg/L)		Treated 0190-019 (µg/L)	
	Result	DL	Result	DL
4-Methyl-2-pentanone	-	250	-	12.5
Methylene chloride	-	25.0	-	1.25
Naphthalene	39.6 J	20.0	-	1.00
n-Propylbenzene	-	12.5	-	0.625
Styrene	-	12.5	-	0.625
1,1,1,2-Tetrachloroethane	-	25.0	-	1.25
1,1,2,2-Tetrachloroethane	2,750	12.5	-	0.625
Tetrachloroethene	11,300	25.0	44.3	1.25
Toluene	289 J	25.0	1.55 J	1.25
1,2,3-Trichlorobenzene	-	12.5	-	0.625
1,2,4-Trichlorobenzene	34.7 J	20.0	1.41 J	1.00
1,1,1-Trichloroethane	-	25.0	-	1.25
1,1,2-Trichloroethane	-	25.0	-	1.25
Trichloroethene	442 J	25.0	38.8	1.25
Trichlorofluoromethane	-	25.0	-	1.25
1,2,3-Trichloropropane	-	50.0	-	2.50
1,2,4-Trimethylbenzene	-	25.0	-	1.25
1,3,5-Trimethylbenzene	-	25.0	-	1.25
Vinyl acetate	-	250	-	12.5
Vinyl chloride	-	25.0	-	1.25
o-Xylene	108 J	25.0	-	1.25
m, p -Xylene	477 J	25.0	1.53 J	1.25

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit
I Semiquantitative resutl (above instrument calibration range)

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 32
VERIFICATION TESTING
PRETREATMENT: 135 MINUTE AIR STRIPPING
POST-TREATMENT: 7.5% PORTLAND CEMENT / 15% CLASS "C" FLY ASH (0190-020)
Summary of SPLP Volatiles Analyses - EPA Methods 1312/ 8260B

SPLP VOLATILES	Baseline (µg/L)		Treated 0190-020 (µg/L)	
	Result	DL	Result	DL
Acetone	-	250	-	12.5
Benzene	175 J	12.5	1.91 J	0.625
Bromobenzene	19.9 J	12.5	-	0.625
Bromochloromethane	-	20.0	-	1.00
Bromodichloromethane	-	25.0	-	1.25
Bromoform	-	50.0	-	2.50
Bromomethane	-	50.0	-	2.50
2-Butanone	-	250	-	12.5
n-Butylbenzene	-	25.0	-	1.25
sec-Butylbenzene	-	25.0	-	1.25
tert-Butylbenzene	-	25.0	-	1.25
Carbon disulfide	-	50.0	-	2.50
Carbon tetrachloride	54.2 J	25.0	-	1.25
Chlorobenzene	347 J	12.5	1.71 J	0.625
Chlorodibromomethane	-	25.0	-	1.25
Chloroethane	-	50.0	-	2.50
2-Chloroethyl vinyl ether	-	1,000	-	50.0
Chloroform	-	12.5	-	0.625
Chloromethane	-	25.0	4.74 J	1.25
2-Chlorotoluene	-	12.5	-	0.625
4-Chlorotoluene	-	25.0	-	1.25
1,2-Dibromo-3-chloropropane	-	100	-	5.00
1,2-Dibromoethane	-	25.0	-	1.25
Dibromomethane	-	25.0	-	1.25
1,2-Dichlorobenzene	54,700 I	12.5	777	0.625
1,3-Dichlorobenzene	25.5 J	25.0	-	1.25
1,4-Dichlorobenzene	407 J	12.5	4.53 J	0.625
Dichlorodifluoromethane	-	25.0	-	1.25
1,1-Dichloroethane	-	12.5	-	0.625
1,2-Dichloroethane	-	25.0	1.29 J	1.25
1,1-Dichloroethene	-	50.0	-	2.50
cis-1,2-Dichloroethene	-	25.0	-	1.25
trans-1,2-Dichloroethene	-	25.0	-	1.25
1,2-Dichloropropane	-	20.0	-	1.00
1,3-Dichloropropane	-	20.0	-	1.00
2,2-Dichloropropane	-	25.0	-	1.25
cis-1,3-Dichloropropene	-	25.0	-	1.25
trans-1,3-Dichloropropene	-	50.0	-	2.50
1,1-Dichloropropene	-	25.0	-	1.25
Ethylbenzene	119 J	25.0	-	1.25
2-Hexanone	-	250	-	12.5
Hexachlorobutadiene	-	25.0	2.23 J	1.25
Isopropylbenzene	156 J	25.0	-	1.25
p-Isopropyltoluene	-	25.0	-	1.25

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES
NEASE CHEMICAL
TABLE 32
VERIFICATION TESTING
PRETREATMENT: 135 MINUTE AIR STRIPPING
POST-TREATMENT: 7.5% PORTLAND CEMENT / 15% CLASS "C" FLY ASH (0190-020)
Summary of SPLP Volatiles Analyses - EPA Methods 1312/ 8260B

SPLP VOLATILES	Baseline (µg/L)		Treated 0190-020 (µg/L)	
	Result	DL	Result	DL
4-Methyl-2-pentanone	-	250	-	12.5
Methylene chloride	-	25.0	-	1.25
Naphthalene	39.5 J	20.0	-	1.00
n-Propylbenzene	-	12.5	-	0.625
Styrene	-	12.5	-	0.625
1,1,1,2-Tetrachloroethane	-	25.0	-	1.25
1,1,2,2-Tetrachloroethane	3,050	12.5	-	0.625
Tetrachloroethene	10,100	25.0	25.9	1.25
Toluene	313 J	25.0	-	1.25
1,2,3-Trichlorobenzene	-	12.5	-	0.625
1,2,4-Trichlorobenzene	40.0 J	20.0	-	1.00
1,1,1-Trichloroethane	-	25.0	-	1.25
1,1,2-Trichloroethane	-	25.0	-	1.25
Trichloroethene	498 J	25.0	23.6 J	1.25
Trichlorofluoromethane	-	25.0	-	1.25
1,2,3-Trichloropropane	-	50.0	-	2.50
1,2,4-Trimethylbenzene	-	25.0	-	1.25
1,3,5-Trimethylbenzene	-	25.0	-	1.25
Vinyl acetate	-	250	-	12.5
Vinyl chloride	-	25.0	-	1.25
o-Xylene	97.3 J	25.0	-	1.25
m, p -Xylene	440 J	25.0	-	1.25

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit
[Semiquantitative resutl (above instrument calibration range)

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 33

VERIFICATION TESTING

PRETREATMENT: 90 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-019)

Summary of Total Semivolatiles Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	Baseline (µg/Kg)		AS & SS (0190-019) (µg/Kg)	
	Result	DL	Result	DL
Phenol	-	488	-	820
Bis (2-Chloroethyl) ether	-	488	-	820
2-Chlorophenol	-	488	-	820
1,3-Dichlorobenzene	-	488	-	820
1,4-Dichlorobenzene	1,970	488	-	820
Benzyl alcohol	-	488	-	820
1,2-Dichlorobenzene	101,000	1,950	28,300	820
2-Methylphenol	-	488	-	820
3-,4-Methylphenol	-	488	-	820
bis (2-Chloroisopropyl) ether	-	488	-	820
N-Nitroso-di-n-propylamine	-	488	-	820
Hexachloroethane	2,580	488	-	820
Nitrobenzene	-	488	-	820
Isophorone	-	488	-	820
2-Nitrophenol	-	488	-	820
2,4-Dimethylphenol	-	488	-	820
Benzoic acid	42,200	7,810	-	3,280
Bis (2-Chloroethoxy) Methane	-	488	-	820
2,4-Dichlorophenol	713 J	488	-	820
1,2,4-Trichlorobenzene	-	488	-	820
Naphthalene	-	488	-	820
4-Chloroaniline	-	488	-	820
Hexachlorobutadiene	701 J	488	-	820
4-Chloro-3-methylphenol	-	488	-	820
2-Methylnaphthalene	-	488	-	820
Hexachlorocyclopentadiene	-	488	-	820
2,4,6-Trichlorophenol	-	488	-	820
2,4,5-Trichlorophenol	-	488	-	820
2-Chloronaphthalene	-	488	-	820
2-Nitroaniline	-	1,950	-	3,280
Dimethylphthalate	-	488	-	820
Acenaphthylene	-	488	-	820
2,6-Dinitrotoluene	-	488	-	820
3-Nitroaniline	-	1,950	-	3,280
Acenaphthene	-	488	-	820
2,4-Dinitrophenol	-	1,950	-	3,280
4-Nitrophenol	-	1,950	-	3,280
Dibenzofuran	-	488	-	820
2,4-Dinitrotoluene	-	488	-	820
Diethylphthalate	-	488	-	820
4-Chlorophenyl-phenyl ether	-	488	-	820
Fluorene	-	488	-	820
4-Nitroaniline	-	1,950	-	3,280

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 33

VERIFICATION TESTING

PRETREATMENT: 90 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-019)

Summary of Total Semivolatiles Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	Baseline (µg/Kg)		AS & SS (0190-019) (µg/Kg)	
	Result	DL	Result	DL
4,6-Dinitro-2-methylphenol	-	1,950	-	3,280
N-Nitrosodiphenylamine	-	488	-	820
4-Bromophenyl-phenylether	-	488	-	820
Hexachlorobenzene	2,760	488	8,130	820
Pentachlorophenol	-	1,950	-	3,280
Phenanthrene	-	488	-	820
Anthracene	-	488	-	820
Di-n-butylphthalate	-	488	-	820
Fluoranthene	-	488	-	820
Pyrene	-	488	-	820
Butylbenzylphthalate	-	488	-	820
3,3-Dichlorobenzidine	-	976	-	1,640
Benzo(a)anthracene	-	488	-	820
Chrysene	-	488	-	820
bis(2-Ethylhexyl)phthalate	-	488	-	820
Di-n-octylphthalate	-	488	-	820
Benzo(b)fluoranthene	-	488	-	820
Benzo(k)fluoranthene	-	488	-	820
Benzo(a)pyrene	-	488	-	820
Indeno(1,2,3-cd)pyrene	-	488	-	820
Dibenzo(a,h)Anthracene	-	488	-	820
Benzo(g,h,i)Perylene	-	488	-	820

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 34

VERIFICATION TESTING

PRETREATMENT: 135 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-020)

Summary of Total Semivolatiles Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	Baseline (µg/Kg)		AS & SS (0190-020) (µg/Kg)	
	Result	DL	Result	DL
Phenol	-	492	-	802
Bis (2-Chloroethyl) ether	-	492	-	802
2-Chlorophenol	-	492	-	802
1,3-Dichlorobenzene	-	492	-	802
1,4-Dichlorobenzene	2,020	492	-	802
Benzyl alcohol	-	492	-	802
1,2-Dichlorobenzene	105,000	1,970	26,800	802
2-Methylphenol	-	492	-	802
3-,4-Methylphenol	-	492	-	802
bis (2-Chloroisopropyl) ether	-	492	-	802
N-Nitroso-di-n-propylamine	-	492	-	802
Hexachloroethane	2,690	492	-	802
Nitrobenzene	-	492	-	802
Isophorone	-	492	-	802
2-Nitrophenol	-	492	-	802
2,4-Dimethylphenol	-	492	-	802
Benzoic acid	40,300	7,880	-	3,210
Bis (2-Chloroethoxy) Methane	-	492	-	802
2,4-Dichlorophenol	723 J	492	-	802
1,2,4-Trichlorobenzene	-	492	-	802
Naphthalene	-	492	-	802
4-Chloroaniline	-	492	-	802
Hexachlorobutadiene	706 J	492	-	802
4-Chloro-3-methylphenol	-	492	-	802
2-Methylnaphthalene	-	492	-	802
Hexachlorocyclopentadiene	-	492	-	802
2,4,6-Trichlorophenol	-	492	-	802
2,4,5-Trichlorophenol	-	492	-	802
2-Chloronaphthalene	-	492	-	802
2-Nitroaniline	-	1,970	-	3,210
Dimethylphthalate	-	492	-	802
Acenaphthylene	-	492	-	802
2,6-Dinitrotoluene	-	492	-	802
3-Nitroaniline	-	1,970	-	3,210
Acenaphthene	-	492	-	802
2,4-Dinitrophenol	-	1,970	-	3,210
4-Nitrophenol	-	1,970	-	3,210
Dibenzofuran	-	492	-	802
2,4-Dinitrotoluene	-	492	-	802
Diethylphthalate	-	492	-	802
4-Chlorophenyl-phenyl ether	-	492	-	802
Fluorene	-	492	-	802
4-Nitroaniline	-	1,970	-	3,210

KEMRON
ENVIRONMENTAL SERVICES

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TABLE 34

VERIFICATION TESTING

PRETREATMENT: 135 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-020)

Summary of Total Semivolatiles Analyses - EPA Method 8270C

TOTAL SEMIVOLATILES	Baseline (µg/Kg)		AS & SS (0190-020) (µg/Kg)	
	Result	DL	Result	DL
4,6-Dinitro-2-methylphenol	-	1,970	-	3,210
N-Nitrosodiphenylamine	-	492	-	802
4-Bromophenyl-phenylether	-	492	-	802
Hexachlorobenzene	2,360	492	5,260	802
Pentachlorophenol	-	1,970	-	3,210
Phenanthrene	-	492	-	802
Anthracene	-	492	-	802
Di-n-butylphthalate	-	492	-	802
Fluoranthene	-	492	-	802
Pyrene	-	492	-	802
Butylbenzylphthalate	-	492	-	802
3,3-Dichlorobenzidine	-	984	-	1,600
Benzo(a)anthracene	-	492	-	802
Chrysene	-	492	-	802
bis(2-Ethylhexyl)phthalate	-	492	-	802
Di-n-octylphthalate	-	492	-	802
Benzo(b)fluoranthene	-	492	-	802
Benzo(k)fluoranthene	-	492	-	802
Benzo(a)pyrene	-	492	-	802
Indeno(1,2,3-cd)pyrene	-	492	-	802
Dibenzo(a,h)Anthracene	-	492	-	802
Benzo(g,h,i)Perylene	-	492	-	802

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 35

VERIFICATION TESTING

PRETREATMENT: 90 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-019)

Summary of SPLP Semivolatiles Analyses - EPA Methods 1312/ 8270C

SPLP SEMIVOLATILES	Baseline (µg/L)		AS & SS (0190-019) (µg/L)	
	Result	DL	Result	DL
Pheno	-	25.5	-	25.5
Bis (2-Chloroethyl) ether	-	25.5	-	25.5
2-Chlorophenol	-	25.5	-	25.5
1,3-Dichlorobenzene	-	25.5	-	25.5
1,4-Dichlorobenzene	156	25.5	-	25.5
Benzyl alcohol	-	25.5	-	25.5
1,2-Dichlorobenzene	22,800	1,280	689	25.5
2-Methylphenol	-	25.5	-	25.5
3-,4-Methylphenol	-	25.5	-	25.5
bis (2-Chloroisopropyl) ether	-	25.5	-	25.5
N-Nitroso-di-n-propylamine	-	25.5	-	25.5
Hexachloroethane	178	25.5	-	25.5
Nitrobenzene	-	25.5	-	25.5
Isophorone	-	25.5	-	25.5
2-Nitrophenol	-	25.5	-	25.5
2,4-Dimethylphenol	-	25.5	-	25.5
Benzoic acid	6,220	1,280	3,910	638
Bis (2-Chloroethoxy) Methane	-	25.5	-	25.5
2,4-Dichlorophenol	32.1 J	25.5	384	25.5
1,2,4-Trichlorobenzene	-	25.5	-	25.5
Naphthalene	-	25.5	-	25.5
4-Chloroaniline	-	25.5	-	25.5
Hexachlorobutadiene	-	25.5	-	25.5
4-Chloro-3-methylphenol	-	25.5	-	25.5
2-Methylnaphthalene	-	25.5	-	25.5
Hexachlorocyclopentadiene	-	25.5	-	25.5
2,4,6-Trichlorophenol	-	25.5	-	25.5
2,4,5-Trichlorophenol	-	25.5	-	25.5
2-Chloronaphthalene	-	25.5	-	25.5
2-Nitroaniline	-	128	-	128
Dimethylphthalate	-	25.5	-	25.5
Acenaphthylene	-	25.5	-	25.5
2,6-Dinitrotoluene	-	25.5	-	25.5
3-Nitroaniline	-	128	-	128
Acenaphthene	-	25.5	-	25.5
2,4-Dinitrophenol	-	128	-	128
4-Nitrophenol	-	128	-	128
Dibenzofuran	-	25.5	-	25.5
2,4-Dinitrotoluene	-	25.5	-	25.5
Diethylphthalate	-	25.5	-	25.5
4-Chlorophenyl-phenyl ether	-	25.5	-	25.5
Fluorene	-	25.5	-	25.5
4-Nitroaniline	-	128	-	128

KEMRON ENVIRONMENTAL SERVICES

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TABLE 35

VERIFICATION TESTING

PRETREATMENT: 90 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-019)

Summary of SPLP Semivolatiles Analyses - EPA Methods 1312/ 8270C

SPLP SEMIVOLATILES	Baseline (µg/L)		AS & SS (0190-019) (µg/L)	
	Result	DL	Result	DL
4,6-Dinitro-2-methylphenol	-	128	-	128
N-Nitrosodiphenylamine	-	25.5	-	25.5
4-Bromophenyl-phenylether	-	25.5	-	25.5
Hexachlorobenzene	-	25.5	-	25.5
Pentachlorophenol	-	128	-	128
Phenanthrene	-	25.5	-	25.5
Anthracene	-	25.5	-	25.5
Di-n-butylphthalate	-	25.5	-	25.5
Fluoranthene	-	25.5	-	25.5
Pyrene	-	25.5	-	25.5
Butylbenzylphthalate	-	25.5	-	25.5
3,3-Dichlorobenzidine	-	25.5	-	25.5
Benzo(a)anthracene	-	25.5	-	25.5
Chrysene	-	25.5	-	25.5
bis(2-Ethylhexyl)phthalate	-	25.5	-	25.5
Di-n-octylphthalate	-	25.5	-	25.5
Benzo(b)fluoranthene	-	25.5	-	25.5
Benzo(k)fluoranthene	-	25.5	-	25.5
Benzo(a)pyrene	-	25.5	-	25.5
Indeno(1,2,3-cd)pyrene	-	25.5	-	25.5
Dibenzo(a,h)Anthracene	-	25.5	-	25.5
Benzo(g,h,i)Perylene	-	25.5	-	25.5

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

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TABLE 36

VERIFICATION TESTING

PRETREATMENT: 135 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-020)

Summary of SPLP Semivolatiles Analyses - EPA Methods 1312/ 8270C

SPLP SEMIVOLATILES	Baseline (µg/L)		AS & SS (0190-020) (µg/L)	
	Result	DL	Result	DL
Phenol	-	25.5	-	25.5
Bis (2-Chloroethyl) ether	-	25.5	-	25.5
2-Chlorophenol	-	25.5	-	25.5
1,3-Dichlorobenzene	-	25.5	-	25.5
1,4-Dichlorobenzene	142	25.5	-	25.5
Benzyl alcohol	-	25.5	-	25.5
1,2-Dichlorobenzene	20,700	1,280	503	25.5
2-Methylphenol	-	25.5	-	25.5
3-,4-Methylphenol	-	25.5	-	25.5
bis (2-Chloroisopropyl) ether	-	25.5	-	25.5
N-Nitroso-di-n-propylamine	-	25.5	-	25.5
Hexachloroethane	161	25.5	-	25.5
Nitrobenzene	-	25.5	-	25.5
Isophorone	-	25.5	-	25.5
2-Nitrophenol	-	25.5	-	25.5
2,4-Dimethylphenol	-	25.5	-	25.5
Benzoic acid	5,910	1,280	4,530	638
Bis (2-Chloroethoxy) Methane	-	25.5	-	25.5
2,4-Dichlorophenol	29.5 J	25.5	409	25.5
1,2,4-Trichlorobenzene	-	25.5	-	25.5
Naphthalene	-	25.5	-	25.5
4-Chloroaniline	-	25.5	-	25.5
Hexachlorobutadiene	-	25.5	-	25.5
4-Chloro-3-methylphenol	-	25.5	-	25.5
2-Methylnaphthalene	-	25.5	-	25.5
Hexachlorocyclopentadiene	-	25.5	-	25.5
2,4,6-Trichlorophenol	-	25.5	-	25.5
2,4,5-Trichlorophenol	-	25.5	-	25.5
2-Chloronaphthalene	-	25.5	-	25.5
2-Nitroaniline	-	128	-	128
Dimethylphthalate	-	25.5	-	25.5
Acenaphthylene	-	25.5	-	25.5
2,6-Dinitrotoluene	-	25.5	-	25.5
3-Nitroaniline	-	128	-	128
Acenaphthene	-	25.5	-	25.5
2,4-Dinitrophenol	-	128	-	128
4-Nitrophenol	-	128	-	128
Dibenzofuran	-	25.5	-	25.5
2,4-Dinitrotoluene	-	25.5	-	25.5
Diethylphthalate	-	25.5	-	25.5
4-Chlorophenyl-phenyl ether	-	25.5	-	25.5
Fluorene	-	25.5	-	25.5
4-Nitroaniline	-	128	-	128

KEMRON ENVIRONMENTAL SERVICES

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TABLE 36

VERIFICATION TESTING

PRETREATMENT: 135 MINUTE AIR STRIPPING

POST-TREATMENT: 7.5% PORTLAND CEMENT / 15 % CLASS "C" FLY ASH (0190-020)

Summary of SPLP Semivolatiles Analyses - EPA Methods 1312/ 8270C

SPLP SEMIVOLATILES	Baseline (µg/L)		AS & SS (0190-020) (µg/L)	
	Result	DL	Result	DL
4,6-Dinitro-2-methylphenol	-	128	-	128
N-Nitrosodiphenylamine	-	25.5	-	25.5
4-Bromophenyl-phenylether	-	25.5	-	25.5
Hexachlorobenzene	-	25.5	-	25.5
Pentachlorophenol	-	128	-	128
Phenanthrene	-	25.5	-	25.5
Anthracene	-	25.5	-	25.5
Di-n-butylphthalate	-	25.5	-	25.5
Fluoranthene	-	25.5	-	25.5
Pyrene	-	25.5	-	25.5
Butylbenzylphthalate	-	25.5	-	25.5
3,3-Dichlorobenzidine	-	25.5	-	25.5
Benzo(a)anthracene	-	25.5	-	25.5
Chrysene	-	25.5	-	25.5
bis(2-Ethylhexyl)phthalate	-	25.5	-	25.5
Di-n-octylphthalate	-	25.5	-	25.5
Benzo(b)fluoranthene	-	25.5	-	25.5
Benzo(k)fluoranthene	-	25.5	-	25.5
Benzo(a)pyrene	-	25.5	-	25.5
Indeno(1,2,3-cd)pyrene	-	25.5	-	25.5
Dibenzo(a,h)Anthracene	-	25.5	-	25.5
Benzo(g,h,i)Perylene	-	25.5	-	25.5

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

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TABLE 37

VERIFICATION PHASE: CARBON SAMPLING OF 90 MINUTE AIR STRIPPING (0190-019)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Control (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	496	1,140	509	1,010	495	3,410	489	8,160	511
Benzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Bromobenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Bromochloromethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Bromodichloromethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Bromoform	-	49.6	73.9 J	50.9	91.2 J	49.5	-	48.9	-	51.1
Bromomethane	-	99.1	-	102	103 J	98.9	101 J	97.8	-	102
2-Butanone	-	248	353 J	255	461 J	247	1,090	245	3,080	256
n-Butylbenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
sec-Butylbenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
tert-Butylbenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Carbon disulfide	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Carbon tetrachloride	-	49.6	210 J	50.9	118 J	49.5	-	48.9	-	51.1
Chlorobenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Chlorodibromomethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Chloroethane	-	99.1	-	102	-	98.9	-	97.8	-	102
2-Chloroethyl vinyl ether	-	198	-	204	-	198	-	196	-	204
Chloroform	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Chloromethane	415 J	198	445 J	204	664 J	49.5	606 J	196	610 J	204
2-Chlorotoluene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
4-Chlorotoluene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,2-Dibromo-3-chloropropane	-	198	-	204	-	198	-	196	-	204
1,2-Dibromoethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Dibromomethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,2-Dichlorobenzene	-	49.6	565	50.9	2,070	49.5	2,790	48.9	764	51.1
1,3-Dichlorobenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,4-Dichlorobenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Dichlorodifluoromethane	156 J	99.1	216 J	102	225 J	98.9	198 J	97.8	274 J	102
1,1-Dichloroethane	-	99.1	-	102	-	98.9	-	97.8	-	102
1,2-Dichloroethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,1-Dichloroethene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
cis-1,2-Dichloroethene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
trans-1,2-Dichloroethene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,2-Dichloropropane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,3-Dichloropropane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
2,2-Dichloropropane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
cis-1,3-Dichloropropene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
trans-1,3-Dichloropropene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,1-Dichloropropene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Ethylbenzene	154 J	49.6	150 J	50.9	388 J	49.5	168 J	245	192 J	51.1
2-Hexanone	-	248	-	255	-	247	-	48.9	-	256
Hexachlorobutadiene	-	49.6	-	50.9	-	49.5	341 J	48.9	262 J	51.1

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 37

VERIFICATION PHASE: CARBON SAMPLING OF 90 MINUTE AIR STRIPPING (0190-019)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Control (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Isopropylbenzene	-	49.6	58.8 J	50.9	93.8 J	49.5	102 J	48.9	-	51.1
p-Isopropyltoluene	-	49.6	-	50.9	184 J	49.5	-	48.9	-	51.1
4-Methyl-2-pentanone	-	248	-	255	-	247	-	245	-	256
Methylene chloride	-	99.1	-	102	-	98.9	-	97.8	-	
Naphthalene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
n-Propylbenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Styrene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,1,1,2-Tetrachloroethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,1,2,2-Tetrachloroethane	-	49.6	3,080	50.9	1,780	49.5	495	48.9	324 J	51.1
Tetrachloroethene	-	49.6	9,330	50.9	13,400	49.5	2,130	48.9	431 J	51.1
Toluene	-	49.6	78.9 J	50.9	78.7 J	49.5	78.7 J	48.9	-	51.1
1,2,3-Trichlorobenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,2,4-Trichlorobenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,1,1-Trichloroethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,1,2-Trichloroethane	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Trichloroethene	-	49.6	2,220	50.9	3,280	49.5	1,060	48.9	246 J	51.1
Trichlorofluoromethane	351 J	99.1	629 J	102	740 J	98.9	629 J	97.8	801 J	102
1,2,3-Trichloropropane	-	99.1	-	102	-	98.9	-	97.8	-	102
1,2,4-Trimethylbenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
1,3,5-Trimethylbenzene	-	49.6	-	50.9	-	49.5	-	48.9	-	51.1
Vinyl acetate	-	99.1	-	102	-	98.9	-	97.8	-	102
Vinyl chloride	-	99.1	-	102	-	98.9	-	97.8	-	102
o-Xylene	91.9 J	49.6	61.1 J	50.9	164 J	49.5	106 J	48.9	110 J	51.1
m, p -Xylene	318 J	49.6	212 J	50.9	584	49.5	318 J	48.9	356 J	51.1

- Not detected or below adjusted sample detection limit.
J The analyte was positively identified, but the quantitation was below Reporting Limit.
DL Method Detection Limit

KEMRON ENVIRONMENTAL SERVICES

GOLDER ASSOCIATES

NEASE CHEMICAL

TABLE 38

VERIFICATION PHASE: CARBON SAMPLING OF 135 MINUTE AIR STIPPING (0190-020)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Control (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS 135 min (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Acetone	-	501	2,820	510	3,830	496	4,990	518	7,040	554	15,000	495
Benzene	-	50.1	71.4 J	51.0	-	49.6	-	51.8	-	55.4		49.5
Bromobenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Bromochloromethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Bromodichloromethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Bromoform	-	50.1	130 J	51.0	113 J	49.6	-	51.8	-	55.4		49.5
Bromomethane	102 J	100	103 J	102	-	99.1	-	104	-	111		98.9
2-Butanone	-	251	1010 J	255	1,230	248	1,460	259	2,420	277	4,600	247
n-Butylbenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
sec-Butylbenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
tert-Butylbenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Carbon disulfide	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Carbon tetrachloride	-	50.1	291 J	51.0	86.1 J	49.6	-	51.8	-	55.4		49.5
Chlorobenzene	-	50.1	68.3 J	51.0	60.5 J	49.6	-	51.8	-	55.4		49.5
Chlorodibromomethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Chloroethane	-	100	-	102	-	99.1	-	104	-	111		98.9
2-Chloroethyl vinyl ether	-	200	-	204	-	198	-	207	-	222		198
Chloroform	-	50.1	-	51.0	-	49.6		51.8	-	55.4		49.5
Chloromethane	437 J	200	474 J	204	444 J	198	412 J	207	376 J	222	360 J	198
2-Chlorotoluene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
4-Chlorotoluene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,2-Dibromo-3-chloropropane	-	200	-	204	-	198	-	207	-	222		198
1,2-Dibromoethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Dibromomethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,2-Dichlorobenzene	-	50.1	1,970	51.0	4,840	49.6	2,930	51.8	1,270	55.4	1,320	49.5
1,3-Dichlorobenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,4-Dichlorobenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Dichlorodifluoromethane	-	100	140 J	102	-	99.1	-	104	-	111	260 J	98.9
1,1-Dichloroethane	-	100	-	102	-	99.1	-	104	-	111		98.9
1,2-Dichloroethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4	50.2 J	49.5
1,1-Dichloroethene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
cis-1,2-Dichloroethene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
trans-1,2-Dichloroethene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,2-Dichloropropane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,3-Dichloropropane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
2,2-Dichloropropane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
cis-1,3-Dichloropropene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
trans-1,3-Dichloropropene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,1-Dichloropropene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Ethylbenzene	124 J	50.1	361 J	51.0	745	49.6	129 J	51.8	423 J	55.4	182 J	49.5
2-Hexanone	-	251	-	255	-	248	-	259	-	277	389 J	247
Hexachlorobutadiene	-	50.1	177 J	51.0	322 J	49.6	320 J	51.8	309 J	55.4	573	49.5

KEMRON ENVIRONMENTAL SERVICES

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TABLE 38

VERIFICATION PHASE: CARBON SAMPLING OF 135 MINUTE AIR STIPPING (0190-020)

Summary of Total Volatiles Analyses - EPA Method 8260B

TOTAL VOLATILES	Control (µg/Kg)		AS 10 min (µg/Kg)		AS 30 min (µg/Kg)		AS 60 min (µg/Kg)		AS 90 min (µg/Kg)		AS 135 min (µg/Kg)	
	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL	Result	DL
Isopropylbenzene	-	50.1	223 J	51.0	320 J	49.6	82.4 J	51.8	69.1 J	55.4		49.5
p-Isopropyltoluene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
4-Methyl-2-pentanone	-	251	-	255	-	248	-	259	-	277		247
Methylene chloride	-	100	-	102	-	99.1	-	104	-	111		98.9
Naphthalene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
n-Propylbenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Styrene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,1,1,2-Tetrachloroethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,1,2,2-Tetrachloroethane	-	50.1	3,030	51.0	3,190	49.6	1,210	51.8	704	55.4	1,050	49.5
Tetrachloroethene	-	50.1	17,500	51.0	13,300	49.6	1,890	51.8	571	55.4	602	49.5
Toluene	-	50.1	123 J	51.0	78.1 J	49.6	-	51.8	-	55.4		49.5
1,2,3-Trichlorobenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,2,4-Trichlorobenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,1,1-Trichloroethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,1,2-Trichloroethane	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
Trichloroethene	-	50.1	3,750	51.0	3,120	49.6	846	51.8	294 J	55.4	264 J	49.5
Trichlorofluoromethane	-	100	357 J	102	-	99.1	157 J	104	-	111	492 J	98.9
1,2,3-Trichloropropane	-	100	-	102	-	99.1	-	104	-	111		98.9
1,2,4-Trimethylbenzene	-	50.1	-	51.0	-	49.6	-	51.8	-	55.4		49.5
1,3,5-Trimethylbenzene	-	50.1	-	51.0	63.4 J	49.6	-	51.8	56.7 J	55.4		49.5
Vinyl acetate	-	100	-	102	-	99.1	-	104	-	111		98.9
Vinyl chloride	-	100	-	102	-	99.1	-	104	-	111		98.9
o-Xylene	59.7 J	50.1	161 J	51.0	378 J	49.6	69.3 J	51.8	248 J	55.4	96.4 J	49.5
m, p -Xylene	244 J	50.1	580	51.0	1,250	49.6	216 J	51.8	782	55.4	314 J	49.5

- Not detected or below adjusted sample detection limit.

J The analyte was positively identified, but the quantitation was below Reporting Limit.

DL Method Detection Limit

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TABLE 39

VERIFICATION PHASE: Air Stripping and Solidification / Stabilization Evaluations
Mixture Development and Pocket Penetrometer Results

KEMRON SAMPLE No.	AIR STRIPPING PRETREATMENT	REAGENT TYPE	REAGENT ADDITION (%)	WATER ADDITION (%) (1)	PENETROMETER TESTING (tons/ft^2)						
					1 Day	2 Day	3 Day	4 Day	5 Day	6 Day	7 Day
SE0190-019	90 Minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15	> 4.5	-	> 4.5	-	-	-	-
SE0190-020	135 Minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15	> 4.5	-	> 4.5	-	-	-	-

(1) Reagents were combined together dry and blended. The reagent blend was then slurried with water. All addition rates were added on a by-weight basis according to the initial weight of the untreated material used in the mixture. That is for a mixture with a 10% addition

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TABLE 40

VERIFICATION PHASE: Air Stripping and Solidification / Stabilization Evaluations
Unconfined Compressive Strength @ 21-Day Cure

KEMRON SAMPLE No.	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)	DQO UCS (lbs/in^2)	UNCONFINED COMPRESSIVE STRENGTH			
					Moisture Content (%)	Bulk Density (lbs/ft^3)	Dry Density (lbs/ft^3)	UCS (lbs/in^2)
SE0190-019	Cement / Class "C" Fly Ash	7.5 / 15	8.15	15	20.1	125.6	104.6	704.5
SE0190-020	Cement / Class "C" Fly Ash	7.5 / 15	8.15	15	17.4	128.1	109.2	640.0

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TABLE 41
VERIFICATION PHASE: TREATED MATERIAL CHARACTERIZATION

TESTING PARAMETER	TEST METHOD	UNIT	RESULTS 0190-019	RESULTS 0190-020
PHYSICAL PROPERTIES				
Unit Weight	ASTM D2937	lb/ft³	129.3	127.6
Moisture Content	ASTM D2216	%	20.12	17.34
Percent Solids	EPA	%	83.25	85.22
Volumetric Expansion	-	-	17.77	15.09

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TABLE 42

VERFICATION PHASE MIX DESIGNS

KEMRON SAMPLE No.	PRETREATMENT STRIPPING TIME	REAGENT TYPE	REAGENT ADDITION (%) (1)	WATER ADDITION (%) (1)
SE0190-019	90 minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15
SE0190-020	135 minutes	Cement / Class "C" Fly Ash	7.5 / 15	8.15

(1) Reagents will be combined together dry and blended. The reagent blend will then be slurried with a quantity of potable water to be determined. The water addition will be based on developing a pumpable reagent slurry to facilitate in-situ treatment.

Note that all addition rates will be on a by-weight basis based on the initial quantity of