APPENDIX J

EISB Treatability Study Reports for Shallow Groundwater

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Laboratory Biotreatability Study to Evaluate Anaerobic Remediation of Benzene and p-Cymene in Groundwater

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

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LIST OF ABBREVIATIONS

%	percent
°C	degrees Celsius
°C/min	degrees Celsius per minute
µg/L	micrograms per liter
µL	microliter
abcA	benzene carboxylase
CO_2	carbon dioxide
DAP	diammonium phosphate
FID	flame ionization detector
g	grams
GC	gas chromatograph
Geosyntec	Geosyntec Consultants Inc.
gene copies/L	gene copies per liter
IC	ion chromatograph
mg/L	milligrams per liter
min	minutes
mL	milliliter
mL/min	milliliters per minute
mM	millimolar
mmol/bottle	millimoles per bottle
mV	millivolts
NRBC	nitrate reducing benzene culture
ORP	oxidation-reduction potential
p-cymene	para-cymene
pepto-ben	Peptococcaceae
psi	pounds per square inch
QL	quantitation limit
RPM	revolutions per minute
SiREM	SiREM Laboratory
the Site	Brunswick site
VFA	volatile fatty acid
VOC	volatile organic compound
qPCR	quantitative polymerase chain reaction
SRB	sulfate reducing bacteria
rRNA	ribosomal ribonucleic acid

1. INTRODUCTION

Geosyntec Consultants Inc., (Geosyntec) retained SiREM Laboratory (SiREM) to perform a laboratory treatability study to evaluate the degradation of volatile organic compounds (VOCs) in the SGW-23 area near Stillhouse Control Room at the Brunswick site in Georgia (the Site). The purpose of the study was to assess the potential for anaerobic biodegradation of the target VOCs, namely benzene and para-cymene (p-cymene).

The groundwater labelled MPE Well was collected on 20 Feb 2020 by Geosyntec personnel and received by SiREM on 24 Feb 2020 at a temperature of 4 degrees Celsius (°C). The geologic material labelled Pinova MPE (2-5', 5-10', 6-8', 8-10') was collected on 18 Feb 2020 by Geosyntec personnel and received by SiREM on 21 Feb 2020 at a temperature of 3 °C. Refer to Appendix A for the chain of custody documentation received with the materials.

The remainder of this report contains a summary of key biodegradation processes (Section 1.1), the experimental materials and methods (Section 2), the results and discussion of the microcosm study (Section 3), conclusions (Section 4) and report references (Section 5).

1.1 Summary of Biodegradation Processes

Benzene compounds can be biologically degraded under a variety of aerobic and anaerobic conditions (Wiedemeier et al. 1995). Under aerobic conditions the compounds are oxidized using atmospheric oxygen and carbon dioxide (CO_2) is produced. Under anaerobic conditions, natural attenuation processes can occur in situ and are often mediated by indigenous microbial populations present at sites containing benzene. Benzene can act as an electron donor for nitrate-reducing, iron-reducing, sulfate reducing, or methanogenic bacteria. In the process benzene is oxidized via anaerobic pathways to carbon dioxide (Ulrich et al., 2005). Enhanced biological remediation can in certain cases be achieved by stimulating the indigenous microbial populations through the addition of electron acceptors, such as nitrate.

Named in honor of anaerobic hydrocarbon degradation pioneer Dunja Grbić-Galić, DGG-B™ is an anaerobic mixed microbial consortium capable of degrading benzene. This mixed culture originated as an enrichment from a diverse natural microbial community chronically exposed to hydrocarbons (Nales et al., 1998), and has been maintained by the University of Toronto and SiREM for over 20 years (Burland and Edwards, 1999; Ulrich and Edwards, 2003; Mancini et al., 2008; Luo et al., 2016). Benzene is added as the sole carbon source and can couple hydrocarbon degradation to sulfate reduction, or fermentative (methanogenic) metabolism.

The DGG-B™ culture, grown fermentatively on benzene, has consistently been dominated by four microorganisms for more than 15 years (Ulrich and Edwards, 2003; Mancini et al., 2008; Luo et al., 2016). Benzene fermentation is first catalyzed by a *Deltaproteobacteria* designated ORM2 (Luo et al., 2016), which typically comprises 14-32 percent (%) of the total microbial community composition at a concentration of 10^7-10^8 gene copies per liter (gene copies/L). The other organisms in the cultures are predominantly methanogens.

A research culture from the University of Toronto referred to as the nitrate reducing benzene culture (NRBC) was also tested in this study. This culture has similarly been maintained on benzene under nitrate reducing conditions for over 15 years at the University of Toronto (Burland and Edwards, 1999).

2. MATERIALS AND METHODS

The following sections describe the materials and methods used for microcosm construction and incubation (Section 2.1), and microcosm sampling and analysis (Section 2.2).

2.1 Microcosm Construction and Incubation

2.1.1 Microcosm Construction

Treatability microcosms were constructed in a disposable anaerobic glove bag containing the Site groundwater and geologic materials and all the materials required to construct the treatment and control microcosms. The glove bag was purged with nitrogen gas in order to create an anaerobic environment and to protect any microorganisms present in the site materials from oxygen exposure. Prior to microcosm construction, all of the Site geologic materials were thoroughly homogenized by hand.

Microcosms were constructed on 27 February 2020 (Day -11) by filling sterile 250 millilitre (mL) (nominal volume) screw cap Boston round clear glass bottles (Systems Plus, New Hamburg, ON) with 200 mL of Site groundwater and 60 grams (g) of geologic material. The DGG Bioaugmented treatment was added to the scope of the study after the initial set up, so those microcosms were constructed using the same procedure on 25 June 2020 (Day -21) and have a different Time 0 date than the rest of the study. The bottles were capped with Mininert™ closures to allow repetitive sampling with minimal VOC loss. All treatment and control microcosms were constructed in triplicate. Table 1 summarizes the details of microcosm construction and the amendments used for the control and treatment microcosms.

Anaerobic sterile control microcosms were constructed to quantify potential abiotic and experimental volatile losses from the microcosms. The sterile controls were constructed by autoclaving the Site geologic materials at 121 °C and 15 pounds per square inch (psi) pressure for 45 to 60 minutes (min). After autoclaving, the sterile control microcosms were returned to the anaerobic chamber, filled with 200 mL of Site groundwater and amended with mercuric chloride and sodium azide as described in Table 1.

2.1.2 Microcosm Amendments and Incubation

All microcosms were sampled and incubated in an anaerobic chamber (Coy Laboratory Products, Grass Lake, MI) filled with an atmosphere of approximately 80% nitrogen, 10% CO_2 and 10% hydrogen (Linde Gases, Guelph, ON). Hydrogen in the anaerobic chamber functions to scavenge trace oxygen via a palladium catalyst. Anaerobic conditions in the anaerobic chamber were verified using an indicator containing resazurin (Sigma, St. Louis, MO) in a mineral medium, which turns pink in the presence of oxygen. During quiescent incubation, all microcosms were covered

to minimize photodegradation, and stored horizontally to minimize volatile losses via the (submerged) Mininert™ closure. Microcosms were incubated for a period of up to 225 days at approximately 22°C (room temperature).

The initial benzene and p-cymene concentrations in the microcosms were 5.2 milligrams per litre (mg/L) and 4.8 mg/L respectively. Geosyntec confirmed that these concentrations were representative of the Site conditions, so it was not necessary to spike the microcosms. However, the DGG Bioaugmented microcosms that were constructed at later date had a lower concentration of benzene and were spiked with 61 µL of a saturated benzene solution on 16 July 20 (Day 0) to target a concentration of 5 mg/L.

In this study, nitrate was selected as the electron acceptor to be evaluated and was provided in the form of sodium nitrate (BioShop Canada Inc., Burlington, ON). In one treatment nitrate amendment was tested in combination with NRBC bioaugmentation. In another treatment nitrate amendment was tested in combination with nutrient amendment using diammonium phosphate (DAP) (BioShop Canada Inc., Burlington, ON) to potentially stimulate intrinsic nitrate reducing bacteria.

On 16 March 2020 (Day 0), Nitrate Amended microcosms were amended with sodium nitrate and Nitrate and Nutrient Amended microcosms were amended with sodium nitrate and diammonium phosphate. In consultation with Geosyntec, it was decided to target a nitrate concentration of 100 mg/L (as nitrogen) and a DAP concentration of 20 mg/L. On 16 July 2020 (Day 0), DGG Bioaugmented microcosms were amended with 100 microliters (µL) of an iron sulfide suspension to accelerate the establishment of reducing conditions.

The first microcosm of each treatment and control was amended with resazurin (Sigma, St. Louis, MO) to monitor redox conditions. Resazurin turns from pink to clear in the absence of oxygen and can be used to indicate the on-set of reducing conditions. Details of amendments are provided in Table 1 and Table 2.

2.2 Microcosm Sampling and Analysis

2.2.1 Microcosm Sampling Schedules

The sampling frequency for all parameters was determined in consultation with Geosyntec based on anticipated microbial activity. The microcosms were sampled using gas-tight 250 µL Hamilton glass syringes. Syringes were cleaned with acidified water (pH ~2) and rinsed 10 times with de-ionized water between samples to ensure that the VOCs and microorganisms were not transferred between different samples or treatments.

VOC, pH, ORP, and anion samples were collected from ongoing microcosms. Samples for ammonia and p-cymene analysis were taken from designated sacrificial microcosms. The DGG Bioaugmented microcosms were not sampled for anion, p-cymene, or ammonia analysis. At Time 0, the active control microcosms were sampled for p-Cymene analysis and ammonia samples were collected from the first replicate of treatments that were amended with nitrate. These results were used to represent the initial p-cymene and ammonia concentrations.

2.2.2 Analysis of VOC Compounds

This section describes the methods used by SiREM to quantify the VOCs and DHGs. The quantitation limits (QL) for these compounds were typically 20 micrograms per liter (µg/L) in the microcosms based on the lowest concentration standards that were included in the linear calibration trend.

Aqueous VOC concentrations in the microcosms were measured using a Hewlett-Packard (Hewlett Packard 7890) gas chromatograph (GC) equipped with an auto sampler (Hewlett Packard G1888) programmed to heat each sample vial to 75°C for 45 min. prior to headspace injection into a GSQ Plot column (0.53 millimeters x 30 meters, J&W) and a flame ionization detector (FID). Sample vials were heated to ensure that all VOCs in the aqueous sample would partition into the headspace. The injector temperature was 200°C, and the detector temperature was 250°C. The oven temperature was programmed as follows: 35°C for 2 min, increased to 100°C at 50 degrees Celsius per minute (°C/min), then increased to 185°C at 25°C/min and held at 185°C for 6.80 min. The carrier gas was helium at a flow rate of 11 milliliters per minute (mL/min).

After withdrawing a 0.1 milliliter (mL) sample (as described in section 2.2.1), the sample was injected into a 10 mL auto sampler vial containing 5.9 mL of acidified de-ionized water (pH ~2). The water was acidified to inhibit microbial activity between microcosm sampling and GC analysis. The vial was sealed with an inert Teflon®-coated septum and aluminium crimp cap for automated injection of 3 mL of headspace onto the GC. One standard was analysed with each set of samples to verify the instrument five-point calibration curve. Calibration was performed using external standard solutions (Sigma, St Louis, MO), where known volumes of standard solutions were added to acidified water in auto sampler vials and analysed as described above for microcosm samples. Data were integrated using Chemstation Software (Agilent Technologies, Santa Clara, CA).

2.2.3 Analysis of Anions

Anion and total VFA analysis were performed by SIREM on a Thermo-Fisher ICS-2100 ion chromatograph (IC) equipped with a Thermo-Fisher AS-DV autosampler and an AS18 column, the sample loop volume was 25 µL. An isocratic separation was performed using 33 millimolar (mM) reagent grade sodium hydroxide eluent generator cartridge (Thermo Scientific, Burlington, ON) eluent for 13 min. One standard was analysed with each set of samples tested in order to verify the seven-point calibration using external standards of known concentrations. External standards were prepared gravimetrically using chemicals of the highest purity available (Sigma St Louis, MO or Bioshop, Burlington, ON). Data were integrated using Chromeleon 7® Chromatography software (Thermo-Fisher, Burlington, ON). The QLs were as follows: 0.07 mg/L total volatile fatty acid (VFA), 0.07 mg/L chloride, 0.09 mg/L nitrite, 0.09 mg/L nitrate, 0.07 mg/L sulfate, 0.07 mg/L phosphate and 0.08 mg/L bromide. The total VFA value includes lactate, formate, acetate, propionate, pyruvate and butyrate (valerate has not been confirmed).

A 0.5 mL sample was withdrawn (as described in section 2.2.1), after which the sample was placed in a 1.5 mL micro-centrifuge tube. Samples were centrifuged for five minutes at 13,000 revolutions per minute (RPM) to remove solids. The supernatant was removed, diluted 50-fold in deionized water and placed in a Thermo-Fisher autosampler vial with a cap that filters the sample during automated injection onto the IC.

2.2.4 Analysis of ORP

Oxidation-reduction potential (ORP) measurements were performed using an Omega PHH-127 Multi-Parameter Water Quality Monitor with ORP Probe (Omega, Laval, QC). A 1.5 mL sample was taken (as described in section 2.2.1) and placed in a 5 mL Thermo-Fisher vial. The ORP was measured on the lab bench immediately after sampling. A single point calibration of the meter was performed at each sampling event with Zobell ORP calibration solution (YSI Incorporated, Yellow Springs, OH).

2.2.5 Analysis of pH

The pH measurements were performed by SIREM using an Oakton pH spear with a combination pH electrode (Oakton, Vernon Hills, IL). A 0.5 mL sample was taken (as described in section 2.2.1), the vial was removed from the glove box and the pH was measured on the lab bench. The pH spear was calibrated at each sampling event according to the manufacturer's instructions using pH 4.0, 7.0 and 10 standards.

2.2.6 Gene-Trac® Testing

Gene-Trac® quantitative polymerase chain reaction (qPCR) testing was performed in this study to quantify and characterize sulfate reducing bacteria (SRB), ORM2, and *Peptococcaceae* (pepto-ben) microorganisms as well as the functional gene benzene carboxylase (abcA). SRB facilitate the reduction of sulfate to sulfide and are well known to promote the degradation of various petroleum hydrocarbons. The Gene-Trac® SRB test targets the drsA gene. ORM2 are benzene specialists and facilitate the oxidation of benzene to carbon dioxide. The Gene-Trac® ORM2 tests quantify the total ORM2 by targeting the 16S ribosomal ribonucleic acid (rRNA) gene. Pepto-ben can co-metabolically degrade benzene in the presence of nitrate. The functional gene benzene carboxylase is involved in the cleavage of the aromatic benzene ring.

Samples for Gene-Trac® analysis were collected from the bulk groundwater at the beginning of the study.

2.2.7 Analysis of p-Cymene and Ammonia

Analysis of p-cymene was conducted by Pace Analytical in Indianapolis, IN. Samples were collected in 40 mL glass vials and preserved with hydrochloric acid. Analysis of ammonia was conducted by ALS Environmental in Waterloo, ON. Samples were collected in 40 mL glass vials and preserved with sulfuric acid.

3. RESULTS AND DISCUSSION

The following sections present and discuss the results of the biotreatability study:

- Gene-Trac® Results (Section 3.1),
- Redox processes (Section 3.2),
- VOC Biodegradation Results (Section 3.3)

Tables 2, 3, 4, 5, and 6 provide VOC, DHG, anion, pH, ORP, Gene-Trac®, and half-life data. All VOC and DHG concentrations are presented in units of mg/L and millimoles per microcosm bottle (mmol/bottle) to demonstrate mass balances on a molar basis. Concentrations were converted from mg/L to mmol/bottle using Henry's Law as demonstrated in Appendix B. Anion concentrations are reported in mg/L. ORP is reported in millivolts (mV). Gene-Trac® data is reported in gene copies/L. VOC half-life data is reported in days. Figures 1-5 present trends in the concentrations of VOCs in the control and treatment microcosms over the incubation period. Gene-Trac®, ALS, and Pace reports are provided in Appendix C, D, and E, respectively.

3.1 Gene-Trac® Results

The Gene-Trac® results from the bulk groundwater are presented in Table 5. ORM2 and SRB were detected at 10^4 gene copies/L. abcA and pepto-ben were not detected. These results suggest that indigenous nitrate reducing benzene degrading organisms may not be present, while low concentrations of sulfate reducing and potentially benzene degrading organisms may be present.

3.2 Redox Processes

The presence of electron donors, including benzene and other organic compounds, and electron acceptors (i.e., nitrate), typically stimulates microbial activity that promotes increasingly reduced conditions in groundwater.

The sequence of redox reactions in groundwater is well known (Appelo and Postma, 1994). Oxygen is first consumed, followed by nitrate (denitrification), iron, manganese, and sulfate reduction producing sulfides. The final step is CO_2 reduction producing methane (methanogenesis). The consumption of each species in sequence indicates that conditions are becoming increasingly reducing. Benzene degrades readily under aerobic conditions and can also be degraded anaerobically in the range of nitrate reducing to methanogenic conditions.

Nitrate and sulfate concentrations in the Nitrate Amended and Nitrate and Nutrient Amended treatments remained relatively stable during the incubation period (Table 3) indicating that the reducing conditions necessary for anaerobic benzene degradation to occur were not established. This is further supported by the Day 225 ORP results in the range of 67 to 78 mV for these treatments (Table 4).

For the DGG Bioaugmented treatment, Day 1 ORP results (-49 mV) indicate that reducing conditions were established after the addition iron sulfide. However, the Day 104 results (52 mV) suggest that reducing conditions may not have persisted throughout the incubation period (Table 4). Anion analysis was not conducted for this treatment.

These results suggest that the reducing conditions required for anaerobic benzene degradation to occur may not be able to be achieved intrinsically, by amendment with nitrate, or by amendment with nitrate and nutrients in the form of DAP. Microbial populations capable of creating increasingly reducing conditions with these amendments may not have been present or were only present at low concentrations.

3.3 VOC Biodegradation Results

3.3.1 Half Lives

Laboratory half-lives were calculated based on the average dechlorination observed in the treatment microcosms. First order reaction kinetics was assumed for all calculations as described in Newell et al, 2002. The half-lives were calculated using the following relationship:

$$Half - life = \frac{\ln(2)}{\left[\frac{\ln\left(\frac{C_2}{C_1}\right)}{t_2 - t_1}\right]}$$

where,

C_1 is the concentration at first time (t_1 days)

C_2 is the concentration at second time (t_2 days)

Half-lives were not calculated if net degradation of the compound was not detected during the study period.

3.3.2 VOC Biodegradation Results

All VOC results discussed in this section are presented in Table 2 and Figures 1-5. Half-life data is presented in Table 6. Aside from the cases discussed below, net degradation of benzene and p-cymene was not observed during the incubation period and half-lives were not calculated.

A half-life of 242 days was calculated for p-cymene in the Sterile Control. The decrease in the concentration of p-cymene in the Sterile Control occurred between Day 0 and Day 28 (the subsequent data point), whereas the concentration remained relatively stable after Day 28. The Time 0 Active Control p-cymene data was used to represent Time 0 conditions for all controls and treatments. It's possible that the Time 0 Active Control p-cymene data may not be representative of the concentration of p-cymene that would have been reported for the Sterile Control. For example, the autoclaving of geologic material for the Sterile Control may have resulted in losses

that led to a lower equilibrium concentration in the microcosm groundwater after construction. No p-cymene degradation was observed in the Active Control suggesting that no intrinsic degradation of p-cymene occurred.

Small benzene losses were observed in the DGG Bioaugmented treatment resulting in a calculated half-life of 1436 days. Endpoint sampling for this treatment occurred 103 days post bioaugmentation and the onset benzene degradation may not have occurred yet in these microcosms.

These results suggest that nitrate and nutrient amendments did not stimulate intrinsic degradation of benzene or p-cymene. DGG-B^{TM} bioaugmentation did not increase degradation rates in the time period that was studied.

4. CONCLUSIONS

The study was conducted with a primary objective to assess the potential for anaerobic degradation of benzene and p-cymene using nitrate amendment and nutrient amendment. Bioaugmentation was added to the scope midway through the study. The laboratory biotreatability study results suggest the following conclusions:

1. Benzene degrading ORM2 organisms were detected in the Site groundwater at low concentrations suggesting that anaerobic biodegradation of benzene may be possible under sulfate reducing or methanogenic conditions. No nitrate reducing microbial populations were detected at the onset of the study.

2. Nitrate reducing conditions were not established in the treatment microcosms with or without the addition of nutrients.

3. Degradation of benzene and p-cymene was not achieved over the incubation period. Potential degradation may have been inhibited by suboptimal conditions, such as insufficiently reducing conditions. For the DGG Bioaugmented treatment, the incubation period may not have been long enough to allow benzene degradation activity to get established.

The results indicate that nitrate and nutrient amendment may not be capable of stimulating degradation of benzene via nitrate reduction. Further testing or longer incubation period may be required to determine the suitability of bioaugmentation using DGG consortium as a remedy for this area of the Site.

5. REFERENCES

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TABLES

TABLE 1: SUMMARY OF MICROCOSM CONTROLS, TREATMENTS AND AMENDMENTS
SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

Treatment/Control	Assigned Microcosm Number	Number of Microcosms	Number of Sacrificial Microcosms	Geological Material (g)	Groundwater (mL)	Headspace (mL)	Sodium Azide	Mercuric Chloride	Iron Sulfide	VOCs	Rezasurin	Nitrate	DAP	Bioaugmentation
Sterile Control	1 to 3	3	12	60	200	20	Amended with 0.5 mL of a 5% solution on Day -18.	Amended with 2.8 mL of a 2.7% solution on Day -18.	--	--	Amended first replicate with 100 µL of a 1,000 mg/L solution on Day -18.	--	--	--
Active Control	4 to 6	3	12	60	200	20	--	--	--	--		--	--	--
Nitrate Amended/NRBC Bioaugmented	7 to 9	3	12	60	200	20	--	--	--	--		Amended with 0.5 mL of a 267 g/L sodium nitrate solution to a target a nitrate-N concentration of 100 mg/L.	--	Bioaugmented with 8 mL of NRBC on Day 73
Nitrate and Nutrient Amended	10 to 12	3	12	60	200	20	--	--	--	--		Amended with 0.5 mL of a 267 g/L sodium nitrate solution to a target a nitrate-N concentration of 100 mg/L.	Amended with 267 µL of a 15 g/L DAP solution to a target a concentration of 20 mg/L.	--
DGG Bioaugmented	13 to 15	3	12	60	200	20	--	--	Amended with 100 µL of an iron sulfide suspension.	Spiked with 61 µL of a saturated benzene solution to target a concentration of 5		--	--	Bioaugmented with 5 mL of DGG-B™ on Day 0.

Notes:

-- - not applicable
% - percent
µL - microliter
DAP - diammonium phosphate
DGG - Dunja Grbić-Galić
DGG-B - Dunja Grbić-Galić Benzene
g - grams
g/L - grams per liter
mg/L - milligrams per liter
mL - milliliters
nitrate-N - nitrate-nitrogen
NRBC - nitrate reducing benzene culture
VOCs - volatile organic compounds

TABLE 2: SUMMARY OF MICROCOSM VOC AND DHG RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Replicate	Bottle	Ethene mg/L	Acetylene mg/L	Ethane mg/L	Methane mg/L	Benzene mg/L	p-Cymene mg/L	
Sterile Control	27-Feb-20	-18									Poisoned with mercuric chloride and sodium azide
											Amended the first replicate with resazurin.
	16-Mar-20	0	ANSC-1	1	<0.010	<0.0010	<0.010	0.68	4.6	--	
			ANSC-2	2	<0.010	<0.0010	<0.010	0.70	4.8	--	
			ANSC-3	3	<0.010	<0.0010	<0.010	0.76	5.4	--	
			Average Concentration (mg/L)		ND	ND	ND	0.71	4.9	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.8E-03	1.1E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.033**	**0.013**	**--**	
	30-Mar-20	14	ANSC-1	1	<0.020	<0.0020	<0.020	0.89	6.1	--	
			ANSC-2	2	<0.020	<0.0020	<0.020	0.93	6.5	--	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.94	7.2	--	
			Average Concentration (mg/L)		ND	ND	ND	0.92	6.6	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.2E-03	1.4E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.043**	**0.017**	**--**	
	13-Apr-20	28	ANSC-1	1	<0.020	<0.0020	<0.020	0.69	5.9	1.07	
			ANSC-2	2	<0.020	<0.0020	<0.020	0.75	6.2	1.50	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.76	6.7	1.40	
			Average Concentration (mg/L)		ND	ND	ND	0.73	6.3	1.32	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.8E-03	1.0E-03	2.3E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.034**	**0.016**	**0.0022**	
	04-May-20	49	ANSC-1	1	<0.020	<0.0020	<0.020	0.68	6.1	--	
			ANSC-2	2	<0.020	<0.0020	<0.020	0.74	6.3	--	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.86	6.9	--	
			Average Concentration (mg/L)		ND	ND	ND	0.76	6.4	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	4.4E-03	1.1E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.035**	**0.017**	**--**	
	26-May-20	71	ANSC-1	1	<0.020	<0.0020	<0.020	0.76	6.1	--	
			ANSC-2	2	<0.020	<0.0020	<0.020	1.0	6.3	--	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.91	7.1	--	
			Average Concentration (mg/L)		ND	ND	ND	0.89	6.5	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	5.8E-03	1.3E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.041**	**0.017**	**--**	
	19-Jun-20	95	ANSC-1	1	<0.020	<0.0020	<0.020	0.70	5.5	--	
			ANSC-2	2	<0.020	<0.0020	<0.020	0.71	5.6	--	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.74	6.3	--	
			Average Concentration (mg/L)		ND	ND	ND	0.72	5.8	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	9.2E-04	1.1E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.033**	**0.015**	**--**	
	25-Aug-20	162	ANSC-1	1	<0.020	<0.0020	<0.020	0.70	6.2	--	
			ANSC-2	2	<0.020	<0.0020	<0.020	0.77	6.5	--	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.52	7.2	--	
			Average Concentration (mg/L)		ND	ND	ND	0.66	6.6	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	6.0E-03	1.3E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.031**	**0.017**	**--**	
	27-Oct-20	225	ANSC-1	1	<0.020	<0.0020	<0.020	0.64	6.2	2.48	
			ANSC-2	2	<0.020	<0.0020	<0.020	0.76	6.3	1.23	
			ANSC-3	3	<0.020	<0.0020	<0.020	0.56	7.1	1.04	
			Average Concentration (mg/L)		ND	ND	ND	0.65	6.5	1.58	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	4.8E-03	1.3E-03	7.8E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.03**	**0.017**	**0.0026**	
Active Control	27-Feb-20	-18									Amended the first replicate with resazurin.
	16-Mar-20	0	ANAC-1	4	<0.010	<0.0010	<0.010	0.78	4.9	4.97	
			ANAC-2	5	<0.010	<0.0010	<0.010	0.82	4.8	3.77	
			ANAC-3	6	<0.010	<0.0010	<0.010	0.78	4.8	4.30	
			Average Concentration (mg/L)		ND	ND	ND	0.79	4.8	4.34	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	9.7E-04	1.3E-04	6.0E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.037**	**0.013**	**0.0071**	
	30-Mar-20	14	ANAC-1	4	<0.020	<0.0020	<0.020	1	6.7	--	
			ANAC-2	5	<0.020	<0.0020	<0.020	1.1	6.7	--	
			ANAC-3	6	<0.020	<0.0020	<0.020	1.1	6.7	--	
			Average Concentration (mg/L)		ND	ND	ND	1.1	6.7	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.7E-03	3.2E-05	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.049**	**0.017**	**--**	

TABLE 2: SUMMARY OF MICROCOSM VOC AND DHG RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Replicate	Bottle	Ethene	Acetylene	Ethane	Methane	Benzene	p-Cymene	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
Active Control	13-Apr-20	28	ANAC-1	4	<0.020	<0.0020	<0.020	0.84	6.1	4.15	
Continued			ANAC-2	5	<0.020	<0.0020	<0.020	0.85	6.0	4.01	
			ANAC-3	6	<0.020	<0.0020	<0.020	0.86	6.2	5.07	
			Average Concentration (mg/L)		ND	ND	ND	0.85	6.1	4.41	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	5.4E-04	2.3E-04	5.8E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.039**	**0.016**	**0.0072**	
	04-May-20	49	ANAC-1	4	<0.020	<0.0020	<0.020	0.78	6.2	--	
			ANAC-2	5	<0.020	<0.0020	<0.020	0.83	6.0	--	
			ANAC-3	6	<0.020	<0.0020	<0.020	0.85	6.4	--	
			Average Concentration (mg/L)		ND	ND	ND	0.82	6.2	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.7E-03	6.2E-04	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.038**	**0.016**	**--**	
	26-May-20	71	ANAC-1	4	<0.020	<0.0020	<0.020	0.93	6.5	--	
			ANAC-2	5	<0.020	<0.0020	<0.020	0.86	5.5	--	
			ANAC-3	6	<0.020	<0.0020	<0.020	1	6.6	--	
			Average Concentration (mg/L)		ND	ND	ND	0.94	6.2	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	4.0E-03	1.6E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.044**	**0.016**	**--**	
	19-Jun-20	95	ANAC-1	4	<0.020	<0.0020	<0.020	0.83	5.7	--	
			ANAC-2	5	<0.020	<0.0020	<0.020	0.82	5.7	--	
			ANAC-3	6	<0.020	<0.0020	<0.020	0.85	5.7	--	
			Average Concentration (mg/L)		ND	ND	ND	0.83	5.7	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.4E-04	9.5E-05	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.039**	**0.015**	**--**	
	25-Aug-20	162	ANAC-1	4	<0.020	<0.0020	<0.020	0.87	6.6	--	
			ANAC-2	5	<0.020	<0.0020	<0.020	0.89	6.5	--	
			ANAC-3	6	<0.020	<0.0020	<0.020	0.87	6.6	--	
			Average Concentration (mg/L)		ND	ND	ND	0.88	6.6	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	6.3E-04	1.9E-04	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.041**	**0.017**	**--**	
	27-Oct-20	225	ANAC-1	4	<0.020	<0.0020	<0.020	0.81	6.5	3.80	
			ANAC-2	5	<0.020	<0.0020	<0.020	0.88	6.4	5.06	
			ANAC-3	6	<0.020	<0.0020	<0.020	1	6.3	4.50	
			Average Concentration (mg/L)		ND	ND	ND	0.9	6.4	4.45	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	4.4E-03	2.5E-04	6.3E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.042**	**0.017**	**0.0073**	
Nitrate Amended/NRBC Bioaugmented	27-Feb-20	-18									Amended the first replicate with resazurin.
	16-Mar-20	0									Amended with 0.5 mL of a 267 g/L sodium nitrate solution to target a concentration of 100 mg/L.
			NIT-1	7	<0.010	<0.0010	<0.010	0.58	5.0	--	
			NIT-2	8	<0.010	<0.0010	<0.010	0.32	4.0	--	
			NIT-3	9	<0.010	<0.0010	<0.010	0.38	4.3	--	
			Average Concentration (mg/L)		ND	ND	ND	0.43	4.4	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	6.3E-03	1.3E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.02**	**0.012**	**--**	
	30-Mar-20	14	NIT-1	7	<0.020	<0.0020	<0.020	0.61	6.7	--	
			NIT-2	8	<0.020	<0.0020	<0.020	0.19	5.2	--	
			NIT-3	9	<0.020	<0.0020	<0.020	0.39	5.7	--	
			Average Concentration (mg/L)		ND	ND	ND	0.40	5.9	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	9.6E-03	1.9E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.018**	**0.015**	**--**	
	13-Apr-20	28	NIT-1	7	<0.020	<0.0020	<0.020	0.48	6.2	4.51	
			NIT-2	8	<0.020	<0.0020	<0.020	0.15	4.9	4.64	
			NIT-3	9	<0.020	<0.0020	<0.020	0.32	5.3	4.04	
			Average Concentration (mg/L)		ND	ND	ND	0.32	5.5	4.40	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.6E-03	1.7E-03	3.2E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.015**	**0.014**	**0.0072**	
	04-May-20	49	NIT-1	7	<0.020	<0.0020	<0.020	0.48	6.4	--	
			NIT-2	8	<0.020	<0.0020	<0.020	0.15	5.2	--	
			NIT-3	9	<0.020	<0.0020	<0.020	0.31	5.6	--	
			Average Concentration (mg/L)		ND	ND	ND	0.32	5.7	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.6E-03	1.6E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.015**	**0.015**	**--**	

TABLE 2: SUMMARY OF MICROCOSM VOC AND DHG RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Replicate	Bottle	Ethene	Acetylene	Ethane	Methane	Benzene	p-Cymene	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
Nitrate Amended/NRBC Bioaugmented Continued	26-May-20	71	NIT-1	7	<0.020	<0.0020	<0.020	0.56	6.5	--	
			NIT-2	8	<0.020	<0.0020	<0.020	1.1	4.9	--	
			NIT-3	9	<0.020	<0.0020	<0.020	0.29	3.6	--	
			Average Concentration (mg/L)		ND	ND	ND	0.63	5.0	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.8E-02	3.8E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.029**	**0.013**	**--**	
	28-May-20	73									Bioaugmented with 8 mL of NRBC.
	19-Jun-20	95	NIT-1	7	<0.020	<0.0020	<0.020	0.44	5.5	--	
			NIT-2	8	<0.020	<0.0020	<0.020	0.14	4.4	--	
			NIT-3	9	<0.020	<0.0020	<0.020	0.32	5.0	--	
			Average Concentration (mg/L)		ND	ND	ND	0.3	5.0	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.0E-03	1.5E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.014**	**0.013**	**--**	
	25-Aug-20	162	NIT-1	7	<0.020	<0.0020	<0.020	0.48	6.3	--	
			NIT-2	8	<0.020	<0.0020	<0.020	0.15	5.0	--	
			NIT-3	9	<0.020	<0.0020	<0.020	0.32	5.4	--	
			Average Concentration (mg/L)		ND	ND	ND	0.32	5.6	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.5E-03	1.7E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.015**	**0.015**	**--**	
	27-Oct-20	225	NIT-1	7	<0.020	<0.0020	<0.020	0.46	6.3	4.35	
			NIT-2	8	<0.020	<0.0020	<0.020	0.15	5	5.15	
			NIT-3	9	<0.020	<0.0020	<0.020	0.33	5.6	5.17	
			Average Concentration (mg/L)		ND	ND	ND	0.31	5.6	4.89	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.4E-03	1.6E-03	4.7E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.014**	**0.015**	**0.0080**	
Nitrate and Nutrient Amended	27-Feb-20	-18									Amended the first replicate with resazurin.
	16-Mar-20	0									Amended with 0.5 mL of a 267 g/L sodium nitrate solution to target a concentration of 100 mg/L.
											Amended with 267 µL of a 15 g/L DAP solution to target a concentration of 20 mg/L.
			NIT/NUT-1	10	<0.010	<0.0010	<0.010	0.75	4.2	--	
			NIT/NUT-2	11	<0.010	<0.0010	<0.010	0.57	4.7	--	
			NIT/NUT-3	12	<0.010	<0.0010	<0.010	0.78	5.0	--	
			Average Concentration (mg/L)		ND	ND	ND	0.70	4.6	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	5.2E-03	1.1E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.033**	**0.012**	**--**	
	30-Mar-20	14	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.95	5.4	--	
			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.64	6.0	--	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.89	6.0	--	
			Average Concentration (mg/L)		ND	ND	ND	0.83	5.8	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.7E-03	8.3E-04	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.038**	**0.015**	**--**	
	13-Apr-20	28	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.81	5.0	4.31	
			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.54	5.6	4.41	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.81	5.9	4.84	
			Average Concentration (mg/L)		ND	ND	ND	0.72	5.5	4.52	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.2E-03	1.2E-03	2.8E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.033**	**0.014**	**0.0074**	
	04-May-20	49	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.79	5.1	--	
			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.52	5.9	--	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.79	6.2	--	
			Average Concentration (mg/L)		ND	ND	ND	0.7	5.7	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.2E-03	1.5E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.033**	**0.015**	**--**	
	26-May-20	71	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.94	5.2	--	
			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.65	6.2	--	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.91	6.1	--	
			Average Concentration (mg/L)		ND	ND	ND	0.83	5.9	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.4E-03	1.4E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.039**	**0.015**	**--**	
	19-Jun-20	95	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.74	4.6	--	
			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.54	5.4	--	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.82	5.7	--	
			Average Concentration (mg/L)		ND	ND	ND	0.70	5.2	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	6.6E-03	1.4E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.032**	**0.014**	**--**	

TABLE 2: SUMMARY OF MICROCOSM VOC AND DHG RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Replicate	Bottle	Ethene	Acetylene	Ethane	Methane	Benzene	p-Cymene	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
Nitrate and Nutrient Amended	25-Aug-20	162	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.77	5.0	--	
Continued			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.52	6.0	--	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.76	6.3	--	
			Average Concentration (mg/L)		ND	ND	ND	0.68	5.8	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	6.8E-03	1.8E-03	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.032**	**0.015**	**--**	
	27-Oct-20	225	NIT/NUT-1	10	<0.020	<0.0020	<0.020	0.81	5	4.83	
			NIT/NUT-2	11	<0.020	<0.0020	<0.020	0.52	6	4.04	
			NIT/NUT-3	12	<0.020	<0.0020	<0.020	0.76	6.3	4.62	
			Average Concentration (mg/L)		ND	ND	ND	0.7	5.8	4.50	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	7.0E-03	1.7E-03	4.1E-01	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.032**	**0.015**	**0.0074**	
DGG Bioaugmented	25-Jun-20	-21									New set of microcosms constructed.
	16-Jul-20	0									Amended the first replicate with resazurin.
											Amended with 100 µL of an iron sulfide suspension.
											Spiked with 61 µL of a saturated benzene solution to target a concentration of 5 mg/L.
											Bioaugmented with 5 mL of DGG-B.
			DGG-1	13	<0.020	<0.0020	<0.020	0.060	4.9	--	
			DGG-2	14	<0.020	<0.0020	<0.020	0.10	5.1	--	
			DGG-3	15	<0.020	<0.0020	<0.020	0.10	4.9	--	
			Average Concentration (mg/L)		ND	ND	ND	0.09	5.0	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	2.5E-02	1.4E-01	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.00013**	**0.013**	**--**	
	04-Aug-20	19	DGG-1	13	<0.020	<0.0020	<0.020	0.050	4.3	--	
			DGG-2	14	<0.020	<0.0020	<0.020	0.084	4.5	--	
			DGG-3	15	<0.020	<0.0020	<0.020	0.086	4.4	--	
			Average Concentration (mg/L)		ND	ND	ND	0.073	4.4	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	2.0E-02	1.1E-01	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.00011**	**0.011**	**--**	
	25-Aug-20	40	DGG-1	13	<0.020	<0.0020	<0.020	0.046	4.6	--	
			DGG-2	14	<0.020	<0.0020	<0.020	0.079	4.9	--	
			DGG-3	15	<0.020	<0.0020	<0.020	0.076	4.7	--	
			Average Concentration (mg/L)		ND	ND	ND	0.067	4.7	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.8E-02	1.8E-01	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.00010**	**0.012**	**--**	
	27-Oct-20	103	DGG-1	13	<0.020	<0.0020	<0.020	0.036	4.6	--	
			DGG-2	14	<0.020	<0.0020	<0.020	0.065	4.8	--	
			DGG-3	15	<0.020	<0.0020	<0.020	0.068	4.7	--	
			Average Concentration (mg/L)		ND	ND	ND	0.057	4.7	--	
			Standard Deviation (mmoles)		0.0E+00	0.0E+00	0.0E+00	1.8E-02	1.0E-01	--	
			Average Total mmoles		**ND**	**ND**	**ND**	**0.00008**	**0.012**	**--**	

Notes:

< - compound not detected, the associated value is the detection limit
-- - not applicable
µL - microliter
DAP - diammonium phosphate
DGG - Dunja Grbić-Galić
DGG-B - Dunja Grbić-Galić Benzene
DHG - dissolved hydrocarbon gases
g/L -grams per liter
mg/L - milligrams per liter
mL - milliliters
mmoles - millimoles
ND - not detected
NIT - nitrate
NIT/NUT - nitrate/nutrient
NRBC - nitrate reducing benzene culture
p-Cymene - para-cymene

TABLE 3: SUMMARY OF MICROCOSM ANION RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

Treatment	Date	Day	Bottle	Replicate	Total VFAs mg/L	Chloride mg/L	Nitrite-N mg/L	Nitrate-N mg/L	Sulfate mg/L	Phosphate mg/L
Sterile Control	16-Mar-20	0	1	ANSC-1	<0.07	171	<0.09	<0.09	14	<0.07
			2	ANSC-2	<0.07	167	<0.09	<0.09	14	<0.07
			3	ANSC-3	<0.07	168	<0.09	<0.09	12	<0.07
				Average Concentration (mg/L)	**ND**	**169**	**ND**	**ND**	**13**	**ND**
	30-Mar-20	14	1	ANSC-1	<0.07	181	<0.09	<0.09	14	<0.07
			2	ANSC-2	<0.07	176	<0.09	<0.09	15	<0.07
			3	ANSC-3	<0.07	171	<0.09	<0.09	12	<0.07
				Average Concentration (mg/L)	**ND**	**176**	**ND**	**ND**	**14**	**ND**
	13-Apr-20	28	1	ANSC-1	<0.07	195	<0.09	<0.09	16	<0.07
			2	ANSC-2	<0.07	190	<0.09	<0.09	15	<0.07
			3	ANSC-3	<0.07	186	<0.09	<0.09	13	<0.07
				Average Concentration (mg/L)	**ND**	**190**	**ND**	**ND**	**15**	**ND**
	4-May-20	49	1	ANSC-1	<0.07	186	<0.09	<0.09	15	<0.07
			2	ANSC-2	<0.07	195	<0.09	<0.09	16	<0.07
			3	ANSC-3	<0.07	179	<0.09	<0.09	12	<0.07
				Average Concentration (mg/L)	**ND**	**187**	**ND**	**ND**	**14**	**ND**
	19-Jun-20	95	1	ANSC-1	<0.07	196	<0.09	<0.09	13	<0.07
			2	ANSC-2	<0.07	195	<0.09	<0.09	14	<0.07
			3	ANSC-3	<0.07	184	<0.09	<0.09	12	<0.07
				Average Concentration (mg/L)	**ND**	**192**	**ND**	**ND**	**13**	**ND**
	4-Aug-20	141	1	ANSC-1	<0.07	196	<0.09	<0.09	15	<0.07
			2	ANSC-2	<0.07	203	<0.09	<0.09	17	<0.07
			3	ANSC-3	<0.07	187	<0.09	<0.09	15	<0.07
				Average Concentration (mg/L)	**ND**	**195**	**ND**	**ND**	**16**	**ND**
Active Control	16-Mar-20	0	4	ANAC-1	<0.07	115	<0.09	<0.09	10	<0.07
			5	ANAC-2	<0.07	122	<0.09	<0.09	11	<0.07
			6	ANAC-3	<0.07	114	<0.09	<0.09	10	<0.07
				Average Concentration (mg/L)	**ND**	**117**	**ND**	**ND**	**10**	**ND**
	30-Mar-20	14	4	ANAC-1	<0.07	121	<0.09	<0.09	10	<0.07
			5	ANAC-2	<0.07	119	<0.09	<0.09	10	<0.07
			6	ANAC-3	<0.07	120	<0.09	<0.09	10	<0.07
				Average Concentration (mg/L)	**ND**	**120**	**ND**	**ND**	**10**	**ND**
	13-Apr-20	28	4	ANAC-1	<0.07	124	<0.09	<0.09	10	<0.07
			5	ANAC-2	<0.07	135	<0.09	<0.09	11	<0.07
			6	ANAC-3	<0.07	117	<0.09	<0.09	11	<0.07
				Average Concentration (mg/L)	**ND**	**125**	**ND**	**ND**	**11**	**--**
	4-May-20	49	4	ANAC-1	<0.07	125	<0.09	<0.09	10	<0.07
			5	ANAC-2	<0.07	127	<0.09	<0.09	10	<0.07
			6	ANAC-3	<0.07	130	<0.09	<0.09	11	<0.07
				Average Concentration (mg/L)	**ND**	**127**	**ND**	**ND**	**10**	**ND**
	19-Jun-20	95	4	ANAC-1	<0.07	132	<0.09	<0.09	9.5	<0.07
			5	ANAC-2	<0.07	129	<0.09	<0.09	10	<0.07
			6	ANAC-3	<0.07	135	<0.09	<0.09	11	<0.07
				Average Concentration (mg/L)	**ND**	**132**	**ND**	**ND**	**10**	**ND**
	4-Aug-20	141	4	ANAC-1	<0.07	138	<0.09	<0.09	11	<0.07
			5	ANAC-2	<0.07	134	<0.09	<0.09	11	<0.07
			6	ANAC-3	<0.07	132	<0.09	<0.09	10	<0.07
				Average Concentration (mg/L)	**ND**	**135**	**ND**	**ND**	**11**	**ND**
Nitrate Amended/NRBC Bioaugmented	16-Mar-20	0	7	NIT-1	<0.07	113	<0.09	98	10	<0.07
			8	NIT-2	<0.07	115	<0.09	94	10	<0.07
			9	NIT-3	<0.07	121	<0.09	106	11	<0.07
				Average Concentration (mg/L)	**ND**	**116**	**ND**	**100**	**10**	**ND**
	30-Mar-20	14	7	NIT-1	<0.07	119	<0.09	99	9.3	<0.07
			8	NIT-2	<0.07	118	<0.09	92	10	<0.07
			9	NIT-3	<0.07	117	<0.09	97	9.3	<0.07
				Average Concentration (mg/L)	**ND**	**118**	**ND**	**96**	**9.4**	**ND**
	13-Apr-20	28	7	NIT-1	<0.07	129	<0.09	101	10	<0.07
			8	NIT-2	<0.07	126	<0.09	93	10	<0.07
			9	NIT-3	<0.07	127	<0.09	99	10	<0.07
				Average Concentration (mg/L)	**ND**	**127**	**ND**	**98**	**10**	**ND**
	4-May-20	49	7	NIT-1	<0.07	126	<0.09	96	10	<0.07
			8	NIT-2	<0.07	126	<0.09	90	10	<0.07
			9	NIT-3	<0.07	127	<0.09	95	10	<0.07
				Average Concentration (mg/L)	**ND**	**126**	**ND**	**94**	**10**	**ND**
	26-May-20	71	7	NIT-1	<0.07	134	<0.09	99	10	<0.07
			8	NIT-2	<0.07	142	<0.09	96	11	<0.07
			9	NIT-3	<0.07	142	<0.09	100	11	<0.07
				Average Concentration (mg/L)	**ND**	**139**	**ND**	**98**	**11**	**ND**
	29-May-20	74	7	NIT-1	<0.07	142	<0.09	94	11	<0.07
			8	NIT-2	<0.07	144	<0.09	91	11	<0.07
			9	NIT-3	<0.07	146	<0.09	97	11	<0.07
				Average Concentration (mg/L)	**ND**	**144**	**ND**	**94**	**11**	**ND**
	19-Jun-20	95	7	NIT-1	<0.07	144	<0.09	97	10	<0.07
			8	NIT-2	<0.07	139	<0.09	88	11	<0.07
			9	NIT-3	<0.07	136	<0.09	90	10	<0.07
				Average Concentration (mg/L)	**ND**	**140**	**ND**	**91**	**10**	**ND**
	4-Aug-20	141	7	NIT-1	<0.07	139	<0.09	95	10	<0.07
			8	NIT-2	<0.07	145	<0.09	90	11	<0.07
			9	NIT-3	<0.07	142	<0.09	94	12	<0.07
				Average Concentration (mg/L)	**ND**	**142**	**ND**	**93**	**11**	**ND**
	8-Sep-20	176	7	NIT-1	<0.07	162	<0.09	111	13	<0.07
			8	NIT-2	<0.07	183	<0.09	120	14	<0.07
			9	NIT-3	<0.07	155	<0.09	106	12	<0.07
				Average Concentration (mg/L)	**ND**	**167**	**ND**	**112**	**13**	**ND**

TABLE 3: SUMMARY OF MICROCOSM ANION RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Bottle	Replicate	Total VFAs mg/L	Chloride mg/L	Nitrite-N mg/L	Nitrate-N mg/L	Sulfate mg/L	Phosphate mg/L
Nitrate and Nutrient Amended	16-Mar-20	0	10	NIT/NUT-1	<0.07	128	<0.09	109	13	<0.07
			11	NIT/NUT-2	<0.07	115	<0.09	102	10	<0.07
			12	NIT/NUT-3	<0.07	112	<0.09	99	10	<0.07
				Average Concentration (mg/L)	**ND**	**118**	**ND**	**103**	**11**	**ND**
	30-Mar-20	14	10	NIT/NUT-1	<0.07	119	<0.09	102	10	<0.07
			11	NIT/NUT-2	<0.07	122	<0.09	108	10	<0.07
			12	NIT/NUT-3	<0.07	114	<0.09	100	10	<0.07
				Average Concentration (mg/L)	**ND**	**118**	**ND**	**103**	**10**	**ND**
	13-Apr-20	28	10	NIT/NUT-1	<0.07	119	<0.09	96	10	<0.07
			11	NIT/NUT-2	<0.07	125	<0.09	104	10	<0.07
			12	NIT/NUT-3	<0.07	124	<0.09	102	11	<0.07
				Average Concentration (mg/L)	**ND**	**123**	**ND**	**101**	**10**	**ND**
	4-May-20	49	10	NIT/NUT-1	<0.07	127	<0.09	99	10	<0.07
			11	NIT/NUT-2	<0.07	129	<0.09	105	11	<0.07
			12	NIT/NUT-3	<0.07	124	<0.09	99	10	<0.07
				Average Concentration (mg/L)	**ND**	**127**	**ND**	**101**	**10**	**ND**
	19-Jun-20	95	10	NIT/NUT-1	<0.07	130	<0.09	101	10	<0.07
			11	NIT/NUT-2	<0.07	133	<0.09	109	10	<0.07
			12	NIT/NUT-3	<0.07	124	<0.09	100	11	<0.07
				Average Concentration (mg/L)	**ND**	**129**	**ND**	**103**	**10**	**ND**
	4-Aug-20	141	10	NIT/NUT-1	<0.07	132	<0.09	103	11	<0.07
			11	NIT/NUT-2	<0.07	143	<0.09	117	13	<0.07
			12	NIT/NUT-3	<0.07	131	<0.09	106	11	<0.07
				Average Concentration (mg/L)	**ND**	**135**	**ND**	**108**	**12**	**ND**
	8-Sep-20	176	10	NIT/NUT-1	<0.07	142	<0.09	114	11	<0.07
			11	NIT/NUT-2	<0.07	157	<0.09	131	13	<0.07
			12	NIT/NUT-3	<0.07	139	<0.09	114	11	<0.07
				Average Concentration (mg/L)	**ND**	**146**	**ND**	**120**	**12**	**ND**

Notes:

< - compound not detected, the associated value is the detection limit
ANAC - anaerobic active control
ANSC - anaerobic sterile control
ND - not detected
NIT - nitrate
NIT/NUT - nitrate/nutrient
Nitrate-N - nitrate-nitrogen
Nitrite-N - nitrite-nitrogen
NRBC - nitrate reducing benzene culture
mg/L - milligrams per liter
VFAs - total volatile fatty acids, calibrated as lactate but may include other VFAs such as formate, acetate, propionate, pyruvate and butyrate

TABLE 4: SUMMARY OF MICROCOSM pH, ORP, AND AMMONIA RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Bottle	Replicate	pH	ORP	Ammonia
						mV	mg/L
Sterile Control	16-Mar-20	0	1	ANSC-1	6.07	149	--
			2	ANSC-2	6.02	164	--
			3	ANSC-3	5.99	202	--
				Average	**6.03**	**172**	**--**
	30-Mar-20	14	1	ANSC-1	5.77	--	--
			2	ANSC-2	5.61	--	--
			3	ANSC-3	5.71	--	--
				Average	**5.70**	**--**	**--**
	13-Apr-20	28	1	ANSC-1	5.70	--	--
			2	ANSC-2	5.59	--	--
			3	ANSC-3	5.64	--	--
				Average	**5.64**	**--**	**--**
	4-May-20	49	1	ANSC-1	5.62	--	--
			2	ANSC-2	5.56	--	--
			3	ANSC-3	5.60	--	--
				Average	**5.59**	**--**	**--**
	26-May-20	71	1	ANSC-1	6.01	--	--
			2	ANSC-2	6.03	--	--
			3	ANSC-3	6.00	--	--
				Average	**6.01**	**--**	**--**
	19-Jun-20	95	1	ANSC-1	5.60	--	--
			2	ANSC-2	5.59	--	--
			3	ANSC-3	5.59	--	--
				Average	**5.59**	**--**	**--**
	25-Aug-20	162	1	ANSC-1	5.93	--	--
			2	ANSC-2	5.87	--	--
			3	ANSC-3	5.92	--	--
				Average	**5.91**	**--**	**--**
	27-Oct-20	225	1	ANSC-1	5.73	87	4.7
			2	ANSC-2	5.68	116	4.6
			3	ANSC-3	5.74	114	4.59
				Average	**5.72**	**106**	**4.6**
Active Control	16-Mar-20	0	4	ANAC-1	6.13	121	--
			5	ANAC-2	6.13	106	--
			6	ANAC-3	6.08	105	--
				Average	**6.11**	**111**	**--**
	30-Mar-20	14	4	ANAC-1	5.98	--	--
			5	ANAC-2	6.00	--	--
			6	ANAC-3	6.00	--	--
				Average	**5.99**	**--**	**--**
	13-Apr-20	28	4	ANAC-1	5.96	--	--
			5	ANAC-2	5.97	--	--
			6	ANAC-3	5.93	--	--
				Average	**5.95**	**--**	**--**
	4-May-20	49	4	ANAC-1	5.91	--	--
			5	ANAC-2	5.94	--	--
			6	ANAC-3	5.91	--	--
				Average	**5.92**	**--**	**--**
	26-May-20	71	4	ANAC-1	6.31	--	--
			5	ANAC-2	6.33	--	--
			6	ANAC-3	6.29	--	--
				Average	**6.31**	**--**	**--**
	19-Jun-20	95	4	ANAC-1	5.96	--	--
			5	ANAC-2	5.95	--	--
			6	ANAC-3	5.96		--
				Average	**5.96**	**--**	**--**
	25-Aug-20	162	4	ANAC-1	6.26	--	--
			5	ANAC-2	6.28	--	--
			6	ANAC-3	6.26	--	--
				Average	**6.27**	**--**	**--**
	27-Oct-20	225	4	ANAC-1	6.08	83	3.64
			5	ANAC-2	6.10	75	52
			6	ANAC-3	6.09	69	14
				Average	**6.09**	**76**	**23**
Nitrate Amended/NRBC Bioaugmented	16-Mar-20	0	7	NIT-1	6.09	55	3.2
			8	NIT-2	6.20	65	--
			9	NIT-3	6.18	86	--
				Average	**6.16**	**69**	**3.2**
	30-Mar-20	14	7	NIT-1	6.09	--	--
			8	NIT-2	6.17	--	--
			9	NIT-3	6.11	--	--
				Average	**6.12**	**--**	**--**
	13-Apr-20	28	7	NIT-1	5.99	--	3.3
			8	NIT-2	6.10	--	3.4
			9	NIT-3	6.05	--	3.1
				Average	**6.05**	**--**	**3.3**
	4-May-20	49	7	NIT-1	6.04	--	--
			8	NIT-2	6.04	--	--
			9	NIT-3	6.02	--	--
				Average	**6.03**	**--**	**--**
	26-May-20	71	7	NIT-1	6.26	--	--
			8	NIT-2	6.38	--	--
			9	NIT-3	6.35	--	--
				Average	**6.33**	**--**	**--**
	19-Jun-20	95	7	NIT-1	6.20	--	--
			8	NIT-2	6.38	--	--
			9	NIT-3	6.33	--	--
				Average	**6.30**	**--**	**--**
	25-Aug-20	162	7	NIT-1	6.54	--	--
			8	NIT-2	6.62	--	--
			9	NIT-3	6.54	--	--
				Average	**6.57**	**--**	**--**
	27-Oct-20	225	7	NIT-1	6.39	67	15
			8	NIT-2	6.45	68	11
			9	NIT-3	6.44	76	12
				Average	**6.43**	**70**	**13**

TABLE 4: SUMMARY OF MICROCOSM pH, ORP, AND AMMONIA RESULTS
SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	Day	Bottle	Replicate	pH	ORP	Ammonia
						mV	mg/L
Nitrate and Nutrient Amended	16-Mar-20	0	10	NIT/NUT-1	6.08	86	6.5
			11	NIT/NUT-2	6.08	101	--
			12	NIT/NUT-3	6.02	114	--
				Average	**6.06**	**100**	**6.5**
	30-Mar-20	14	10	NIT/NUT-1	6.01	--	--
			11	NIT/NUT-2	6.02	--	--
			12	NIT/NUT-3	6.03	--	--
				Average	**6.02**	**--**	**--**
	13-Apr-20	28	10	NIT/NUT-1	5.93	--	6.4
			11	NIT/NUT-2	5.95	--	6.4
			12	NIT/NUT-3	5.92	--	6.4
				Average	**5.93**	**--**	**6.4**
	4-May-20	49	10	NIT/NUT-1	5.92	--	--
			11	NIT/NUT-2	5.92	--	--
			12	NIT/NUT-3	5.91	--	--
				Average	**5.92**	**--**	**--**
	26-May-20	71	10	NIT/NUT-1	6.25	--	--
			11	NIT/NUT-2	6.25	--	--
			12	NIT/NUT-3	6.19	--	--
				Average	**6.23**	**--**	**--**
	19-Jun-20	95	10	NIT/NUT-1	6.04	--	--
			11	NIT/NUT-2	6.06	--	--
			12	NIT/NUT-3	6.00	--	--
				Average	**6.03**	**--**	**--**
	25-Aug-20	162	10	NIT/NUT-1	6.26	--	--
			11	NIT/NUT-2	6.29	--	--
			12	NIT/NUT-3	6.23	--	--
				Average	**6.26**	**--**	**--**
	27-Oct-20	225	10	NIT/NUT-1	6.09	78	15
			11	NIT/NUT-2	6.14	78	13
			12	NIT/NUT-3	6.09	78	<10
				Average	**6.11**	**78**	**9.3**
DGG Bioaugmented	15-Jul-20	-1	13	DGG-1	--	18	--
			14	DGG-2	--	22	--
			15	DGG-3	--	22	--
				Average	**--**	**21**	**--**
	16-Jul-20	0		Amended with 100 µL of an iron sulfide suspension.			
			13	DGG-1	--		--
			14	DGG-2	--	-49	--
			15	DGG-3	--		--
				Average	**--**	**-49**	**--**
	4-Aug-20	19	13	DGG-1	6.43	--	--
			14	DGG-2	6.35	--	--
			15	DGG-3	6.32	--	--
				Average	**6.37**	**--**	**--**
	25-Aug-20	40	13	DGG-1	6.49	--	--
			14	DGG-2	6.45	--	--
			15	DGG-3	6.41	--	--
				Average	**6.45**	**--**	**--**
	27-Oct-20	103	13	DGG-1	6.34	54	--
			14	DGG-2	6.26	50	--
			15	DGG-3	6.21	52	--
				Average	**6.27**	**52**	**--**

Notes:

-- - not applicable
µL - microliter
ANAC - anaerobic active control
ANSC - anaerobic sterile control
DGG - Dunja Grbić-Galić
mg/L - milligrams per liter
mV - millivolts
NIT - nitrate
NIT/NUT - nitrate/nutrient
NRBC nitrate reducing benzene culture
ORP - oxidation-reduction potential

TABLE 5: SUMMARY OF GENE-TRAC® RESULTS

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment	Date	ORM2	SRB	abcA	Pepto-ben
		Gene Copies/L	Gene Copies/L	Gene Copies/L	Gene Copies/L
Bulk Groundwater	26-Mar-20	3×10^4	1×10^4	6×10^3 U	6×10^3 U

Notes:

abcA - benzene carboxylase
Gene Copies/L - gene copies of functional gene per liter
Pepto-ben - peptococcaceae
SRB - sulfate reducing bacteria
U - not detected, the associated value is the quantitation limit

TABLE 6: HALF-LIVES (DAYS) OF VOCs

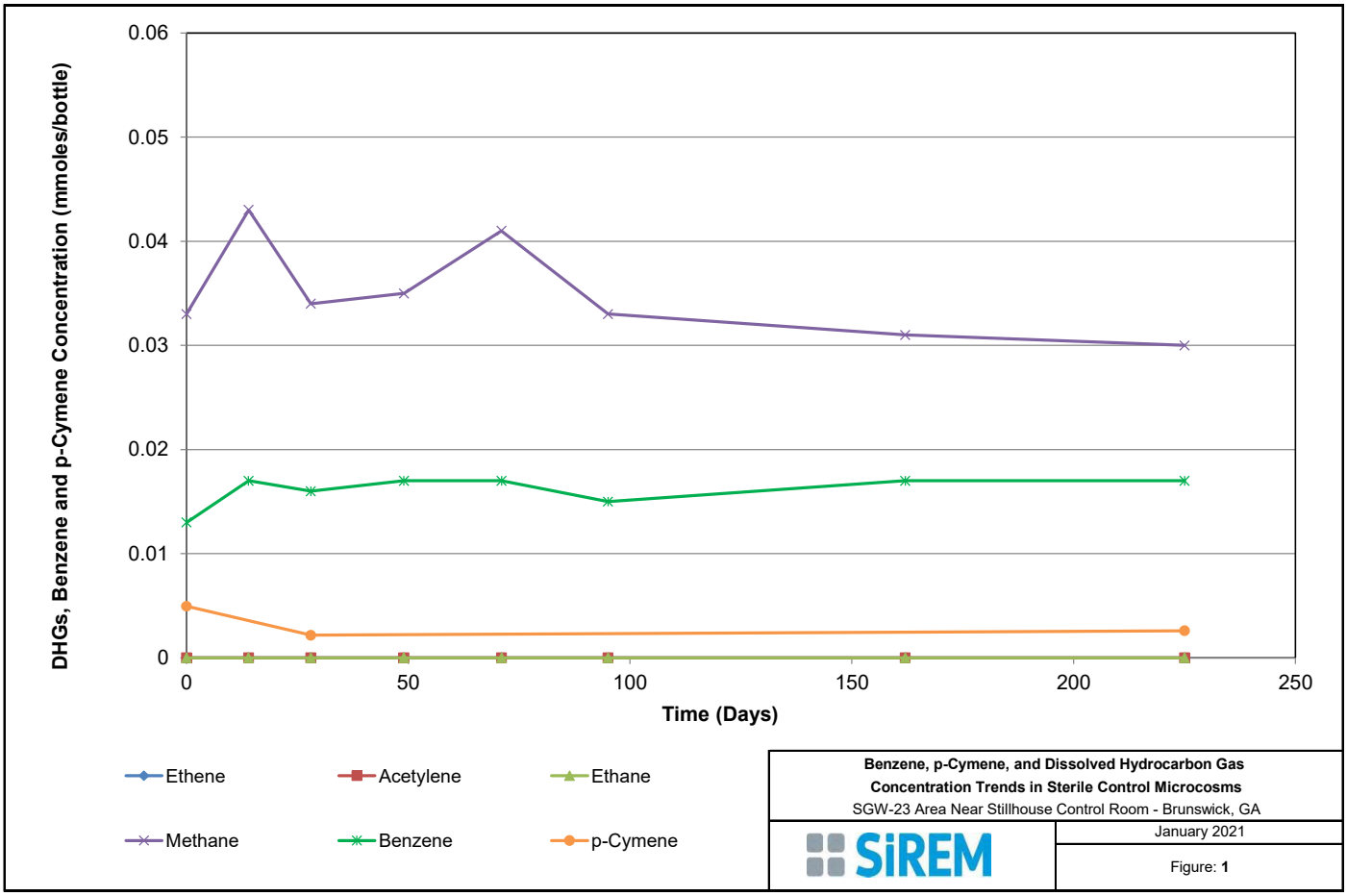
SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

Treatment/Control	Benzene			p-Cymene		
	Half Life (Days)	T_1 (Day)	T_2 (Days)	**Half Life (Days)**	T_1 (Day)	T_2 (Days)
Anaerobic Sterile Control	~	--	--	242	0	225
Anaerobic Active Control	~	--	--	~	--	--
Nitrate Amended/NRBC Bioaugmented	~	--	--	~	--	--
Nitrate and Nutrient Amended	~	--	--	~	--	--
DGG Bioaugmented	1436	0	103	~	--	--

Notes:

-- - not applicable
~ - net degradation of compound was not detected over duration of study
DGG - Dunja Grbić-Galić
NRBC - nitrate reducing benzene culture
p-Cymene - para-cymene
VOC - volatile organic carbon

FIGURES



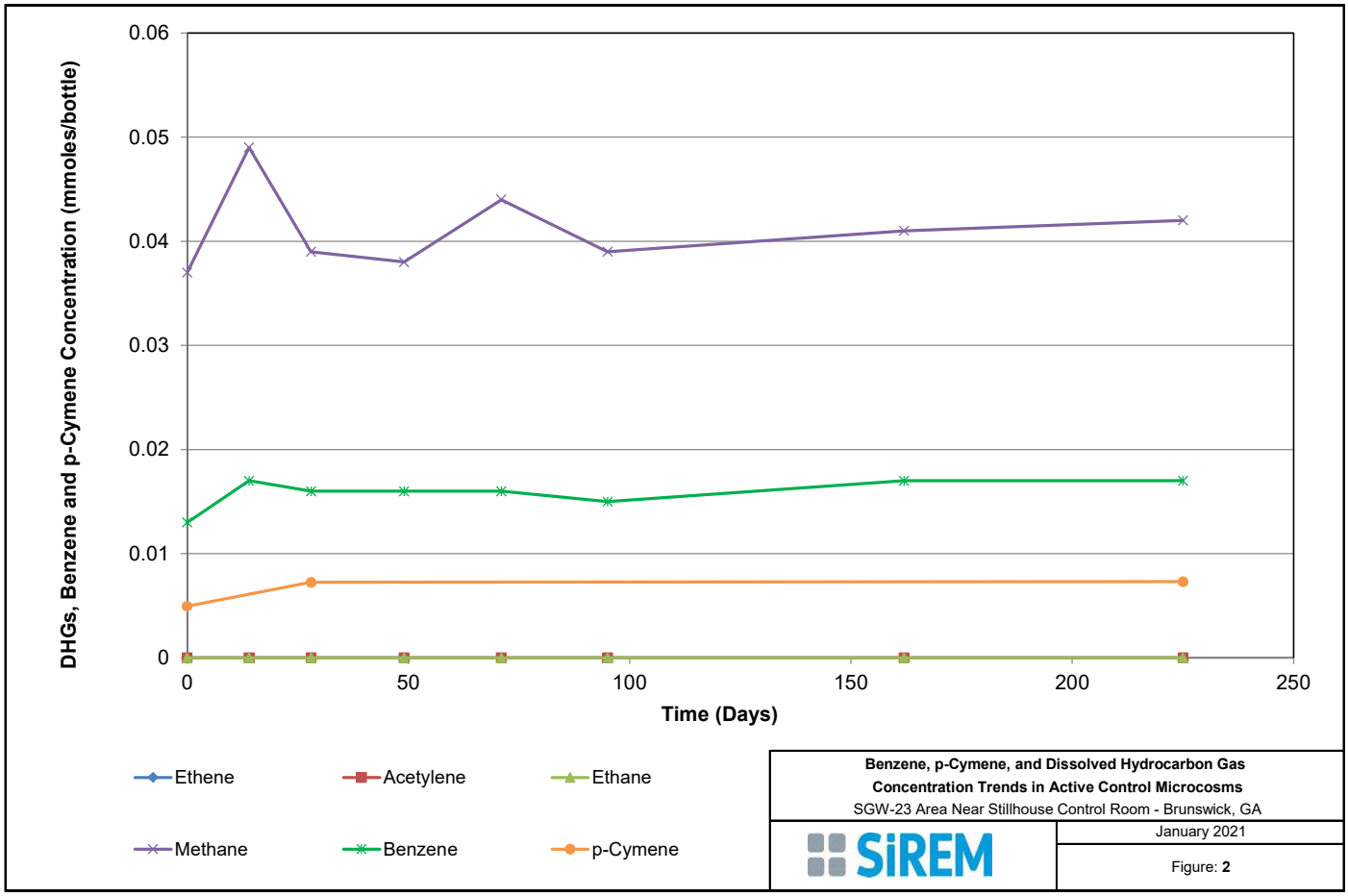
Benzene, p-Cymene, and Dissolved Hydrocarbon Gas Concentration Trends in Sterile Control Microcosms

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

January 2021

Figure: **1**



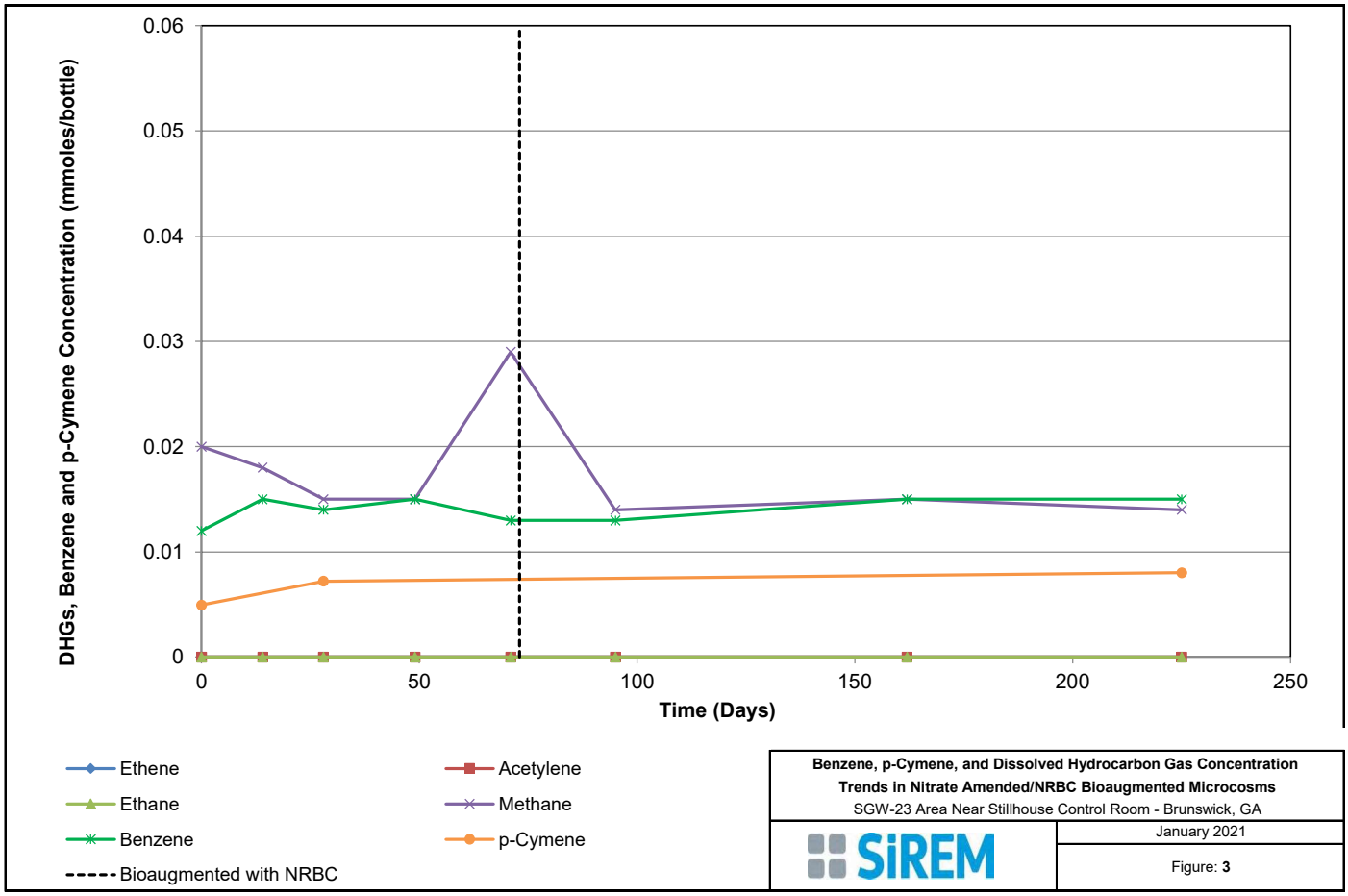
Benzene, p-Cymene, and Dissolved Hydrocarbon Gas Concentration Trends in Active Control Microcosms

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

January 2021

Figure: **2**



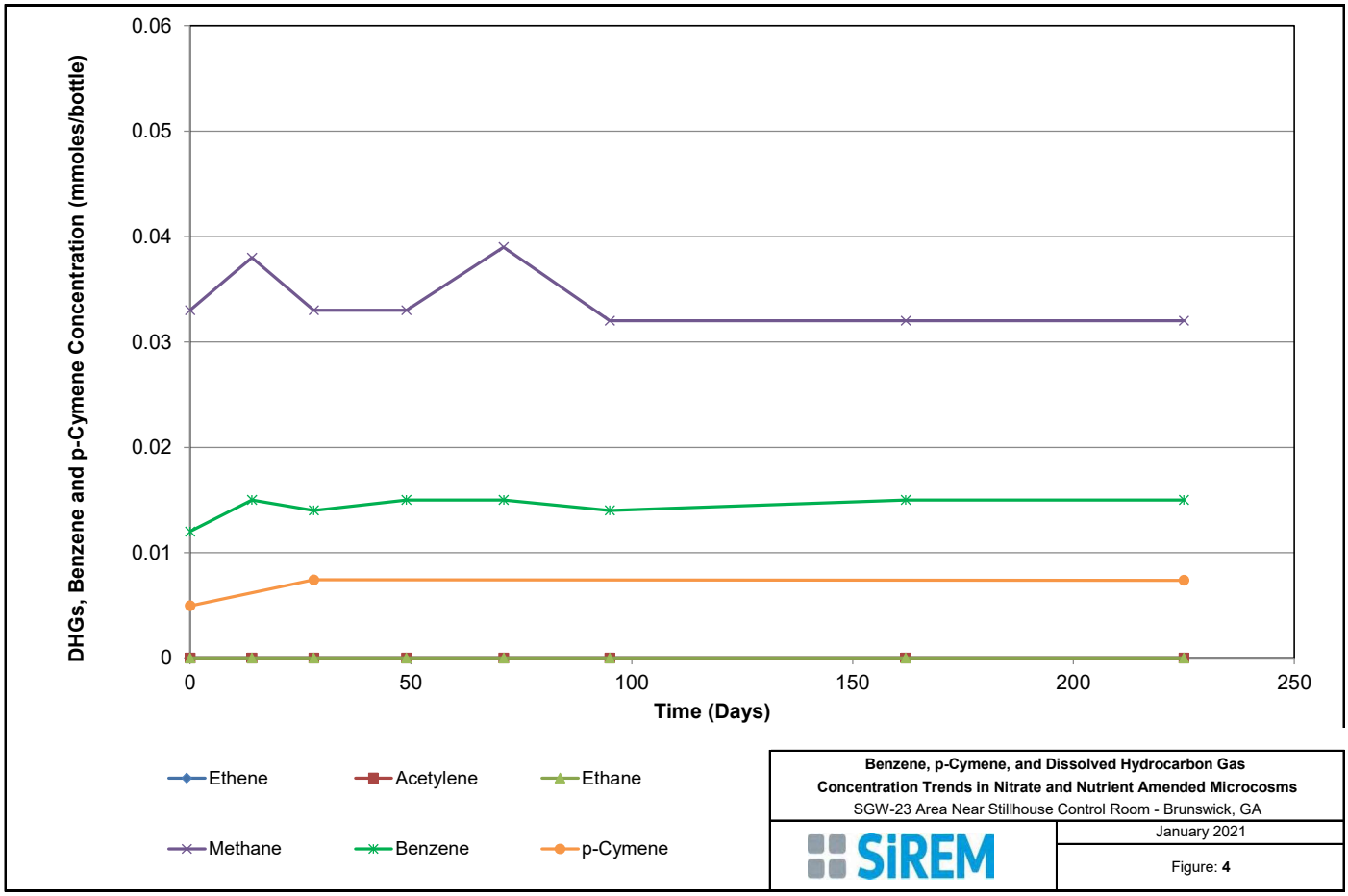
Benzene, p-Cymene, and Dissolved Hydrocarbon Gas Concentration Trends in Nitrate Amended/NRBC Bioaugmented Microcosms

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

January 2021

Figure: **3**



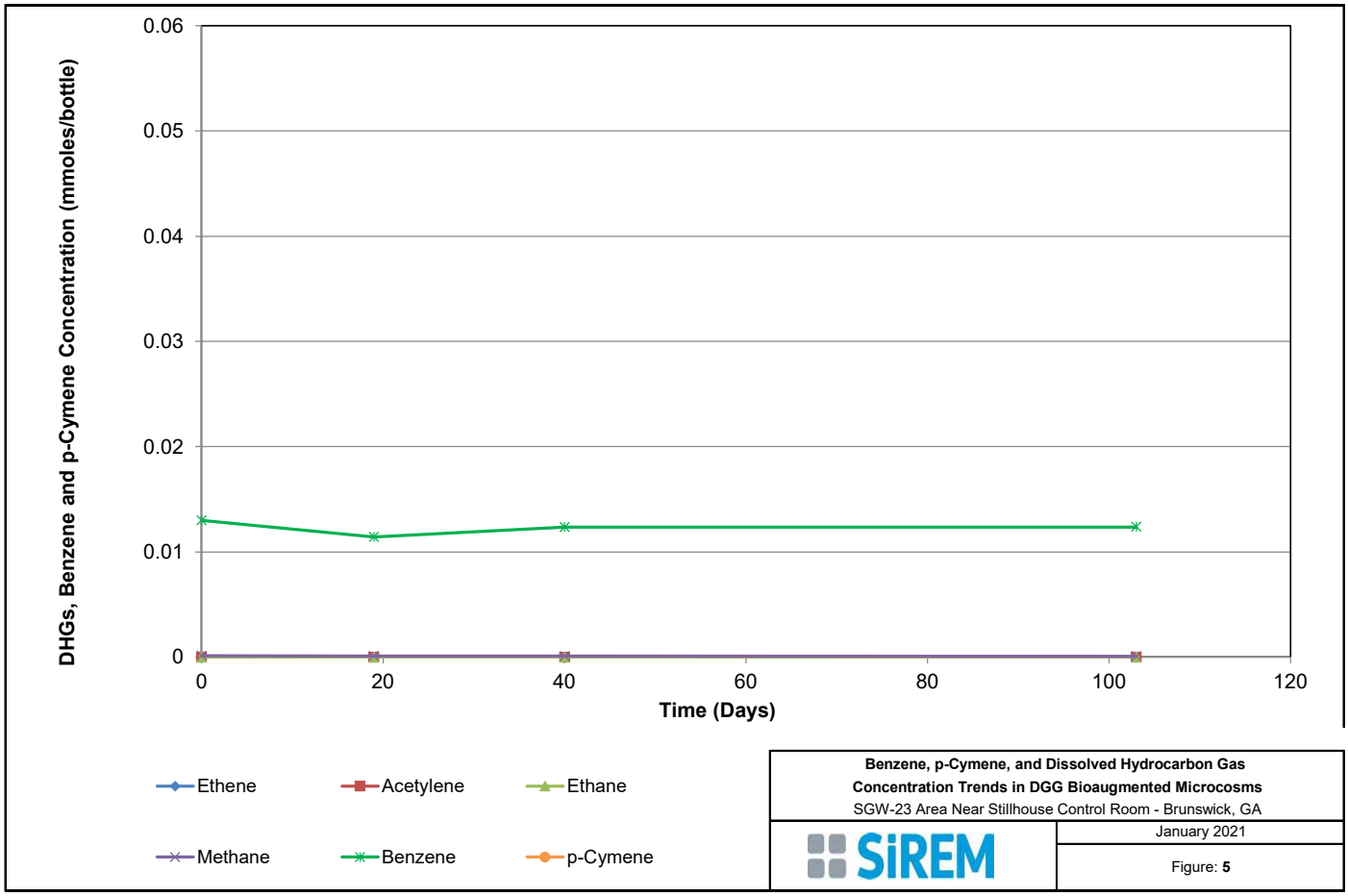
Benzene, p-Cymene, and Dissolved Hydrocarbon Gas Concentration Trends in Nitrate and Nutrient Amended Microcosms

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

January 2021

Figure: **4**



Benzene, p-Cymene, and Dissolved Hydrocarbon Gas Concentration Trends in DGG Bioaugmented Microcosms

SGW-23 Area Near Stillhouse Control Room - Brunswick, GA

SiREM

January 2021

Figure: **5**

APPENDIX A: Chain of Custody Documentation

SiREM

Chain-of-Custody Form

siremlab.com

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Lab# S-5715

*Project Name: Hercules Brunswick | *Project #: GR6881C
*Project Manager: Adria Reimer | *Company: Geosyntec
*Email Address: areimer@geosyntec.com
Address (Street): 1255 Roberts Blvd.
City: Kennesaw | State/Province: GA | Country: USA
*Phone #: 678-202-9500
*Sampler's Signature | *Sampler's Printed Name: Nardos Tilahun

	Client Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac DHC	Gene-Trac FGA (vcA, bvcA, tceA)	Gene-Trac DHB	Gene-Trac DHG	Gene-Trac SRB	Volatile Fatty Acids	Dissolved hydrocarbon gases	Treatability Study	Other Information
1.	Pinova MPE (2-5')	2/18/20	1400	SO	1								X	Recovery = 12"
2.	Pinova MPE (5-10')	2/18/20	1400	SO	1								X	Recovery = 18"
3.	Pinova MPE (2-5')	2/18/20	1410	SO	1								X	Recovery = 2 ft.
4.	Pinova MPE (6-8')	2/18/20	1410	SO	1								X	Recovery = 4ft (1 of 2)
5.	Pinova MPE (8-10')	2/18/20	1410	SO	1								X	Recovery = 4ft (2 of 2)
6.	Pinova PZ-1 (2-5')	2/18/20	1420	SO	1								X	Recovery = 2ft
7.	Pinova PZ-1 (5-10')	2/18/20	1420	SO	1								X	Recovery = 18"

Analysis — Preservative Key: 0. None; 1. HCL; 2. Other ____; 3. Other ____; 4. Other ____; 5. Other ____; 6. Other ____

P.O. # | Billing Information
*Bill To:

Turnaround Time Requested: Normal ☐ Rush ☐

For Lab Use Only
Cooler Condition: Good
Cooler Temperature: 3°C
Custody Seals: Yes ☐ No ☒

For Lab Use Only
Proposal #: ____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: Rich Murray	Printed Name:	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: Geosyntec	Firm:	Firm:	Firm:	Firm:	Firm:
Date/Time: 2/19/2020 1730	Date/Time:	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - return to Originator; Yellow - Lab Copy; Pink - Retained by Client
* Mandatory Fields

SiREM

Chain-of-Custody Form

siremlab.com

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Lab # S-5718

GR6881C

*Project Name: Hercules Brunswick	*Project #: ~~678-202-9500~~ (RJ)
*Project Manager: Adria Reimer	*Company: Geosyntec
*Email Address: areimer@geosyntec.com	
Address (Street): ~~2155~~ 1255 Roberts Blvd.	
City: Kennesaw	State/Province: GA
Country: 30144	
*Phone #: 678-202-9500	
*Sampler's Signature:	*Sampler's Printed Name: Rich Murray

Client Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac DHC	Gene-Trac FGA (vcA, bvcA, tceA)	Gene-Trac DHB	Gene-Trac DHG	Gene-Trac SRB	Volatile Fatty Acids	Dissolved hydrocarbon gases	Treatability Study				Other Information
MPE Well	2/20/2020	1400	WG	4								X				4 x 2-L Bottles
~~MPE Well~~ (RJ)																

Preservative Key: 0. None; 1. HCL; 2. Other; 3. Other; 4. Other; 5. Other; 6. Other

Billing Information

P.O. #:

*Bill To:

Turnaround Time Requested

Normal ☐

Rush ☐

For Lab Use Only

Cooler Condition: Good

Cooler Temperature: 4°C

Custody Seals: Yes ☐ No ☒

For Lab Use Only

Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: Rich Murray	Printed Name: D. Vespoli	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: Geosyntec	Firm: SiREM	Firm:	Firm:	Firm:	Firm:
Date/Time: 2/20/2020 · 1700	Date/Time: Feb 24 '20 1:30pm	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - return to Originator; Yellow - Lab Copy; Pink - Retained by Client

* Mandatory Fields

SiREM

Chain-of-Custody Form

siremlab.com

130 Stone Road West
Guelph ON, Canada N1G 3Z2
(519) 822-2265

Lab # 5-6408

*Project Name: Brunswick	*Project #: GR6881C
*Project Manager: Adria Reimer	*Company: Geosyntec
*Email Address: areimer@geosyntec.com	
Address (Street): 1255 Roberts blvd NW ste 200	
City: Kennesaw	State/Province: Ga	Country: USA
*Phone #: 470-367-7557	
*Sampler's Signature: Ashley Ramsey	*Sampler's Printed Name: Ashley Ramsey

Analysis

Client Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac DHC	Gene-Trac VC	Gene-Trac DHB	Gene-Trac DHG	Treatability Study	Other Information
MW-21 treatability	10/9/20	1303	GW	1					X	

Preservative Key
0. None
1. HCL
2. Other
3. Other
4. Other
5. Other
6. Other

Billing Information
P.O. # GR6881C/100/1001
*Bill To:

Turnaround Time Requested
Normal ☒
Rush ☐

For Lab Use Only
Cooler Condition: Good
Cooler Temperature: 13°C
Custody Seals: Yes ☐ No ☑

For Lab Use Only
Proposal #:

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: Ashley Ramsey	Signature: Rachel Hallman	Signature:	Signature:	Signature:	Signature:
Printed Name: Ashley Ramsey	Printed Name: Rachel Hallman	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: Geosyntec	Firm: SiREM	Firm:	Firm:	Firm:	Firm:
Date/Time: 10/15/20	Date/Time: 19 Oct 20 4:15 pm	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - return to Originator; Yellow - Lab Copy; Pink - Retained by Client

APPENDIX B: Henry's Law Calculation

The following Henry's Law calculation was used to convert aqueous concentrations (Table 2) to total mmoles of each analyte per microcosm bottle (Figures 2 to 8):

$$Total\ mmoles = \frac{C_{liq} \cdot \left(V_{liq} + H \cdot V_{gas}\right)}{Molecular\ Weight\ (\frac{mg}{mmol})}$$

Where for the 250 mL microcosms:

C_{liq} = liquid concentration (mg/L)
V_{liq} = liquid volume (0.200 L) per bottle
V_{gas} = headspace volume (0.020 L) per bottle
H = Henry's Law constant (dimensionless)

Where for the 1 L microcosms:

C_{liq} = liquid concentration (mg/L)
V_{liq} = liquid volume (0.800 L) per bottle
V_{gas} = headspace volume (0.080 L) per bottle
H = Henry's Law constant (dimensionless)

The Henry's Law constants used are summarized in the table below.

Analyte	Henry's Law Constant [a] (dimensionless)
Benzene	0.222
Chlorobenzene	0.161
Methane	27.3
1,2-dichlorobenezen	0.064
1,3-diclorobenzene	0.117
1,4-dichlorobenzene	0.130

[a] Source: Montgomery, J.H. 2000. *Groundwater Chemicals Desk Reference, Third Edition.* CRC Press LLC, Boca Raton, FL.

APPENDIX C: Gene-Trac® Laboratory Reports

SiREM
Leading Science · Lasting Solutions

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Certificate of Analysis: Gene-Trac® ORM-2, Assay

Customer: Duane Graves, Geosyntec Consultants
Project: Brunswick Plant
Customer Reference: GR6881

SiREM Reference: S-5771
Report Date: 22-Apr-20
Data Files: iQ5C-ORM-2-QPCR-0134
iQ5C-DB-ORM-2-QPCR-0134

Table 1a: Test Results

Sample ID	Deltaproteobacterium ORM-2	
	Percent ORM-2[(1)]	ORM-2 16S rRNA Gene Copies/Liter
Si-4401-BULK	0.008 - 0.02 %	3×10^4

See final page for notes.

Analyst: Taylor Aris
Taylor Aris, B.Sc.
Laboratory Technician

Approved: Ximena Druar
Ximena Druar, B.Sc.
Genetic Testing Supervisor

SiREM
Leading Science · Lasting Solutions

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Certificate of Analysis: Gene-Trac® SRB, Sulfate Reducing Bacteria (*dsrA*) Assay

Customer: Duane Graves, Geosyntec Consultants

Project: Brunswick Plant

Customer Reference: GR6881

SiREM Reference: S-5771

Report Date: 22-Apr-20

Data Files: iQ5B-SRB-QPCR-0057
iQ5B-DB-SRB-QPCR-0057

Table 1b: Test Results

Sample ID	Sulfate Reducing Bacteria (*dsrA*)	
	Percent *dsrA* (1)	*dsrA* Gene Copies/Liter
Si-4401-BULK	0.003 - 0.01 %	1×10^4

See final page for notes.

Analyst: Taylor Aris
Taylor Aris, B.Sc.
Laboratory Technician

Approved: Ximena Druar
Ximena Druar, B.Sc.
Genetic Testing Supervisor

SiREM
Leading Science · Lasting Solutions

Certificate of Analysis: Gene-Trac® abcA Benzene Carboxylase Assay

Customer: Duane Graves, Geosyntec Consultants

Project: Brunswick Plant

Customer Reference: GR6881

SiREM Reference: S-5771

Report Date: 22-Apr-20

Data Files: iQ5A-abcA-QPCR-0113
iQ5A-DB-abcA-QPCR-0113

Table 1c: Test Results

Sample ID	Benzene Carboxylase (*abcA*)	
	Percent *abcA* (1)	*abcA* Gene Copies/Liter
Si-4401-BULK	NA	6×10^3 U

See final page for notes.

Analyst: Taylor Aris

Taylor Aris, B.Sc.
Laboratory Technician

Approved: Ximena Druar

Ximena Druar, B.Sc.
Genetic Testing Supervisor

SiREM
Leading Science · Lasting Solutions

Certificate of Analysis: Gene-Trac® Pepto-ben *Peptococcaceae* Assay

Customer: Duane Graves, Geosyntec Consultants
Project: Brunswick Plant
Customer Reference: GR6881

SiREM Reference: S-5771
Report Date: 22-Apr-20
Data Files: iQ5B-Pepto-QPCR-0112
iQ5B-DB-Pepto-QPCR-0112

Table 1d: Test Results

Sample ID	*Peptococcaceae*	
	Percent *Peptococcaceae* (1)	*Peptococcaceae* 16S rRNA Gene Copies/Liter
Si-4401-BULK	NA	6×10^3 U

See final page for notes.

Analyst: Taylor Aris
Taylor Aris, B.Sc.
Laboratory Technician

Approved: Ximena Druar
Ximena Druar, B.Sc.
Genetic Testing Coordinator

Table 2: Detailed Test Parameters, Test Reference S-5771

Customer Sample ID	Si-4401-BULK
SiREM ORM-2 Test ID	ORM-0187
SiREM SRB Test ID	SRB-0329
SiREM abcA Test ID	ABC-0155
SiREM Pepto Test ID	PEP-0138
Date Sampled [(2)]	26-Mar-20
Matrix	Groundwater
Date Received [(2)]	26-Mar-20
Sample Temperature	NA
Filtration Date [(2)]	27-Mar-20
Volume Used for DNA Extraction	200 mL
DNA Extraction Date	27-Mar-20
DNA Concentration in Sample (extractable)	686 ng/L (J)
PCR Amplifiable DNA	Detected
ORM-2 qPCR Date Analyzed	2-Apr-20
SRB qPCR Date Analyzed	2-Apr-20
abcA qPCR Date Analyzed	3-Apr-20
Pepto qPCR Date Analyzed	3-Apr-20
Laboratory Controls (see Tables 3 -6)	Passed
Comments	- -

See final page for notes.

Table 3: Control Results, Test Reference S-5771

Laboratory Control	Analysis Date	Control Description	ORM-2		Comments
			Spiked Gene Copies per Liter	Recovered Gene Copies per Liter	
Positive Control Low Concentration	2-Apr-20	Genomic DNA (CSLO-0134)	5.2×10^8	3.9×10^8	Passed
Positive Control High Concentration	2-Apr-20	Genomic DNA (CSHO-0134)	9.1×10^9	7.9×10^9	Passed
DNA Extraction Blank	2-Apr-20	Sterile Water (FB-3518)	0	2.6×10^3 U	Passed
Negative Control	2-Apr-20	Test Reagent Blank (TBO-0134)	0	2.6×10^3 U	Passed

See final page for notes.

Table 4: Control Results, Test Reference S-5771

Laboratory Control	Analysis Date	Control Description	*dsrA*		Comments
			Spiked Gene Copies per Liter	Recovered Gene Copies per Liter	
Positive Control Low Concentration	2-Apr-20	Genomic DNA (CSLSR-0057)	8.6×10^5	1.1×10^6	Passed
Positive Control High Concentration	2-Apr-20	Genomic DNA (CSHSR-0057)	4.8×10^7	4.2×10^7	Passed
DNA Extraction Blank	2-Apr-20	Sterile Water (FB-3518)	0	2.6×10^3 U	Passed
Negative Control	2-Apr-20	Test Reagent Blank (TBSR-0057)	0	2.6×10^3 U	Passed

See final page for notes.

Table 5: Gene-Trac abcA Control Results, Test Reference S-5771

Laboratory Control	Analysis Date	Control Description	*abcA*		Comments
			Spiked Gene Copies per Reaction	Recovered Gene Copies per Reaction	
Positive Control Low Concentration	3-Apr-20	Plasmid DNA (CSLAB-0113)	3.5×10^4	2.5×10^4	Passed
Positive Control High Concentration	3-Apr-20	PlasmidGenomic DNA (CSHAB-0113)	3.5×10^6	3.3×10^6	Passed
DNA Extraction Blank	3-Apr-20	Sterile Water (FB-3518)	0	2.6×10^3 U	Passed
Negative Control	3-Apr-20	Test Reagent Blank (TBAB-0113)	0	2.6×10^3 U	Passed

See final page for notes.

Table 6: Gene-Trac Pepto-ben Control Results, Test Reference S-5771

Laboratory Control	Analysis Date	Control Description	Pepto-ben		Comments
			Spiked Gene Copies per Reaction	Recovered Gene Copies per Reaction	
Positive Control Low Concentration	3-Apr-20	Genomic DNA (CSLPE-0112)	3.2×10^4	1.5×10^4 (3)	See note 3
Positive Control High Concentration	3-Apr-20	Genomic DNA (CSHPE-0112)	3.2×10^6	1.7×10^6	Passed
DNA Extraction Blank	3-Apr-20	Sterile Water (FB-3518)	0	2.0×10^1 U	Passed
Negative Control	3-Apr-20	Test Reagent Blank (TBPE-0112)	0	2.0×10^1 U	Passed

See final page for notes.

Notes:
ORM-2 = Deltaproteobacterium ORM-2
dsrA = *dissimilatory sulfate reductase A*
abcA = Benzene Carboxylase
Pepto = Peptococcaceae
J The associated value is an estimated quantity between the method detection limit and quantitation limit.
U Not detected, associated value is the quantitation limit.
B Analyte was detected in the method blank within an order of magnitude of the test sample.
E Extracted genomic DNA was not detected in the sample.
I Sample inhibited the test reaction based on inability to PCR amplify extracted DNA with universal primers.
ng/L = nanograms per liter
mL = milliliter
NA = not applicable
ND = not detected
DNA = deoxyribonucleic acid
16S rRNA = 16S ribosomal ribonucleic acid
PCR = polymerase chain reaction
qPCR = quantitative PCR
°C = degrees Celsius

[1]Percent ORM-2 *Deltaproteobacterium* (ORM-2), *Peptococcaceae, dsrA,* or *abcA* in microbial population. This value is calculated by dividing the number of specific gene copies by the total number of bacteria as estimated by the mass of DNA extracted from the sample. Range represents normal variation in enumeration.

[2]Samples are stabilized by freezing at -80 °C upon sample reception (field filters) or in-lab filtration (groundwater). Hold time not exceeded if sampling date is within 14 days of date received or filtration date.

[3]Control was outside recovery limit guidelines (+/- 50%), however, test results are deemed acceptable if one of two positive controls falls within the recovery limit.

SiREM

Chain-of-Custody Form

siremlab.com

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Lab # S-5771

* Sample part of Brunswick p-cymene treat. Study *

*Project Name: Brunswick shallow benzene (p-Cymene)	*Project #: Si-4401		
*Project Manager: Sandra Dworatzek	*Company: SiREM		
*Email Address: on behalf of Ali Ciblak and Duane Graves			
Address (Street)			
City	State/Province	Country	
*Phone #			
*Sampler's Signature	*Sampler's Printed Name		

Analysis

Client Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac DHC	Gene-Trac VC	Gene-Trac DHB	Gene-Trac DHG	Gene-Trac tceA	Volatile Fatty Acids	Dissolved hydrocarbon gases	~~Inventory Study~~ abcA	ORM2	SRB	~~Pedro-Ben~~	Other Information
Si-4401-BULK	Mar 26, 20		GW	1								X	X	X	X	
												X	X	X	X	

Preservative Key
0. None
1. HCL
2. Other _____
3. Other _____
4. Other _____
5. Other _____
6. Other _____

Billing Information
P.O. #
*Bill To:

Turnaround Time Requested
Normal ☐
Rush ☐

For Lab Use Only
Cooler Condition:
Cooler Temperature:
Custody Seals: Yes ☐ No ☐

For Lab Use Only
Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name: Steve Sarbe	Printed Name: Steve Sarbe	Printed Name	Printed Name	Printed Name	Printed Name
Firm: SiREM	Firm: SiREM	Firm	Firm	Firm	Firm
Date/Time: 26 Mar 20	Date/Time: 26 Mar 20	Date/Time	Date/Time	Date/Time	Date/Time

Distribution: White - return to Originator; Yellow - Lab Copy; Pink - Retained by Client

* Mandatory Fields

APPENDIX D: ALS Laboratory Reports

SIREM
ATTN: STEVE SANDE
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 19-MAR-20
Report Date: 24-MAR-20 14:03 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2429950
Project P.O. #: NOT SUBMITTED
Job Reference: SI-4401
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2429950-1 SI-4401-7A Sampled By: R. SCHOFIELD on 19-MAR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	3.18	RRR	0.10	mg/L		20-MAR-20	R5034079
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							
L2429950-2 SI-4401-10A Sampled By: R. SCHOFIELD on 19-MAR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	6.54	RRR	0.20	mg/L		20-MAR-20	R5034079
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RRR	Refer to Report Remarks for issues regarding this analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2429950 Report Date: 24-MAR-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: STEVE SANDE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-WT	Water							
Batch R5034079								
WG3295730-3 DUP		**L2429817-4**						
Ammonia, Total (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	20-MAR-20
WG3295730-2 LCS								
Ammonia, Total (as N)			110.1		%		85-115	20-MAR-20
WG3295730-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	20-MAR-20
WG3295730-4 MS		**L2429817-4**						
Ammonia, Total (as N)			111.7		%		75-125	20-MAR-20

Quality Control Report

Workorder: L2429950 Report Date: 24-MAR-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: STEVE SANDE

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

L2429950-COFC

MMM

Chain of Custody (COC) / Analyt Request Form

COC Number: 17 -

Page 1 of 1

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To	Steve Sande	**Report Format / Distribution**	**Select Service Level Below** (Rush Turnaround Time (TAT) is not available for all tests)
Company:	SiREM	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Steve Sande	Quality Control (QC) Report with Report ☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	130 Stone Road West Guelph, ON N1G 3Z2	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	(519) 822-2265	Email 1 or Fax SSande@Siremlab.com	Specify Date Required for E2,E or P:
		Email 2 mhealey@Siremlab.com	
Invoice To	Same as Report To ☐ Yes ☑ No	**Invoice Distribution**	**Analysis Request**
	Copy of Invoice with Report ☑ Yes ☐ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	SiREM - A Division of Geosyntec Consultants International	Email 1 or Fax AccountsPayableCan@Siremlab.com	
Contact:	Accounts Payable Canada	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID: / Cost Center:	
Job #:	Si-4401	GL Account: / Routing Code:	
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2429950 MAR 20	**ALS Contact:** Gayle Braun	**Sampler:** Rita Schofield

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Ammonia	Number of Containers
	Si-4401-7A	18-Mar-20		Water	R	1
	Si-4401-10A	18-Mar-20		Water	R	1

Drinking Water (DW) Samples[1] (client use)	**Special Instructions / Specify Criteria to add on report (client Use)**	**SAMPLE CONDITION AS RECEIVED (lab use only)**
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	To ALS Waterloo	Frozen ☐ SIF Observations Yes ☐ No ☐ Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☐
Are samples for human drinking water use? ☐ Yes ☑ No		INITIAL COOLER TEMPERATURES °C / FINAL COOLER TEMPERATURES °C: 8.6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Steve Sande	3/18/2020	0:00	Received by:	Date:	Time:	Received by:	Date: 3-19-20	Time: 10:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0328e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SIREM
ATTN: STEVE SANDE
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 14-APR-20
Report Date: 17-APR-20 13:42 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2436571
Project P.O. #: NOT SUBMITTED
Job Reference: SI-4401
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2436571-1 SI-4401-7B Sampled By: RS on 13-APR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	3.29	RRR	0.50	mg/L		16-APR-20	R5057374
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							
L2436571-2 SI-4401-8B Sampled By: RS on 13-APR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	3.38	RRR	0.50	mg/L		16-APR-20	R5057374
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							
L2436571-3 SI-4401-9B Sampled By: RS on 13-APR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	3.13	RRR	0.50	mg/L		16-APR-20	R5057374
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							
L2436571-4 SI-4401-10B Sampled By: RS on 13-APR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	6.38	RRR	0.50	mg/L		16-APR-20	R5057374
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							
L2436571-5 SI-4401-11B Sampled By: RS on 13-APR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	6.36	RRR	0.50	mg/L		16-APR-20	R5057374
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							
L2436571-6 SI-4401-12B Sampled By: RS on 13-APR-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	6.38	RRR	0.50	mg/L		16-APR-20	R5057374
Report Remarks : DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s). USC Unknown Sample Container. Sample received in container not provided by ALS. Container type appears to be appropriate, but ALS cannot verify its cleanliness or overall suitability for this test.							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Ammonia, Total (as N)	MS-B	L2436571-1, -2, -3, -4, -5, -6

Sample Parameter Qualifier key listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRR	Refer to Report Remarks for issues regarding this analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2436571 Report Date: 17-APR-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: STEVE SANDE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-WT	Water							
Batch R5057374								
WG3308534-3 DUP		**WG3308534-5**						
Ammonia, Total (as N)		3.29	3.34		mg/L	1.6	20	16-APR-20
WG3308534-2 LCS								
Ammonia, Total (as N)			93.9		%		85-115	16-APR-20
WG3308534-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	16-APR-20
WG3308534-4 MS		**WG3308534-5**						
Ammonia, Total (as N)			N/A	MS-B	%		-	16-APR-20

Quality Control Report

Workorder: L2436571 Report Date: 17-APR-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: STEVE SANDE

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

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www.alsglobal.com

Chain of Custody (COC) / Analy Request Form

Canada Toll Free: 1 800 668 9878

L2436571-COFC

OC Number: 17 -

Page 1 of 1

Report To	Steve Sande	**Report Format / Distribution**	Turnaround Time (TAT) is not available for all tests
Company:	SiREM	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Steve Sande	Quality Control (QC) Report with Report ☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	130 Stone Road West Guelph, ON N1G 3Z2	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	(519) 822-2265	Email 1 or Fax SSande@Siremlab.com	Specify Date Required for E2,E or P:
		Email 2 mhealey@Siremlab.com	
Invoice To	Same as Report To ☐ Yes ☑ No	**Invoice Distribution**	**Analysis Request**
	Copy of Invoice with Report ☑ Yes ☐ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	SiREM - A Division of Geosyntec Consultants International	Email 1 or Fax AccountsPayableCan@Siremlab.com	
Contact:	Accounts Payable Canada	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID: / Cost Center:	
Job #:	Si-4401	GL Account: / Routing Code:	
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2436571	**ALS Contact:** Gayle Braun	**Sampler:** Rita Schofield

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Ammonia	Number of Containers
	Si-4401-7B	13-Apr-20		Water	R	1
	Si-4401-8B	13-Apr-20		Water	R	1
	Si-4401-9B	13-Apr-20		Water	R	1
	Si-4401-10B	13-Apr-20		Water	R	1
	Si-4401-11B	13-Apr-20		Water	R	1
	Si-4401-12B	13-Apr-20		Water	R	1

Drinking Water (DW) Samples[1] (client use)	**Special Instructions / Specify Criteria to add on report (client Use)**	**SAMPLE CONDITION AS RECEIVED (lab use only)**
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	To ALS Waterloo	Frozen ☐ SIF Observations Yes ☐ No ☐ Ice packs Yes ☑ No ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☐
Are samples for human drinking water use? ☐ Yes ☑ No		INITIAL COOLER TEMPERATURES °C: / FINAL COOLER TEMPERATURES °C: 6.3

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Steve Sande	4/13/2020	0:00	Received by:	Date:	Time:	Received by:	Date: 4-14-2020	Time: 1415

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0328s v08 Front04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SIREM
ATTN: Steve Sande
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 28-OCT-20
Report Date: 04-NOV-20 13:47 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2522624
Project P.O. #: NOT SUBMITTED
Job Reference: SI-4401
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2522624-1 SI-4401-1C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	4.7	DLHC	1.0	mg/L		30-OCT-20	R5270967
L2522624-2 SI-4401-2C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	4.6	DLHC	1.0	mg/L		02-NOV-20	R5270967
L2522624-3 SI-4401-3C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	4.59	DLHC	0.50	mg/L		02-NOV-20	R5270967
L2522624-4 SI-4401-4C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	3.64	DLHC	0.50	mg/L		02-NOV-20	R5270967
L2522624-5 SI-4401-5C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	52	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-6 SI-4401-6C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	14	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-7 SI-4401-7C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	15	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-8 SI-4401-8C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	11	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-9 SI-4401-9C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							
Ammonia, Total (as N)	12	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-10 SI-4401-10C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER **Anions and Nutrients**							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2522624-10 SI-4401-10C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	15	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-11 SI-4401-11C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	13	DLHC	10	mg/L		29-OCT-20	R5270967
L2522624-12 SI-4401-12C Sampled By: S.SANDE on 27-OCT-20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<10	DLHC	10	mg/L		29-OCT-20	R5270967

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Ammonia, Total (as N)	MS-B	L2522624-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2522624 Report Date: 04-NOV-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Steve Sande

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-WT	Water							
Batch R5270967								
WG3434251-3 DUP		**L2522502-1**						
Ammonia, Total (as N)		4.08	3.77		mg/L	7.8	20	02-NOV-20
WG3434251-2 LCS								
Ammonia, Total (as N)			110.8		%		85-115	29-OCT-20
WG3434251-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	29-OCT-20
WG3434251-4 MS		**L2522502-1**						
Ammonia, Total (as N)			N/A	MS-B	%		-	02-NOV-20

Quality Control Report

Workorder: L2522624 Report Date: 04-NOV-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Steve Sande

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

SN

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

L2522624-COFC

Number: 17 -

Page 1 of 1

Canada Toll Free: 1 800 668 9878

Report To	Steve Sande	**Report Format / Distribution**	**Select Service Level Below** (Rush Turnaround Time (TAT) is not available for all tests)
Company:	SiREM	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Steve Sande	Quality Control (QC) Report with Report ☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	130 Stone Road West Guelph, ON N1G 3Z2	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone:	(519) 822-2265	Email 1 or Fax SSande@Siremlab.com	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
		Email 2 mhealey@Siremlab.com	Specify Date Required for E2,E or P:

Invoice To	Same as Report To ☐ Yes ☑ No	**Invoice Distribution**	**Analysis Request**
	Copy of Invoice with Report ☑ Yes ☐ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	SiREM - A Division of Geosyntec Consultants International	Email 1 or Fax AccountsPayableCan@Siremlab.com	
Contact:	Accounts Payable Canada	Email 2	

Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	Si-4401	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	SN L2522624	**ALS Contact:** Gayle Braun	**Sampler:** Steve Sande

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Ammonia	Number of Containers
	Si-4401-1C	27-Oct-20		Water	R	1
	Si-4401-2C	27-Oct-20		Water	R	1
	Si-4401-3C	27-Oct-20		Water	R	1
	Si-4401-4C	27-Oct-20		Water	R	1
	Si-4401-5C	27-Oct-20		Water	R	1
	Si-4401-6C	27-Oct-20		Water	R	1
	Si-4401-7C	27-Oct-20		Water	R	1
	Si-4401-8C	27-Oct-20		Water	R	1
	Si-4401-9C	27-Oct-20		Water	R	1
	Si-4401-10C	27-Oct-20		Water	R	1
	Si-4401-11C	27-Oct-20		Water	R	1
	Si-4401-12C	27-Oct-20		Water	R	1

Drinking Water (DW) Samples[1] (client use)	**Special Instructions / Specify Criteria to add on report (client Use)**	**SAMPLE CONDITION AS RECEIVED (lab use only)**
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	To ALS Waterloo	Frozen ☐ SIF Observations Yes ☐ No ☐ Ice packs Yes ☑ No ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☐
Are samples for human drinking water use? ☐ Yes ☑ No		INITIAL COOLER TEMPERATURES °C / FINAL COOLER TEMPERATURES °C: 5.8

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Steve Sande	10/27/2020	Received by:	Date:	Time:	Received by: SN	Date: 10/28/20	Time: 1406

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA FM-0326e V09 Front04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX E: Pace Laboratory Reports

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

March 06, 2020

Steve Sande
SiREM Lab
130 Stone Road W
Ontario, Canada,

RE: Project: Si-4401
Pace Project No.: 50250884

Dear Steve Sande:
Enclosed are the analytical results for sample(s) received by the laboratory on March 03, 2020. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kelly Jones
kelly.jones@pacelabs.com
(317)228-3100
Project Manager

Enclosures

cc: Michael Healey, SiREM Lab

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Si-4401
Pace Project No.: 50250884

Pace Analytical Services Indianapolis
7726 Moller Road, Indianapolis, IN 46268
Illinois Certification #: 200074
Indiana Certification #: C-49-06
Kansas/NELAP Certification #: E-10177
Kentucky UST Certification #: 80226
Kentucky WW Certification #: 98019
Michigan Department of Environmental Quality, Laboratory #9050
Ohio VAP Certification #: CL0065
Oklahoma Certification #: 9204
Texas Certification #: T104704355
West Virginia Certification #: 330
Wisconsin Certification #: 999788130
USDA Soil Permit #: P330-19-00257

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Si-4401
Pace Project No.: 50250884

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50250884001	**Si-4401-BASE-1**	Water	03/02/20 13:30	03/03/20 09:00
50250884002	**Si-4401-BASE-2**	Water	03/02/20 13:30	03/03/20 09:00

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE ANALYTE COUNT

Project: Si-4401
Pace Project No.: 50250884

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50250884001	**Si-4401-BASE-1**	EPA 8260	ZAH	5	PASI-I
50250884002	**Si-4401-BASE-2**	EPA 8260	ZAH	5	PASI-I

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Si-4401
Pace Project No.: 50250884

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50250884001	**Si-4401-BASE-1**					
EPA 8260	Benzene	4790	ug/L	500	03/04/20 23:08	
EPA 8260	p-Isopropyltoluene	4490	ug/L	500	03/04/20 23:08	
50250884002	**Si-4401-BASE-2**					
EPA 8260	Benzene	5590	ug/L	500	03/04/20 22:52	
EPA 8260	p-Isopropyltoluene	5170	ug/L	500	03/04/20 22:52	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50250884

Sample: Si-4401-BASE-1 **Lab ID: 50250884001** Collected: 03/02/20 13:30 Received: 03/03/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260							
Benzene	**4790**	ug/L	500	100		03/04/20 23:08	71-43-2	
p-Isopropyltoluene	**4490**	ug/L	500	100		03/04/20 23:08	99-87-6	
Surrogates								
Dibromofluoromethane (S)	98	%.	75-120	100		03/04/20 23:08	1868-53-7	HS
4-Bromofluorobenzene (S)	93	%.	85-116	100		03/04/20 23:08	460-00-4	
Toluene-d8 (S)	99	%.	83-111	100		03/04/20 23:08	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50250884

Sample: Si-4401-BASE-2 **Lab ID: 50250884002** Collected: 03/02/20 13:30 Received: 03/03/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260							
Benzene	**5590**	ug/L	500	100		03/04/20 22:52	71-43-2	
p-Isopropyltoluene	**5170**	ug/L	500	100		03/04/20 22:52	99-87-6	
Surrogates								
Dibromofluoromethane (S)	101	%.	75-120	100		03/04/20 22:52	1868-53-7	D4,HS
4-Bromofluorobenzene (S)	96	%.	85-116	100		03/04/20 22:52	460-00-4	
Toluene-d8 (S)	98	%.	83-111	100		03/04/20 22:52	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50250884

QC Batch: 550293 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV
Associated Lab Samples: 50250884002

METHOD BLANK: 2537337 Matrix: Water
Associated Lab Samples: 50250884002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	03/04/20 13:18	
p-Isopropyltoluene	ug/L	ND	5.0	03/04/20 13:18	
4-Bromofluorobenzene (S)	%.	94	85-116	03/04/20 13:18	
Dibromofluoromethane (S)	%.	101	75-120	03/04/20 13:18	
Toluene-d8 (S)	%.	99	83-111	03/04/20 13:18	

LABORATORY CONTROL SAMPLE: 2537338

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	42.4	85	75-118	
p-Isopropyltoluene	ug/L	50	43.7	87	82-119	
4-Bromofluorobenzene (S)	%.			94	85-116	
Dibromofluoromethane (S)	%.			96	75-120	
Toluene-d8 (S)	%.			101	83-111	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2537339 2537340

Parameter	Units	50250794002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	ND	50	50	44.5	44.1	88	87	49-135	1	20	
p-Isopropyltoluene	ug/L	ND	50	50	40.8	41.1	81	82	15-155	1	20	
4-Bromofluorobenzene (S)	%.						94	95	85-116			
Dibromofluoromethane (S)	%.						96	98	75-120			
Toluene-d8 (S)	%.						100	100	83-111			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50250884

QC Batch: 550294
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Associated Lab Samples: 50250884001

METHOD BLANK: 2537343 Matrix: Water
Associated Lab Samples: 50250884001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	03/04/20 13:34	
p-Isopropyltoluene	ug/L	ND	5.0	03/04/20 13:34	
4-Bromofluorobenzene (S)	%.	95	85-116	03/04/20 13:34	
Dibromofluoromethane (S)	%.	102	75-120	03/04/20 13:34	
Toluene-d8 (S)	%.	99	83-111	03/04/20 13:34	

LABORATORY CONTROL SAMPLE: 2537344

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	44.8	90	75-118	
p-Isopropyltoluene	ug/L	50	47.5	95	82-119	
4-Bromofluorobenzene (S)	%.			94	85-116	
Dibromofluoromethane (S)	%.			97	75-120	
Toluene-d8 (S)	%.			103	83-111	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2537345 2537346

Parameter	Units	50250774001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	ND	50	50	45.7	44.5	91	89	49-135	2	20	
p-Isopropyltoluene	ug/L	ND	50	50	46.5	47.0	93	94	15-155	1	20	
4-Bromofluorobenzene (S)	%.						96	95	85-116			
Dibromofluoromethane (S)	%.						99	102	75-120			
Toluene-d8 (S)	%.						102	102	83-111			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALIFIERS

Project: Si-4401
Pace Project No.: 50250884

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-I	Pace Analytical Services - Indianapolis

ANALYTE QUALIFIERS

D4	Sample was diluted due to the presence of high levels of target analytes.
HS	Results are from sample aliquot taken from VOA vial with headspace (air bubble greater than 6 mm diameter).

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Si-4401
Pace Project No.: 50250884

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50250884001	**Si-4401-BASE-1**	EPA 8260	550294		
50250884002	**Si-4401-BASE-2**	EPA 8260	550293		

Pace Analytical®

CHAIN-OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

MTJL Log-in Number Here

ALL SHADED AREAS are for LAB USE ONLY

pany: SiREM	Billing Information: accountspayablecan@siremlab.com
ress: 130 Stone Rd W	
ort To: Steve Sande	Email To: ssande@siremlab.com
y To: mhealey@siremlab.com	Site Collection Info/Address:
tomer Project Name/Number: -4401	State: County/City: Time Zone Collected: ON /Canada/Guelph [ ] PT [ ] MT [ ] CT [✓] ET
ne:	Site/Facility ID #:
il:	Compliance Monitoring? [ ] Yes [✓] No
ected By (print): eve Sande	Purchase Order #: Quote #:
ected By (signature):	DW PWS ID #: DW Location Code:
	Turnaround Date Required:
	Immediately Packed on Ice: [✓] Yes [ ] No
mple Disposal: Dispose as appropriate [ ] Return Archive: ____ Hold: ____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply)
	Field Filtered (if applicable): [ ] Yes [✓] No Analysis: ____

Container Preservative Type **: 3

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

Lab Project Manager:

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	Analyses: P-Cymene (8260)	Lab Profile/Line:
-4401-BASE-1	GW	Grab	Mar 2	3:30				3	X	001
-4401-BASE-2	GW	Grab	Mar 2	3:30				3	X	002

Lab Profile/Line:

Lab Sample Receipt Checklist: SCE SCL

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: ____	
Sample pH Acceptable	Y N NA
pH Strips: ____	
Sulfide Present	Y N NA
Lead Acetate Strips: ____	

LAB USE ONLY:
Lab Sample # / Comments:
50250884

Customer Remarks / Special Conditions / Possible Hazards:
Up to 9 mg/L
P-Cymene

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y (N) NA
Therm ID#: 2
Cooler 1 Temp Upon Receipt: 5.9 oC
Cooler 1 Therm Corr. Factor: -0.3 oC
Cooler 1 Corrected Temp: 5.6 oC
Comments:

Relinquished by/Company: (Signature)	Date/Time: 2 Mar 20	Received by/Company: (Signature) FEDEX	Date/Time:
Relinquished by/Company: (Signature) FEDEX	Date/Time:	Received by/Company: (Signature)	Date/Time: 3/3/20 9:00
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): Page: ____

Toxic Substance Control Act (TSCA) Certification

Date: March 02 2020

Waybill or reference number: 7779 0500 4620

Check only one

Positive Certification

☐ I certify that all chemical substances in this shipment comply with all applicable rules or orders under TSCA and that I am not offering a chemical substance for entry in violation of TSCA or any applicable rule or order thereunder.

or

Negative Certification

☑ I certify that all chemicals in this shipment are not subject to TSCA.

Company name: Geosyntec Consultants DBA SiREM

Company address: 130 Stone Rd W

Certifier name: Samantha Gallant

Certifier title: Administrative Secretary

Certifier phone number: 519-822-2230

Certifier email address: sgallant@geosyntec.com

Certifier signature:

Product description

1.	N/A
2.	N/A
3.	Ground Water Samples For Destructive Analysis
4.	
5.	
6.	
7.	
8.	
9.	
10.	

If the certifier is unsure if their chemical substance is subject to TSCA compliance, contact the Environmental Protection Agency, TSCA Assistance Office at 1.202.554.1404 between 8:30 a.m. and 5:00 p.m.

This invoice must be completed in English

COMMERCIAL INVOICE

EXPORTER
Tax ID# :
Contact Name : Sammie Gallant
Telephone No. : 5198222230
E-Mail : JSchimmel@siremlab.com
Company Name/Address :
SIREM
130 Stone Rd W

GUELPH ON N1G3Z2
Country/Territory : Canada
Parties to Transaction:
☐ Related ☐ Non-Related

Payment Terms :

Purpose of Shipment : Commercial

Ship Date : 02 Mar, 2020

Air Waybill No. / Tracking No. / Bill of Lading : 777905004620

Invoice No. : 01 Purchase Order No. : 02

CONSIGNEE
Tax ID# :
Contact Name : Joshua Richards
Telephone No. : 317-502-9594
E-Mail :
Company Name/Address :
Pace Analytical Services
7726 Moller Road

INDIANAPOLIS IN 46268
Country/Territory : United States

SOLD TO (if different from Consignee)
☑ Same as CONSIGNEE :

Tax ID# :
Company Name/Address :

Country/Territory :

If there is a designated broker for this shipment, please provide contact information
Name of Broker Tel No. Contact Name

Duties and Taxes Payable by ☑ Exporter ☐ Consignee ☐ Other If Other, please specify

No. of Packages	No. of Units	Unit of Measure	Description of Goods	Harmonized Tariff Number	Country/Territory of Origin	Unit Value	Total Value
	1.00	LBS	Commercial - groundwater samples for destructive analyses		CA	10.000000	10.00

Total No. of Packages : 1 | Total Weight (Indicate LBS or KGS) : 3.00 kg

Special Instructions :

Declaration Statement(s) :

I declare that all the information contained in this invoice to be true and correct

Originator or Name of Company Representative if the invoice is being completed on behalf of a company or individual :

Signature / Title / Date

Terms of Sale :	
Subtotal :	10.00
Insurance :	0.00
Freight :	0.00
Packing :	0.00
Handling :	0.00
Other :	0.00
Invoice Total :	10.00
Currency Code :	CAD

02 Mar, 2020

Pace Analytical

SAMPLE CONDITION UPON RECEIPT FORM

Project #: 50250884

Date/Time and Initials of person examining contents: MRW 3/3/20 1115

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other _____

Tracking #: 7779 0500

Custody Seal on Cooler/Box Present: ☑ Yes ☐ No **Seals Intact:** ☑ Yes ☐ No

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other _____

Thermometer: 1 2 3 4 5 6 A B C D E F Ice Type: ☐ Wet ☑ Blue ☐ None | Samples collected today and on ice: ☐ Yes ☐ No ☑ N/A

MRW 3/3/20

Cooler Temperature: 5.9/5.6 Ice Visible in Sample Containers?: ☐ Yes ☑ No ☐ N/A

(Initial/Corrected) Temp should be above freezing to 6°C If temp. is Over 6°C or under 0°C, was the PM Notified?: ☐ Yes ☐ No ☑ N/A

All discrepancies will be written out in the comments section below.

	Yes	No
Were samples from West Virginia? Document any containers out of temp.		✓
USDA Regulated Soils? (ID, NY, WA, OR, CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		✓
Chain of Custody Present:	✓	
Chain of Custody Filled Out:	✓	
Short Hold Time Analysis (<72hr)?: Analysis:		✓
Time 5035A TC placed in Freezer or Short Holds To Lab:		
Rush TAT Requested: 5 Day		✗
Containers Intact?:	✓	
Sample Labels (IDs/Dates/Times) Match COC? Except TCs, which only require sample ID	✓	
Extra labels on Terracore Vials (soils only)?		✓

	Yes	No	N/A
All containers needing acid/base pres. Have been checked?: **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl.** All containers needing preservation are found to be in compliance with EPA recommendation (<2, >9, >12) unless otherwise noted. Circle: HNO3 H2SO4 NaOH NaOH/ZnAc			✓
Dissolved Metals field filtered?:			✓
Headspace Wisconsin Sulfide			✓
	Present	Absent	N/A
Residual Chlorine Check (SVOC 625 Pest/PCB 608)			✓
Residual Chlorine Check (Total/Amenable/Free Cyanide)			✓
Headspace in VOA Vials (>6mm):		✓	
Trip Blank Present?:		✓	
Trip Blank Custody Seals?:		✓	

Comments:

COC PAGE 1 of 1

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H	VG9H	VOA VIALS (>6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H					Matrix	pH <2	pH >9	pH>12
1			3		3/3																						S			
2			3		3/3																						S			
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
11																														
12																														

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	BG1H	1L HCl clear glass
VSG	Headspace septa vial & HCl	BG1S	1L H2SO4 clear glass
WGKU	8oz unpreserved clear jar	BG1T	1L Na Thiosulfate clear glass
WGFU	4oz clear soil jar	BG1U	1L unpreserved glass
JGFU	4oz unpreserved amber wide	BG3H	250mL HCl Clear Glass
CG3H	250mL clear glass HCl	BG3U	250mL Unpres Clear Glass

Plastic / Misc.

BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

May 04, 2020

Steve Sande
SiREM Lab
130 Stone Road W
Ontario, Canada,

RE: Project: Si-4401
Pace Project No.: 50252145

Dear Steve Sande:

Enclosed are the analytical results for sample(s) received by the laboratory on March 17, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - Indianapolis

Revised Report - This revision replaces the original dated, 032320. Revised to include re-analysis of all samples, reported as samples 004/005/006. / 050120kj

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kelly M Jones

Kelly Jones
kelly.jones@pacelabs.com
(317)228-3100
Project Manager

Enclosures

cc: Michael Healey, SiREM Lab

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Si-4401
Pace Project No.: 50252145

Pace Analytical Services Indianapolis
7726 Moller Road, Indianapolis, IN 46268
Illinois Accreditation #: 200074
Indiana Drinking Water Laboratory #: C-49-06
Kansas/TNI Certification #: E-10177
Kentucky UST Agency Interest #: 80226
Kentucky WW Laboratory ID #: 98019
Michigan Drinking Water Laboratory #9050
Ohio VAP Certified Laboratory #: CL0065
Oklahoma Laboratory #: 9204
Texas Certification #: T104704355
West Virginia Certification #: 330
Wisconsin Laboratory #: 999788130
USDA Soil Permit #: P330-19-00257

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Si-4401
Pace Project No.: 50252145

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50252145001	**Si-4401-4A**	Water	03/16/20 08:00	03/17/20 09:30
50252145002	**Si-4401-5A**	Water	03/16/20 08:00	03/17/20 09:30
50252145003	**Si-4401-6A**	Water	03/16/20 08:00	03/17/20 09:30
50252145004	**Si-4401-4A re-analysis**	Water	03/16/20 08:00	03/17/20 09:30
50252145005	**Si-4401-5A re-analysis**	Water	03/16/20 08:00	03/17/20 09:30
50252145006	**Si-4401-6A re-analysis**	Water	03/16/20 08:00	03/17/20 09:30

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Indianapolis, IN 46268
(317)228-3100

SAMPLE ANALYTE COUNT

Project: Si-4401
Pace Project No.: 50252145

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50252145001	**Si-4401-4A**	EPA 8260	TMW	5	PASI-I
50252145002	**Si-4401-5A**	EPA 8260	TMW	5	PASI-I
50252145003	**Si-4401-6A**	EPA 8260	TMW	5	PASI-I
50252145004	**Si-4401-4A re-analysis**	EPA 8260	TMW	5	PASI-I
50252145005	**Si-4401-5A re-analysis**	EPA 8260	TMW	5	PASI-I
50252145006	**Si-4401-6A re-analysis**	EPA 8260	TMW	5	PASI-I

PASI-I = Pace Analytical Services - Indianapolis

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Si-4401
Pace Project No.: 50252145

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50252145001	**Si-4401-4A**					
EPA 8260	Benzene	3050	ug/L	250	03/18/20 14:42	
EPA 8260	p-Isopropyltoluene	2130	ug/L	250	03/18/20 14:42	
50252145002	**Si-4401-5A**					
EPA 8260	Benzene	3730	ug/L	250	03/18/20 16:26	
EPA 8260	p-Isopropyltoluene	2800	ug/L	250	03/18/20 16:26	
50252145003	**Si-4401-6A**					
EPA 8260	Benzene	4570	ug/L	250	03/18/20 17:00	
EPA 8260	p-Isopropyltoluene	4120	ug/L	250	03/18/20 17:00	
50252145004	**Si-4401-4A re-analysis**					
EPA 8260	Benzene	5900	ug/L	250	04/21/20 19:26	H1
EPA 8260	p-Isopropyltoluene	4970	ug/L	250	04/21/20 19:26	H1
50252145005	**Si-4401-5A re-analysis**					
EPA 8260	Benzene	5230	ug/L	250	04/21/20 20:00	H1
EPA 8260	p-Isopropyltoluene	3770	ug/L	250	04/21/20 20:00	H1
50252145006	**Si-4401-6A re-analysis**					
EPA 8260	Benzene	4650	ug/L	250	04/21/20 20:35	H1
EPA 8260	p-Isopropyltoluene	4300	ug/L	250	04/21/20 20:35	H1

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50252145

Sample: Si-4401-4A **Lab ID: 50252145001** Collected: 03/16/20 08:00 Received: 03/17/20 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3050**	ug/L	250	50		03/18/20 14:42	71-43-2	
p-Isopropyltoluene	**2130**	ug/L	250	50		03/18/20 14:42	99-87-6	
Surrogates								
Dibromofluoromethane (S)	105	%.	75-120	50		03/18/20 14:42	1868-53-7	
4-Bromofluorobenzene (S)	98	%.	85-116	50		03/18/20 14:42	460-00-4	
Toluene-d8 (S)	95	%.	83-111	50		03/18/20 14:42	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50252145

Sample: Si-4401-5A **Lab ID: 50252145002** Collected: 03/16/20 08:00 Received: 03/17/20 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3730**	ug/L	250	50		03/18/20 16:26	71-43-2	
p-Isopropyltoluene	**2800**	ug/L	250	50		03/18/20 16:26	99-87-6	
Surrogates								
Dibromofluoromethane (S)	103	%.	75-120	50		03/18/20 16:26	1868-53-7	
4-Bromofluorobenzene (S)	98	%.	85-116	50		03/18/20 16:26	460-00-4	
Toluene-d8 (S)	95	%.	83-111	50		03/18/20 16:26	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50252145

Sample: Si-4401-6A **Lab ID: 50252145003** Collected: 03/16/20 08:00 Received: 03/17/20 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4570**	ug/L	250	50		03/18/20 17:00	71-43-2	
p-Isopropyltoluene	**4120**	ug/L	250	50		03/18/20 17:00	99-87-6	
Surrogates								
Dibromofluoromethane (S)	102	%.	75-120	50		03/18/20 17:00	1868-53-7	
4-Bromofluorobenzene (S)	97	%.	85-116	50		03/18/20 17:00	460-00-4	
Toluene-d8 (S)	95	%.	83-111	50		03/18/20 17:00	2037-26-5	

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50252145

Sample: Si-4401-4A re-analysis **Lab ID: 50252145004** Collected: 03/16/20 08:00 Received: 03/17/20 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**5900**	ug/L	250	50		04/21/20 19:26	71-43-2	H1
p-Isopropyltoluene	**4970**	ug/L	250	50		04/21/20 19:26	99-87-6	H1
Surrogates								
Dibromofluoromethane (S)	89	%.	75-120	50		04/21/20 19:26	1868-53-7	
4-Bromofluorobenzene (S)	93	%.	85-116	50		04/21/20 19:26	460-00-4	
Toluene-d8 (S)	100	%.	83-111	50		04/21/20 19:26	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50252145

Sample: Si-4401-5A re-analysis **Lab ID: 50252145005** Collected: 03/16/20 08:00 Received: 03/17/20 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**5230**	ug/L	250	50		04/21/20 20:00	71-43-2	H1
p-Isopropyltoluene	**3770**	ug/L	250	50		04/21/20 20:00	99-87-6	H1
Surrogates								
Dibromofluoromethane (S)	111	%.	75-120	50		04/21/20 20:00	1868-53-7	
4-Bromofluorobenzene (S)	98	%.	85-116	50		04/21/20 20:00	460-00-4	
Toluene-d8 (S)	96	%.	83-111	50		04/21/20 20:00	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50252145

Sample: Si-4401-6A re-analysis **Lab ID: 50252145006** Collected: 03/16/20 08:00 Received: 03/17/20 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4650**	ug/L	250	50		04/21/20 20:35	71-43-2	H1
p-Isopropyltoluene	**4300**	ug/L	250	50		04/21/20 20:35	99-87-6	H1
Surrogates								
Dibromofluoromethane (S)	111	%.	75-120	50		04/21/20 20:35	1868-53-7	
4-Bromofluorobenzene (S)	96	%.	85-116	50		04/21/20 20:35	460-00-4	
Toluene-d8 (S)	94	%.	83-111	50		04/21/20 20:35	2037-26-5	

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50252145

QC Batch: 552633
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50252145001, 50252145002, 50252145003

METHOD BLANK: 2548499 Matrix: Water
Associated Lab Samples: 50252145001, 50252145002, 50252145003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	03/18/20 12:22	
p-Isopropyltoluene	ug/L	ND	5.0	03/18/20 12:22	
4-Bromofluorobenzene (S)	%.	99	85-116	03/18/20 12:22	
Dibromofluoromethane (S)	%.	105	75-120	03/18/20 12:22	
Toluene-d8 (S)	%.	96	83-111	03/18/20 12:22	

LABORATORY CONTROL SAMPLE: 2548500

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	43.9	88	75-118	
p-Isopropyltoluene	ug/L	50	45.4	91	82-119	
4-Bromofluorobenzene (S)	%.			98	85-116	
Dibromofluoromethane (S)	%.			96	75-120	
Toluene-d8 (S)	%.			96	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50252145

QC Batch: 560071
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50252145004, 50252145005, 50252145006

METHOD BLANK: 2582641 Matrix: Water
Associated Lab Samples: 50252145004, 50252145005, 50252145006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	04/21/20 12:32	
p-Isopropyltoluene	ug/L	ND	5.0	04/21/20 12:32	
4-Bromofluorobenzene (S)	%.	101	85-116	04/21/20 12:32	
Dibromofluoromethane (S)	%.	111	75-120	04/21/20 12:32	
Toluene-d8 (S)	%.	97	83-111	04/21/20 12:32	

LABORATORY CONTROL SAMPLE: 2582642

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	51.1	102	75-118	
p-Isopropyltoluene	ug/L	50	49.9	100	82-119	
4-Bromofluorobenzene (S)	%.			98	85-116	
Dibromofluoromethane (S)	%.			101	75-120	
Toluene-d8 (S)	%.			99	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALIFIERS

Project: Si-4401
Pace Project No.: 50252145

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

H1 Analysis conducted outside the recognized method holding time.

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Si-4401
Pace Project No.: 50252145

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50252145001	**Si-4401-4A**	EPA 8260	552633		
50252145002	**Si-4401-5A**	EPA 8260	552633		
50252145003	**Si-4401-6A**	EPA 8260	552633		
50252145004	**Si-4401-4A re-analysis**	EPA 8260	560071		
50252145005	**Si-4401-5A re-analysis**	EPA 8260	560071		
50252145006	**Si-4401-6A re-analysis**	EPA 8260	560071		

Pace Analytical®

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

MTJL Log-in

WO# : 50252145

50252145

ALL SHADED AREAS

Company: SiREM	Billing Information: accountspayablecan@siremlab.com
Address: 130 Stone Rd W	
Report To: Steve Sande	Email To: ssande@siremlab.com
Copy To: mhealey@siremlab.com	Site Collection Info/Address:
Customer Project Name/Number: Si-4401	State: County/City: ON /Canada/Guelph Time Zone Collected: [ ] PT [ ] MT [ ] CT [✓] ET
Phone: Email:	Site/Facility ID #: Compliance Monitoring? [ ] Yes [✓] No
Collected By (print): Steve Sande	Purchase Order #: Quote #: DW PWS ID #: DW Location Code:
Collected By (signature):	Turnaround Date Required: Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: _____ [ ] Hold: _____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply) Field Filtered (if applicable): [ ] Yes [✓] No Analysis: _____

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Container Preservative Type **

Analyses

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	P-Cymene (8260)	Container Preservative Type **	Lab Profile/Line:
										3	
Si-4401-4A	GW	Grab	Mar 16					3	X		001
Si-4401-5A	GW	Grab	Mar 16					3	X		002
Si-4401-6A	GW	Grab	Mar 16					3	X		003

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _____

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: _____	
Sample pH Acceptable	Y N NA
pH Strips: _____	
Sulfide Present	Y N NA
Lead Acetate Strips: _____	

LAB USE ONLY:
Lab Sample # / Comments:

See Scan

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: _____
Cooler 1 Temp Upon Receipt: _____oC
Cooler 1 Therm Corr. Factor: _____oC
Cooler 1 Corrected Temp: _____oC
Comments: See Scan

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
SiREM	16Mar20	FE	
FE			3-17-20 0930

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): Page:

This invoice must be completed in English

COMMERCIAL INVOICE

EXPORTER : **Tax ID# :** **Contact Name :** Sammie Gallant **Telephone No. :** 5198222230 **E-Mail :** JSchimmel@siremlab.com **Company Name/Address :** SiREM 130 Stone Rd W GUELPH ON N1G3Z2 **Country/Territory :** Canada **Parties to Transaction:** ☐ Related ☐ Non-Related **Payment Terms :** **Purpose of Shipment :** Commercial	**Ship Date :** 16 Mar, 2020 **Air Waybill No. / Tracking No. / Bill of Lading :** 770028609274 **Invoice No. :** **Purchase Order No. :**
CONSIGNEE : **Tax ID# :** **Contact Name :** Joshua Richards **Telephone No. :** 317-502-9594 **E-Mail :** **Company Name/Address :** Pace Analytical Services 7726 Moller Road INDIANAPOLIS IN 46268 **Country/Territory :** United States	**SOLD TO (if different from Consignee) :** ☑ Same as CONSIGNEE **Tax ID#** **Company Name/Address** **Country/Territory**

If there is a designated broker for this shipment, please provide contact information
Name of Broker **Tel No.** **Contact Name**

Duties and Taxes Payable by ☑ Exporter ☐ Consignee ☐ Other If Other, please specify

No. of Packages	No. of Units	Unit of Measure	Description of Goods	Harmonized Tariff Number	Country/Territory of Origin	Unit Value	Total Value
	1.00	LBS	Commercial - groundwater samples for destructive analyses		CA	10.000000	10.00

Total No. of Packages : 1	**Total Weight (Indicate LBS or KGS) :** 3.00 kg	**Terms of Sale :**	FCA
Special Instructions :		**Subtotal :**	10.00
		Insurance :	0.00
		Freight :	0.00
		Packing :	0.00
Declaration Statement(s) :		**Handling :**	0.00
		Other :	0.00
I declare that all the information contained in this invoice to be true and correct		**Invoice Total :**	10.00
Originator or Name of Company Representative if the invoice is being completed on behalf of a company or individual :		**Currency Code :**	CAD
Signature / Title / Date 16 Mar 20			16 Mar, 2020

TOXIC SUBSTANCE CONTROL ACT (TSCA)
CERTIFICATION

Date: March 16, 2020

(CHECK ONE SECTION ONLY)

POSITIVE CERTIFICATION

_____ "I certify that all chemical substances in this shipment comply with all applicable rules or orders under TSCA and that I am not offering a chemical substance for entry in violation of TSCA or any applicable rules order thereunder."

● OR ●

NEGATIVE CERTIFICATION

X "I certify that all chemical substances in this shipment are not subject to TSCA."

Company Name: Geosyntec Consultants

Company Address: 130 Stone Rd W

City/State: Guelph ON

Country/Zip: N1G 3Z2

Authorized Name: Steven Sande

Authorized Signature: 

Title: Laboratory Technician

Federal Express AWB#: 7700 2860 9274

If the certifier is unsure if their chemical substance is subject to TSCA compliance, contact the Environmental Protection Agency, TSCA Assistance Office, Washington, D.C. (202) 554-1404 between 8:30 am and 5:00 pm EST.

Revised 04-2009

Pace Analytical

SAMPLE CONDITION UPON RECEIPT FORM

Project #: 50252145

Date/Time and Initials of person examining contents: JLK 3-17-20 1010

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other _____

Tracking #: 7700 2360 9274

Custody Seal on Cooler/Box Present: ☐ Yes ☒ No **Seals Intact:** ☐ Yes ☐ No

Packing Material: ☒ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other _____

Thermometer: 1 2 3 4 5 6 A B C D E F Ice Type: ~~☒~~ Wet ☒ Blue ☐ None | Samples collected today and on ice: ☐ Yes ☐ No ☒ N/A

Cooler Temperature: 5.6 / 4.7 Ice Visible in Sample Containers?: ☐ Yes ☒ No ☐ N/A

Initial/Corrected) Temp should be above freezing to 6°C If temp. is Over 6°C or under 0°C, was the PM Notified?: ☐ Yes ☐ No ☒ N/A

All discrepancies will be written out in the comments section below.

	Yes	No		Yes	No	N/A
Are samples from West Virginia? Document any containers out of temp		+	All containers needing acid/base pres Have been checked? **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl.** All containers needing preservation are found to be in compliance with EPA recommendation (<2, >9, >12) unless otherwise noted.			+
USDA Regulated Soils? (ID, NY, WA, OR,CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		+				
Chain of Custody Present:	+		Circle: HNO3 H2SO4 NaOH NaOH/ZnAc			
Chain of Custody Filled Out:	~~+~~ 3/17/20	✓	Dissolved Metals field filtered?:			+
Short Hold Time Analysis (<72hr)?: Analysis:		+	Headspace Wisconsin Sulfide			+
Time 5035A TC placed in Freezer or Short Holds To Lab:			Residual Chlorine Check (SVOC 625 Pest/PCB 608)	Present	Absent	N/A +
			Residual Chlorine Check (Total/Amenable/Free Cyanide)			+
Rush TAT Requested:		+	Headspace in VOA Vials (>6mm): All vials	+		+
Containers Intact?:	+		Trip Blank Present?:		+	
Sample Labels (IDs/Dates/Times) Match COC? Except TCs, which only require sample ID	+		Trip Blank Custody Seals?:		+	
Extra labels on Terracore Vials (soils only)?		+				

Comments: No Time on COC or Samples 2L 3/17/20

COC PAGE ____ of ____

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H (VG9H)	VOA VIALS (>6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H					Matrix	pH <2	pH >9	pH>12
1			3	3/3																						WT			
2			↓	3/3																						↓			
3			↓	3/3																									
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	BG1H	1L HCl clear glass
VSG	Headspace septa vial & HCl	BG1S	1L H2SO4 clear glass
WGKU	8oz unpreserved clear jar	BG1T	1L Na Thiosulfate clear glass
WGFU	4oz clear soil jar	BG1U	1L unpreserved glass
JGFU	4oz unpreserved amber wide	BG3H	250mL HCl Clear Glass
CG3H	250mL clear glass HCl	BG3U	250mL Unpres Clear Glass

Plastic / Misc.

BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

April 19, 2020

Steve Sande
SiREM Lab
130 Stone Road W
Ontario, Canada,

RE: Project: Si-4401
Pace Project No.: 50254679

Dear Steve Sande:

Enclosed are the analytical results for sample(s) received by the laboratory on April 15, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - Indianapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kelly Jones
kelly.jones@pacelabs.com
(317)228-3100
Project Manager

Enclosures

cc: Michael Healey, SiREM Lab

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Si-4401
Pace Project No.: 50254679

Pace Analytical Services Indianapolis
7726 Moller Road, Indianapolis, IN 46268
Illinois Accreditation #: 200074
Indiana Drinking Water Laboratory #: C-49-06
Kansas/TNI Certification #: E-10177
Kentucky UST Agency Interest #: 80226
Kentucky WW Laboratory ID #: 98019
Michigan Drinking Water Laboratory #9050
Ohio VAP Certified Laboratory #: CL0065
Oklahoma Laboratory #: 9204
Texas Certification #: T104704355
West Virginia Certification #: 330
Wisconsin Laboratory #: 999788130
USDA Soil Permit #: P330-19-00257

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Si-4401
Pace Project No.: 50254679

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50254679001	**Si-4401-1B**	Water	04/13/20 08:00	04/15/20 09:00
50254679002	**Si-4401-2B**	Water	04/13/20 08:00	04/15/20 09:00
50254679003	**Si-4401-3B**	Water	04/13/20 08:00	04/15/20 09:00
50254679004	**Si-4401-4B**	Water	04/13/20 08:00	04/15/20 09:00
50254679005	**Si-4401-5B**	Water	04/13/20 08:00	04/15/20 09:00
50254679006	**Si-4401-6B**	Water	04/13/20 08:00	04/15/20 09:00
50254679007	**Si-4401-7B**	Water	04/13/20 08:00	04/15/20 09:00
50254679008	**Si-4401-8B**	Water	04/13/20 08:00	04/15/20 09:00
50254679009	**Si-4401-9B**	Water	04/13/20 08:00	04/15/20 09:00
50254679010	**Si-4401-10B**	Water	04/13/20 08:00	04/15/20 09:00
50254679011	**Si-4401-11B**	Water	04/13/20 08:00	04/15/20 09:00
50254679012	**Si-4401-12B**	Water	04/13/20 08:00	04/15/20 09:00

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE ANALYTE COUNT

Project: Si-4401
Pace Project No.: 50254679

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50254679001	**Si-4401-1B**	EPA 8260	CAP	4	PASI-I
50254679002	**Si-4401-2B**	EPA 8260	CAP	4	PASI-I
50254679003	**Si-4401-3B**	EPA 8260	CAP	4	PASI-I
50254679004	**Si-4401-4B**	EPA 8260	CAP	4	PASI-I
50254679005	**Si-4401-5B**	EPA 8260	CAP	4	PASI-I
50254679006	**Si-4401-6B**	EPA 8260	CAP	4	PASI-I
50254679007	**Si-4401-7B**	EPA 8260	CAP	4	PASI-I
50254679008	**Si-4401-8B**	EPA 8260	CAP	4	PASI-I
50254679009	**Si-4401-9B**	EPA 8260	CAP	4	PASI-I
50254679010	**Si-4401-10B**	EPA 8260	CAP	4	PASI-I
50254679011	**Si-4401-11B**	EPA 8260	CAP	4	PASI-I
50254679012	**Si-4401-12B**	EPA 8260	CAP	4	PASI-I

PASI-I = Pace Analytical Services - Indianapolis

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Si-4401
Pace Project No.: 50254679

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50254679001	**Si-4401-1B**					
EPA 8260	p-Isopropyltoluene	1070	ug/L	125	04/16/20 16:31	
50254679002	**Si-4401-2B**					
EPA 8260	p-Isopropyltoluene	1500	ug/L	125	04/16/20 17:04	
50254679003	**Si-4401-3B**					
EPA 8260	p-Isopropyltoluene	1400	ug/L	125	04/16/20 17:37	
50254679004	**Si-4401-4B**					
EPA 8260	p-Isopropyltoluene	4150	ug/L	125	04/16/20 18:09	
50254679005	**Si-4401-5B**					
EPA 8260	p-Isopropyltoluene	4010	ug/L	125	04/16/20 18:42	
50254679006	**Si-4401-6B**					
EPA 8260	p-Isopropyltoluene	5070	ug/L	125	04/16/20 19:15	
50254679007	**Si-4401-7B**					
EPA 8260	p-Isopropyltoluene	4510	ug/L	125	04/16/20 19:48	
50254679008	**Si-4401-8B**					
EPA 8260	p-Isopropyltoluene	4640	ug/L	125	04/16/20 20:21	
50254679009	**Si-4401-9B**					
EPA 8260	p-Isopropyltoluene	4040	ug/L	125	04/16/20 20:53	
50254679010	**Si-4401-10B**					
EPA 8260	p-Isopropyltoluene	4310	ug/L	125	04/16/20 21:26	
50254679011	**Si-4401-11B**					
EPA 8260	p-Isopropyltoluene	4410	ug/L	125	04/16/20 21:59	
50254679012	**Si-4401-12B**					
EPA 8260	p-Isopropyltoluene	4840	ug/L	125	04/17/20 03:11	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-1B **Lab ID: 50254679001** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**1070**	ug/L	125	25		04/16/20 16:31	99-87-6	
Surrogates								
Dibromofluoromethane (S)	98	%.	75-120	25		04/16/20 16:31	1868-53-7	D4
4-Bromofluorobenzene (S)	96	%.	85-116	25		04/16/20 16:31	460-00-4	
Toluene-d8 (S)	99	%.	83-111	25		04/16/20 16:31	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-2B **Lab ID: 50254679002** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**1500**	ug/L	125	25		04/16/20 17:04	99-87-6	
Surrogates								
Dibromofluoromethane (S)	97	%.	75-120	25		04/16/20 17:04	1868-53-7	D4
4-Bromofluorobenzene (S)	94	%.	85-116	25		04/16/20 17:04	460-00-4	
Toluene-d8 (S)	98	%.	83-111	25		04/16/20 17:04	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-3B **Lab ID: 50254679003** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**1400**	ug/L	125	25		04/16/20 17:37	99-87-6	
Surrogates								
Dibromofluoromethane (S)	96	%.	75-120	25		04/16/20 17:37	1868-53-7	D4
4-Bromofluorobenzene (S)	97	%.	85-116	25		04/16/20 17:37	460-00-4	
Toluene-d8 (S)	99	%.	83-111	25		04/16/20 17:37	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-4B **Lab ID: 50254679004** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4150**	ug/L	125	25		04/16/20 18:09	99-87-6	
Surrogates								
Dibromofluoromethane (S)	97	%.	75-120	25		04/16/20 18:09	1868-53-7	D4
4-Bromofluorobenzene (S)	95	%.	85-116	25		04/16/20 18:09	460-00-4	
Toluene-d8 (S)	97	%.	83-111	25		04/16/20 18:09	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-5B **Lab ID: 50254679005** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4010**	ug/L	125	25		04/16/20 18:42	99-87-6	
Surrogates								
Dibromofluoromethane (S)	98	%.	75-120	25		04/16/20 18:42	1868-53-7	
4-Bromofluorobenzene (S)	94	%.	85-116	25		04/16/20 18:42	460-00-4	D4
Toluene-d8 (S)	97	%.	83-111	25		04/16/20 18:42	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-6B **Lab ID: 50254679006** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**5070**	ug/L	125	25		04/16/20 19:15	99-87-6	
Surrogates								
Dibromofluoromethane (S)	98	%.	75-120	25		04/16/20 19:15	1868-53-7	D4
4-Bromofluorobenzene (S)	94	%.	85-116	25		04/16/20 19:15	460-00-4	
Toluene-d8 (S)	99	%.	83-111	25		04/16/20 19:15	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-7B **Lab ID: 50254679007** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4510**	ug/L	125	25		04/16/20 19:48	99-87-6	
Surrogates								
Dibromofluoromethane (S)	97	%.	75-120	25		04/16/20 19:48	1868-53-7	D4
4-Bromofluorobenzene (S)	96	%.	85-116	25		04/16/20 19:48	460-00-4	
Toluene-d8 (S)	98	%.	83-111	25		04/16/20 19:48	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-8B **Lab ID: 50254679008** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4640**	ug/L	125	25		04/16/20 20:21	99-87-6	
Surrogates								
Dibromofluoromethane (S)	97	%.	75-120	25		04/16/20 20:21	1868-53-7	D4
4-Bromofluorobenzene (S)	95	%.	85-116	25		04/16/20 20:21	460-00-4	
Toluene-d8 (S)	98	%.	83-111	25		04/16/20 20:21	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-9B **Lab ID: 50254679009** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4040**	ug/L	125	25		04/16/20 20:53	99-87-6	
Surrogates								
Dibromofluoromethane (S)	98	%.	75-120	25		04/16/20 20:53	1868-53-7	
4-Bromofluorobenzene (S)	94	%.	85-116	25		04/16/20 20:53	460-00-4	D4
Toluene-d8 (S)	99	%.	83-111	25		04/16/20 20:53	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-10B **Lab ID: 50254679010** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4310**	ug/L	125	25		04/16/20 21:26	99-87-6	
Surrogates								
Dibromofluoromethane (S)	97	%.	75-120	25		04/16/20 21:26	1868-53-7	
4-Bromofluorobenzene (S)	94	%.	85-116	25		04/16/20 21:26	460-00-4	D4
Toluene-d8 (S)	99	%.	83-111	25		04/16/20 21:26	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-11B **Lab ID: 50254679011** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4410**	ug/L	125	25		04/16/20 21:59	99-87-6	
Surrogates								
Dibromofluoromethane (S)	96	%.	75-120	25		04/16/20 21:59	1868-53-7	D4
4-Bromofluorobenzene (S)	94	%.	85-116	25		04/16/20 21:59	460-00-4	
Toluene-d8 (S)	98	%.	83-111	25		04/16/20 21:59	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50254679

Sample: Si-4401-12B **Lab ID: 50254679012** Collected: 04/13/20 08:00 Received: 04/15/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
p-Isopropyltoluene	**4840**	ug/L	125	25		04/17/20 03:11	99-87-6	
Surrogates								
Dibromofluoromethane (S)	110	%.	75-120	25		04/17/20 03:11	1868-53-7	D4
4-Bromofluorobenzene (S)	103	%.	85-116	25		04/17/20 03:11	460-00-4	
Toluene-d8 (S)	96	%.	83-111	25		04/17/20 03:11	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50254679

QC Batch: 557519 — Analysis Method: EPA 8260
QC Batch Method: EPA 8260 — Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50254679001, 50254679002, 50254679003, 50254679004, 50254679005, 50254679006, 50254679007, 50254679008, 50254679009, 50254679010, 50254679011

METHOD BLANK: 2571321 — Matrix: Water
Associated Lab Samples: 50254679001, 50254679002, 50254679003, 50254679004, 50254679005, 50254679006, 50254679007, 50254679008, 50254679009, 50254679010, 50254679011

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
p-Isopropyltoluene	ug/L	ND	5.0	04/16/20 14:53	
4-Bromofluorobenzene (S)	%.	96	85-116	04/16/20 14:53	
Dibromofluoromethane (S)	%.	99	75-120	04/16/20 14:53	
Toluene-d8 (S)	%.	98	83-111	04/16/20 14:53	

LABORATORY CONTROL SAMPLE: 2571322

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
p-Isopropyltoluene	ug/L	50	45.1	90	82-119	
4-Bromofluorobenzene (S)	%.			107	85-116	
Dibromofluoromethane (S)	%.			98	75-120	
Toluene-d8 (S)	%.			87	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50254679

QC Batch: 557522
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis

Associated Lab Samples: 50254679012

METHOD BLANK: 2571358 Matrix: Water
Associated Lab Samples: 50254679012

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
p-Isopropyltoluene	ug/L	ND	5.0	04/17/20 02:38	
4-Bromofluorobenzene (S)	%.	103	85-116	04/17/20 02:38	
Dibromofluoromethane (S)	%.	111	75-120	04/17/20 02:38	
Toluene-d8 (S)	%.	97	83-111	04/17/20 02:38	

LABORATORY CONTROL SAMPLE: 2571359

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
p-Isopropyltoluene	ug/L	50	49.7	99	82-119	
4-Bromofluorobenzene (S)	%.			111	85-116	
Dibromofluoromethane (S)	%.			103	75-120	
Toluene-d8 (S)	%.			88	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALIFIERS

Project: Si-4401
Pace Project No.: 50254679

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

D4 Sample was diluted due to the presence of high levels of target analytes.

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Si-4401
Pace Project No.: 50254679

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50254679001	**Si-4401-1B**	EPA 8260	557519		
50254679002	**Si-4401-2B**	EPA 8260	557519		
50254679003	**Si-4401-3B**	EPA 8260	557519		
50254679004	**Si-4401-4B**	EPA 8260	557519		
50254679005	**Si-4401-5B**	EPA 8260	557519		
50254679006	**Si-4401-6B**	EPA 8260	557519		
50254679007	**Si-4401-7B**	EPA 8260	557519		
50254679008	**Si-4401-8B**	EPA 8260	557519		
50254679009	**Si-4401-9B**	EPA 8260	557519		
50254679010	**Si-4401-10B**	EPA 8260	557519		
50254679011	**Si-4401-11B**	EPA 8260	557519		
50254679012	**Si-4401-12B**	EPA 8260	557522		

Pace Analytical

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY- Affix W... ALL SH...

WO# : 50254679

50254679

Company: SiREM	Billing Information: accountspayablecan@siremlab.com
Address: 130 Stone Rd W	
Report To: Steve Sande	Email To: ssande@siremlab.com
Copy To: mhealey@siremlab.com	Site Collection Info/Address:
Customer Project Name/Number: Si-4401	State: ON County/City: /Canada/Guelph Time Zone Collected: [ ] PT [ ] MT [ ] CT [✓] ET

Phone: Email:	Site/Facility ID #:	Compliance Monitoring? [ ] Yes [✓] No
Collected By (print): Steve Sande	Purchase Order #: Quote #:	DW PWS ID #: DW Location Code:
Collected By (signature):	Turnaround Date Required:	Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: ____ [ ] Hold: ____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply)	Field Filtered (if applicable): [ ] Yes [✓] No Analysis: ____

Container Preservative: 3

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Time	Composite End Date	Time	Res Cl	# of Ctns	Analyses: P-Cymene (8260)	Lab Sample # / Comments
Si-4401-1B	GW	Grab	Apr 13					3	X	001
Si-4401-2B	GW	Grab	Apr 13					3	X	002
Si-4401-3B	GW	Grab	Apr 13					3	X	003
Si-4401-4B	GW	Grab	Apr 13					3	X	004
Si-4401-5B	GW	Grab	Apr 13					3	X	005
Si-4401-6B	GW	Grab	Apr 13					3	X	006
Si-4401-7B	GW	Grab	Apr 13					3	X	007
Si-4401-8B	GW	Grab	Apr 13					3	X	008
Si-4401-9B	GW	Grab	Apr 13					3	X	009
Si-4401-10B	GW	Grab	Apr 13					3	X	010

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips:	
Sample pH Acceptable	Y N NA
pH Strips:	
Sulfide Present	Y N NA
Lead Acetate Strips:	

LAB USE ONLY:
Lab Sample # / Comments: SEE SCUR

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y (N) NA
Therm ID#: 1
Cooler 1 Temp Upon Receipt: 4.9 oC
Cooler 1 Therm Corr. Factor: -0.9 oC
Cooler 1 Corrected Temp: 4.0 oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	MTJL LAB USE ONLY
[signature]	13Apr20	Fedex		Table #: Acctnum:
Fedex	4-15-20 0900	[signature]	4-15-20 0900	Template: Prelogin:
				PM: PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

Page: 1 of: 2

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical®

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY- Affix Workorder/Login Label Here or List Pace Workorder Number or MTJL Log-in Number Here

ALL SHADED AREAS are for LAB USE ONLY

Company: SiREM	Billing Information: accountspayablecan@siremlab.com
Address: 130 Stone Rd W	
Report To: Steve Sande	Email To: ssande@siremlab.com
Copy To: mhealey@siremlab.com	Site Collection Info/Address:
Customer Project Name/Number: Si-4401	State: ON County/City: /Canada/Guelph Time Zone Collected: [ ]PT [ ]MT [ ]CT [✓]ET
Phone: Email:	Site/Facility ID #: Compliance Monitoring? [ ] Yes [✓] No
Collected By (print): Steve Sande	Purchase Order #: Quote #: DW PWS ID #: DW Location Code:
Collected By (signature):	Turnaround Date Required: Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: [ ] Hold:	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply) Field Filtered (if applicable): [ ] Yes [✓] No Analysis:

Container Preservative Type **: 3

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other

Lab Project Manager:

Analyses: P-Cymene (8260)

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips:	
Sample pH Acceptable	Y N NA
pH Strips:	
Sulfide Present	Y N NA
Lead Acetate Strips:	

LAB USE ONLY:
Lab Sample # / Comments:

SEE SCUR

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	P-Cymene (8260)	Lab Profile/Line:
Si-4401-11B	GW	Grab	Apr 13					3	X	011
Si-4401-12B	GW	Grab	Apr 13					3	X	012

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y (N) NA
Therm ID#: 1
Cooler 1 Temp Upon Receipt: 4.9 oC
Cooler 1 Therm Corr. Factor: 0.9 oC
Cooler 1 Corrected Temp: 4.0 oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
	13 Apr 20	Fedex	
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Fedex	4-15-20 0900		4-15-20 0900
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:
PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

SAMPLE CONDITION UPON RECEIPT FORM

Face Analytical

Project #: 50254679

Date/Time and Initials of person examining contents: MN 4.15.20 1605

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other _____

Tracking #: 7702 3167 2977

Custody Seal on Cooler/Box Present: ☐ Yes ☑ No **Seals Intact:** ~~☑ Yes~~ MN 4.15.20 ☑ No

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other _____

Thermometer: ① 2 3 4 5 6 A B C D E F Ice Type: ☐ Wet ☑ Blue ☐ None | Samples collected today and on ice: ☐ Yes ☐ No ☑ N/A

Cooler Temperature: 4.9/4.0°C Ice Visible in Sample Containers? ☐ Yes ☑ No ☐ N/A

(Initial/Corrected) Temp should be above freezing to 6°C If temp. is Over 6°C or under 0°C, was the PM Notified? ☐ Yes ☐ No ☑ N/A

All discrepancies will be written out in the comments section below.

	Yes	No		Yes	No	N/A
Are samples from West Virginia? Document any containers out of temp		✓	All containers needing acid/base pres. Have been checked?: **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl.** All containers needing preservation are found to be in compliance with EPA recommendation (<2, >9, >12) unless otherwise noted.			✓
USDA Regulated Soils? (ID, NY, WA, OR,CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		✓				
Chain of Custody Present:	✓		Circle: HNO3 H2SO4 NaOH NaOH/ZnAc			
Chain of Custody Filled Out:		✓	Dissolved Metals field filtered?:			✓
Short Hold Time Analysis (<72hr)?: Analysis:		✓	Headspace Wisconsin Sulfide			✓
Time 5035A TC placed in Freezer or Short Holds To Lab:				Present	Absent	N/A
			Residual Chlorine Check (SVOC 625 Pest/PCB 608)			✓
			Residual Chlorine Check (Total/Amenable/Free Cyanide)		MB 9/15/20	✓
Rush TAT Requested:		✓	Headspace in VOA Vials (>6mm):	✓		
Containers Intact?:	✓		Trip Blank Present?:		✓	
Sample Labels (IDs/Dates/Times) Match COC? Except TCs, which only require sample ID	✓		Trip Blank Custody Seals?		✓	
Extra labels on Terracore Vials (soils only)?		✓				

Comments: No sample times on COC or containers MN 4.15.20

COC PAGE 1 of 2

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H VG9H	VOA VIALS (<6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H					Matrix	pH <2	pH >9	pH>12
1			3	3/3																						WT			
2				2/3																									
3				0/3																									
4				2/3																									
5				2/3																									
6				3/3																									
7				3/3																									
8				2/3																									
9				3/3																									
10				3/3																									
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	BG1H	1L HCl clear glass
VSG	Headspace septa vial & HCl	BG1S	1L H2SO4 clear glass
WGKU	8oz unpreserved clear jar	BG1T	1L Na Thiosulfate clear glass
WGFU	4oz clear soil jar	BG1U	1L unpreserved glass
JGFU	4oz unpreserved amber wide	BG3H	250mL HCl Clear Glass
CG3H	250mL clear glass HCl	BG3U	250mL Unpres Clear Glass

Plastic / Misc.

BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

COC PAGE 2 of 2

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H VG9H	VOA VIALS (>6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H					Matrix	pH <2	pH >9	pH>12
1			3	3|3																						WT			
2			3	3|3																						↓			
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	BG1H	1L HCl clear glass
VSG	Headspace septa vial & HCl	BG1S	1L H2SO4 clear glass
WGKU	8oz unpreserved clear jar	BG1T	1L Na Thiosulfate clear glass
WGFU	4oz clear soil jar	BG1U	1L unpreserved glass
JGFU	4oz unpreserved amber wide	BG3H	250mL HCl Clear Glass
CG3H	250mL clear glass HCl	BG3U	250mL Unpres Clear Glass

Plastic / Misc.

BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

November 04, 2020

Steve Sande
SiREM Lab
130 Stone Road W
Ontario, Canada,

RE: Project: Si-4401
Pace Project No.: 50271521

Dear Steve Sande:

Enclosed are the analytical results for sample(s) received by the laboratory on October 28, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - Indianapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kelly Jones
kelly.jones@pacelabs.com
(317)228-3100
Project Manager

Enclosures

cc: Michael Healey, SiREM Lab

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Si-4401
Pace Project No.: 50271521

Pace Analytical Services Indianapolis
7726 Moller Road, Indianapolis, IN 46268
Illinois Accreditation #: 200074
Indiana Drinking Water Laboratory #: C-49-06
Kansas/TNI Certification #: E-10177
Kentucky UST Agency Interest #: 80226
Kentucky WW Laboratory ID #: 98019
Michigan Drinking Water Laboratory #9050
Ohio VAP Certified Laboratory #: CL0065
Oklahoma Laboratory #: 9204
Texas Certification #: T104704355
West Virginia Certification #: 330
Wisconsin Laboratory #: 999788130
USDA Soil Permit #: P330-19-00257

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Si-4401
Pace Project No.: 50271521

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50271521001	**Si-4401-1C**	Water	10/27/20 08:00	10/28/20 08:30
50271521002	**Si-4401-2C**	Water	10/27/20 08:00	10/28/20 08:30
50271521003	**Si-4401-3C**	Water	10/27/20 08:00	10/28/20 08:30
50271521004	**Si-4401-4C**	Water	10/27/20 08:00	10/28/20 08:30
50271521005	**Si-4401-5C**	Water	10/27/20 08:00	10/28/20 08:30
50271521006	**Si-4401-6C**	Water	10/27/20 08:00	10/28/20 08:30
50271521007	**Si-4401-7C**	Water	10/27/20 08:00	10/28/20 08:30
50271521008	**Si-4401-8C**	Water	10/27/20 08:00	10/28/20 08:30
50271521009	**Si-4401-9C**	Water	10/27/20 08:00	10/28/20 08:30
50271521010	**Si-4401-10C**	Water	10/27/20 08:00	10/28/20 08:30
50271521011	**Si-4401-11C**	Water	10/27/20 08:00	10/28/20 08:30
50271521012	**Si-4401-12C**	Water	10/27/20 08:00	10/28/20 08:30

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE ANALYTE COUNT

Project: Si-4401
Pace Project No.: 50271521

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50271521001	**Si-4401-1C**	EPA 8260	RSW	5	PASI-I
50271521002	**Si-4401-2C**	EPA 8260	RSW	5	PASI-I
50271521003	**Si-4401-3C**	EPA 8260	RSW	5	PASI-I
50271521004	**Si-4401-4C**	EPA 8260	RSW	5	PASI-I
50271521005	**Si-4401-5C**	EPA 8260	RSW	5	PASI-I
50271521006	**Si-4401-6C**	EPA 8260	RSW	5	PASI-I
50271521007	**Si-4401-7C**	EPA 8260	RSW	5	PASI-I
50271521008	**Si-4401-8C**	EPA 8260	RSW	5	PASI-I
50271521009	**Si-4401-9C**	EPA 8260	RSW	5	PASI-I
50271521010	**Si-4401-10C**	EPA 8260	RSW	5	PASI-I
50271521011	**Si-4401-11C**	EPA 8260	RSW	5	PASI-I
50271521012	**Si-4401-12C**	EPA 8260	RSW	5	PASI-I

PASI-I = Pace Analytical Services - Indianapolis

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Si-4401
Pace Project No.: 50271521

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50271521001	**Si-4401-1C**					
EPA 8260	Benzene	5460	ug/L	125	11/03/20 13:03	
EPA 8260	p-Isopropyltoluene	2480	ug/L	125	11/03/20 13:03	
50271521002	**Si-4401-2C**					
EPA 8260	Benzene	5340	ug/L	125	11/03/20 13:37	
EPA 8260	p-Isopropyltoluene	1230	ug/L	25.0	10/31/20 03:03	
50271521003	**Si-4401-3C**					
EPA 8260	Benzene	5610	ug/L	125	11/03/20 14:10	
EPA 8260	p-Isopropyltoluene	1040	ug/L	25.0	10/31/20 03:37	
50271521004	**Si-4401-4C**					
EPA 8260	Benzene	4310	ug/L	125	11/03/20 14:43	
EPA 8260	p-Isopropyltoluene	3800	ug/L	125	11/03/20 14:43	
50271521005	**Si-4401-5C**					
EPA 8260	Benzene	4710	ug/L	125	11/03/20 15:17	
EPA 8260	p-Isopropyltoluene	5060	ug/L	125	11/03/20 15:17	
50271521006	**Si-4401-6C**					
EPA 8260	Benzene	4580	ug/L	125	11/03/20 15:50	
EPA 8260	p-Isopropyltoluene	4500	ug/L	125	11/03/20 15:50	
50271521007	**Si-4401-7C**					
EPA 8260	Benzene	4570	ug/L	125	11/03/20 16:24	
EPA 8260	p-Isopropyltoluene	4350	ug/L	125	11/03/20 16:24	
50271521008	**Si-4401-8C**					
EPA 8260	Benzene	3300	ug/L	125	11/03/20 13:53	
EPA 8260	p-Isopropyltoluene	5150	ug/L	125	11/03/20 13:53	
50271521009	**Si-4401-9C**					
EPA 8260	Benzene	4760	ug/L	125	11/03/20 14:26	
EPA 8260	p-Isopropyltoluene	5170	ug/L	125	11/03/20 14:26	
50271521010	**Si-4401-10C**					
EPA 8260	Benzene	4590	ug/L	125	11/03/20 15:00	
EPA 8260	p-Isopropyltoluene	4830	ug/L	125	11/03/20 15:00	
50271521011	**Si-4401-11C**					
EPA 8260	Benzene	3950	ug/L	125	11/03/20 15:33	
EPA 8260	p-Isopropyltoluene	4040	ug/L	125	11/03/20 15:33	
50271521012	**Si-4401-12C**					
EPA 8260	Benzene	5550	ug/L	125	11/03/20 16:07	
EPA 8260	p-Isopropyltoluene	4620	ug/L	125	11/03/20 16:07	

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-1C **Lab ID: 50271521001** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**5460**	ug/L	125	25		11/03/20 13:03	71-43-2	
p-Isopropyltoluene	**2480**	ug/L	125	25		11/03/20 13:03	99-87-6	
Surrogates								
Dibromofluoromethane (S)	106	%.	75-120	25		11/03/20 13:03	1868-53-7	
4-Bromofluorobenzene (S)	96	%.	85-116	25		11/03/20 13:03	460-00-4	
Toluene-d8 (S)	102	%.	83-111	25		11/03/20 13:03	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-2C **Lab ID: 50271521002** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**5340**	ug/L	125	25		11/03/20 13:37	71-43-2	
p-Isopropyltoluene	**1230**	ug/L	25.0	5		10/31/20 03:03	99-87-6	
Surrogates								
Dibromofluoromethane (S)	101	%.	75-120	5		10/31/20 03:03	1868-53-7	
4-Bromofluorobenzene (S)	97	%.	85-116	5		10/31/20 03:03	460-00-4	
Toluene-d8 (S)	105	%.	83-111	5		10/31/20 03:03	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-3C **Lab ID: 50271521003** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**5610**	ug/L	125	25		11/03/20 14:10	71-43-2	
p-Isopropyltoluene	**1040**	ug/L	25.0	5		10/31/20 03:37	99-87-6	
Surrogates								
Dibromofluoromethane (S)	102	%.	75-120	5		10/31/20 03:37	1868-53-7	
4-Bromofluorobenzene (S)	95	%.	85-116	5		10/31/20 03:37	460-00-4	
Toluene-d8 (S)	103	%.	83-111	5		10/31/20 03:37	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-4C **Lab ID: 50271521004** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4310**	ug/L	125	25		11/03/20 14:43	71-43-2	
p-Isopropyltoluene	**3800**	ug/L	125	25		11/03/20 14:43	99-87-6	
Surrogates								
Dibromofluoromethane (S)	109	%.	75-120	25		11/03/20 14:43	1868-53-7	
4-Bromofluorobenzene (S)	98	%.	85-116	25		11/03/20 14:43	460-00-4	
Toluene-d8 (S)	102	%.	83-111	25		11/03/20 14:43	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-5C **Lab ID: 50271521005** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4710**	ug/L	125	25		11/03/20 15:17	71-43-2	
p-Isopropyltoluene	**5060**	ug/L	125	25		11/03/20 15:17	99-87-6	
Surrogates								
Dibromofluoromethane (S)	106	%.	75-120	25		11/03/20 15:17	1868-53-7	
4-Bromofluorobenzene (S)	99	%.	85-116	25		11/03/20 15:17	460-00-4	
Toluene-d8 (S)	102	%.	83-111	25		11/03/20 15:17	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-6C **Lab ID: 50271521006** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4580**	ug/L	125	25		11/03/20 15:50	71-43-2	
p-Isopropyltoluene	**4500**	ug/L	125	25		11/03/20 15:50	99-87-6	
Surrogates								
Dibromofluoromethane (S)	110	%.	75-120	25		11/03/20 15:50	1868-53-7	
4-Bromofluorobenzene (S)	97	%.	85-116	25		11/03/20 15:50	460-00-4	
Toluene-d8 (S)	99	%.	83-111	25		11/03/20 15:50	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-7C **Lab ID: 50271521007** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4570**	ug/L	125	25		11/03/20 16:24	71-43-2	
p-Isopropyltoluene	**4350**	ug/L	125	25		11/03/20 16:24	99-87-6	
Surrogates								
Dibromofluoromethane (S)	107	%.	75-120	25		11/03/20 16:24	1868-53-7	
4-Bromofluorobenzene (S)	96	%.	85-116	25		11/03/20 16:24	460-00-4	
Toluene-d8 (S)	102	%.	83-111	25		11/03/20 16:24	2037-26-5	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-8C **Lab ID: 50271521008** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3300**	ug/L	125	25		11/03/20 13:53	71-43-2	
p-Isopropyltoluene	**5150**	ug/L	125	25		11/03/20 13:53	99-87-6	
Surrogates								
Dibromofluoromethane (S)	110	%.	75-120	25		11/03/20 13:53	1868-53-7	
4-Bromofluorobenzene (S)	96	%.	85-116	25		11/03/20 13:53	460-00-4	
Toluene-d8 (S)	103	%.	83-111	25		11/03/20 13:53	2037-26-5	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-9C **Lab ID: 50271521009** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4760**	ug/L	125	25		11/03/20 14:26	71-43-2	
p-Isopropyltoluene	**5170**	ug/L	125	25		11/03/20 14:26	99-87-6	
Surrogates								
Dibromofluoromethane (S)	107	%.	75-120	25		11/03/20 14:26	1868-53-7	
4-Bromofluorobenzene (S)	95	%.	85-116	25		11/03/20 14:26	460-00-4	
Toluene-d8 (S)	102	%.	83-111	25		11/03/20 14:26	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-10C **Lab ID: 50271521010** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**4590**	ug/L	125	25		11/03/20 15:00	71-43-2	
p-Isopropyltoluene	**4830**	ug/L	125	25		11/03/20 15:00	99-87-6	
Surrogates								
Dibromofluoromethane (S)	110	%.	75-120	25		11/03/20 15:00	1868-53-7	
4-Bromofluorobenzene (S)	96	%.	85-116	25		11/03/20 15:00	460-00-4	
Toluene-d8 (S)	102	%.	83-111	25		11/03/20 15:00	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
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ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-11C **Lab ID: 50271521011** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3950**	ug/L	125	25		11/03/20 15:33	71-43-2	
p-Isopropyltoluene	**4040**	ug/L	125	25		11/03/20 15:33	99-87-6	
Surrogates								
Dibromofluoromethane (S)	109	%.	75-120	25		11/03/20 15:33	1868-53-7	
4-Bromofluorobenzene (S)	95	%.	85-116	25		11/03/20 15:33	460-00-4	
Toluene-d8 (S)	100	%.	83-111	25		11/03/20 15:33	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(317)228-3100

ANALYTICAL RESULTS

Project: Si-4401
Pace Project No.: 50271521

Sample: Si-4401-12C **Lab ID: 50271521012** Collected: 10/27/20 08:00 Received: 10/28/20 08:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**5550**	ug/L	125	25		11/03/20 16:07	71-43-2	
p-Isopropyltoluene	**4620**	ug/L	125	25		11/03/20 16:07	99-87-6	
Surrogates								
Dibromofluoromethane (S)	106	%.	75-120	25		11/03/20 16:07	1868-53-7	
4-Bromofluorobenzene (S)	95	%.	85-116	25		11/03/20 16:07	460-00-4	
Toluene-d8 (S)	98	%.	83-111	25		11/03/20 16:07	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
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QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50271521

QC Batch: 590357
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50271521002, 50271521003

METHOD BLANK: 2723507 Matrix: Water
Associated Lab Samples: 50271521002, 50271521003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	10/31/20 01:22	
p-Isopropyltoluene	ug/L	ND	5.0	10/31/20 01:22	
4-Bromofluorobenzene (S)	%.	99	85-116	10/31/20 01:22	
Dibromofluoromethane (S)	%.	106	75-120	10/31/20 01:22	
Toluene-d8 (S)	%.	102	83-111	10/31/20 01:22	

LABORATORY CONTROL SAMPLE: 2723508

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	51.0	102	75-118	
p-Isopropyltoluene	ug/L	50	46.6	93	82-119	
4-Bromofluorobenzene (S)	%.			98	85-116	
Dibromofluoromethane (S)	%.			100	75-120	
Toluene-d8 (S)	%.			102	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50271521

QC Batch: 590846 | Analysis Method: EPA 8260
QC Batch Method: EPA 8260 | Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50271521001, 50271521004, 50271521005, 50271521006, 50271521007

METHOD BLANK: 2725412 Matrix: Water
Associated Lab Samples: 50271521001, 50271521004, 50271521005, 50271521006, 50271521007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	11/03/20 11:22	
p-Isopropyltoluene	ug/L	ND	5.0	11/03/20 11:22	
4-Bromofluorobenzene (S)	%.	100	85-116	11/03/20 11:22	
Dibromofluoromethane (S)	%.	94	75-120	11/03/20 11:22	
Toluene-d8 (S)	%.	102	83-111	11/03/20 11:22	

LABORATORY CONTROL SAMPLE: 2725413

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	58.5	117	75-118	
p-Isopropyltoluene	ug/L	50	56.2	112	82-119	
4-Bromofluorobenzene (S)	%.			97	85-116	
Dibromofluoromethane (S)	%.			99	75-120	
Toluene-d8 (S)	%.			102	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: Si-4401
Pace Project No.: 50271521

QC Batch: 590853
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50271521008, 50271521009, 50271521010, 50271521011, 50271521012

METHOD BLANK: 2725432 Matrix: Water
Associated Lab Samples: 50271521008, 50271521009, 50271521010, 50271521011, 50271521012

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	11/03/20 11:39	
p-Isopropyltoluene	ug/L	ND	5.0	11/03/20 11:39	
4-Bromofluorobenzene (S)	%.	95	85-116	11/03/20 11:39	
Dibromofluoromethane (S)	%.	110	75-120	11/03/20 11:39	
Toluene-d8 (S)	%.	102	83-111	11/03/20 11:39	

LABORATORY CONTROL SAMPLE: 2725433

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	54.8	110	75-118	
p-Isopropyltoluene	ug/L	50	52.1	104	82-119	
4-Bromofluorobenzene (S)	%.			95	85-116	
Dibromofluoromethane (S)	%.			95	75-120	
Toluene-d8 (S)	%.			102	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALIFIERS

Project: Si-4401
Pace Project No.: 50271521

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Si-4401
Pace Project No.: 50271521

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50271521001	**Si-4401-1C**	EPA 8260	590846		
50271521002	**Si-4401-2C**	EPA 8260	590357		
50271521003	**Si-4401-3C**	EPA 8260	590357		
50271521004	**Si-4401-4C**	EPA 8260	590846		
50271521005	**Si-4401-5C**	EPA 8260	590846		
50271521006	**Si-4401-6C**	EPA 8260	590846		
50271521007	**Si-4401-7C**	EPA 8260	590846		
50271521008	**Si-4401-8C**	EPA 8260	590853		
50271521009	**Si-4401-9C**	EPA 8260	590853		
50271521010	**Si-4401-10C**	EPA 8260	590853		
50271521011	**Si-4401-11C**	EPA 8260	590853		
50271521012	**Si-4401-12C**	EPA 8260	590853		

Pace Analytical

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

WO# : 50271521

50271521

USE ONLY

mpany: SiREM	Billing Information: accountspayablecan@siremlab.com
dress: 130 Stone Rd W	
port To: Steve Sande	Email To: ssande@siremlab.com
py To: mhealey@siremlab.com	Site Collection Info/Address:
stomer Project Name/Number: Si-4401	State: ON County/City: /Canada/Guelph Time Zone Collected: [ ] PT [ ] MT [ ] CT [✓] ET
one: ail:	Site/Facility ID #: Compliance Monitoring? [ ] Yes [✓] No
lected By (print): Steve Sande	Purchase Order #: Quote #: DW PWS ID #: DW Location Code:
lected By (signature):	Turnaround Date Required: Immediately Packed on Ice: [✓] Yes [ ] No
mple Disposal: Dispose as appropriate [ ] Return Archive: ____ Hold: ____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply)
	Field Filtered (if applicable): [ ] Yes [✓] No Analysis: ____

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), roduct (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

stomer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	Analyses: P-Cymene (8260)	Lab Profile/Line: Lab Sample # / Comments:
Si-4401-1C	GW	Grab	Oct 27					3	X	001
Si-4401-2C	GW	Grab	Oct 27					3	X	002
Si-4401-3C	GW	Grab	Oct 27					3	X	003
Si-4401-4C	GW	Grab	Oct 27					3	X	004
Si-4401-5C	GW	Grab	Oct 27					3	X	005
Si-4401-6C	GW	Grab	Oct 27					3	X	006
Si-4401-7C	GW	Grab	Oct 27					3	X	007
Si-4401-8C	GW	Grab	Oct 27					3	X	008
Si-4401-9C	GW	Grab	Oct 27					3	X	009
Si-4401-10C	GW	Grab	Oct 27					3	X	010

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: ____	
Sample pH Acceptable	Y N NA
pH Strips: ____	
Sulfide Present	Y N NA
Lead Acetate Strips: ____	

LAB USE ONLY
Lab Sample # / Comments:
Shcu

stomer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y (N) NA
Therm ID#: 2
Cooler 1 Temp Upon Receipt: 5.4 oC
Cooler 1 Therm Corr. Factor: -0.4 oC
Cooler 1 Corrected Temp: 5.0 oC
Comments:

inquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
	0527, 20	Fedex	
inquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Fedex	102820		10-28-20 0830
inquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): Page: ____

Pace Analytical

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

MTJL Log-in Number Here

ALL SHADED AREAS are for LAB USE ONLY

mpany: SiREM	Billing Information: accountspayablecan@siremlab.com
dress: 130 Stone Rd W	
port To: Steve Sande	Email To: ssande@siremlab.com
by To: mhealey@siremlab.com	Site Collection Info/Address:
stomer Project Name/Number: Si-4401	State: County/City: Time Zone Collected: ON /Canada/Guelph [ ] PT [ ] MT [ ] CT [✓] ET
one: ail:	Site/Facility ID #: — Compliance Monitoring? [ ] Yes [✓] No
lected By (print): Steve Sande	Purchase Order #: Quote #: — DW PWS ID #: DW Location Code:
lected By (signature):	Turnaround Date Required: — Immediately Packed on Ice: [✓] Yes [ ] No
mple Disposal: Dispose as appropriate [ ] Return Archive: ____ Hold: ____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply) — Field Filtered (if applicable): [ ] Yes [✓] No Analysis: ____

Container Preservative Type **: 3

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

Analyses: P-Cymene (8260)

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: ____	
Sample pH Acceptable	Y N NA
pH Strips: ____	
Sulfide Present	Y N NA
Lead Acetate Strips: ____	

LAB USE ONLY:
Lab Sample # / Comments:
SKUV

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

stomer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	P-Cymene (8260)	Lab Profile/Line:
Si-4401-11C	GW	Grab	Oct 27					3	X	011
Si-4401-12C	GW	Grab	Oct 27					3	X	012

stomer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Packing Material Used:

Lab Tracking #:

Radchem sample(s) screened (<500 cpm): Y N NA

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y (N) NA
Therm ID#: 2
Cooler 1 Temp Upon Receipt: 5.4 oC
Cooler 1 Therm Corr. Factor: -0.4 oC
Cooler 1 Corrected Temp: 5.0 oC
Comments:

	Date/Time:	Received by/Company: (Signature)	Date/Time:
inquished by/Company: (Signature)	Oct 27 20	Fedex	
inquished by/Company: (Signature) Fedex	10.28.20		Date/Time: 10.28.20 0830
inquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s):

Page: ____

F-IN-Q-290-rev.19,23Jul2020

Pace Analytical

SAMPLE CONDITION UPON RECEIPT FORM

Date/Time and Initials of person examining contents: MN 10.28.20 1605

Courier: (Fed Ex) UPS Client Pace USPS Other _____

Custody Seal on Cooler/Box Present: (Yes) No **(If yes)Seals Intact:** (Yes) No **(leave blank if no seals were present)**

Packing Material: Bubble Wrap (Bubble Bags) None Other _____

Thermometer: 1(2)3456 A B C D E F (MW 10.28.20) **Ice Type:** (Wet) Blue None

Cooler Temperature: 5.4/5.0°C **If temp. is over 6°C or under 0°C, was the PM notified?:** Yes No

Temp should be above freezing to 6°C **(Initial/Corrected)**

All discrepancies will be written out in the comments section below.

	Yes	No		Yes	No	N/A
Are samples from West Virginia? Document any containers out of temp.		—	All containers needing acid/base pres. Have been CHECKED?: **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl.** **Circle:** **HNO3 (<2) H2SO4 (<2) NaOH (>10) NaOH/ZnAc (>9)** Any non-conformance to pH recommendations will be noted on the container count form			—
USDA Regulated Soils? (HI, ID, NY, WA, OR,CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		—				
Short Hold Time Analysis (48 hours or less)? Analysis:		—		Present	Absent	N/A
			Residual Chlorine Check (SVOC 625 Pest/PCB 608)			—
Time 5035A TC placed in Freezer or Short Holds To Lab	Time:		Residual Chlorine Check (Total/Amenable/Free Cyanide)			—
Rush TAT Requested (4 days or less):		—	Headspace Wisconsin Sulfide?			—
Custody Signatures Present?	—		Headspace in VOA Vials (>6mm):	—		
Containers Intact?:	—		Trip Blank Present?		—	
Sample Label (IDs/Dates/Times) Match COC?: Except TCs, which only require sample ID	—		Trip Blank Custody Seals?:		—	
Extra labels on Terracore Vials? (soils only)		—				

COMMENTS:

COC PAGE ____ of ____

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H (VG9H)	VOA VIAL HS (>8mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	AG3C	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H				Matrix	pH <2	pH >9	pH>10
1			3	3/3	3 MN 10.28.20																					WT			
2				3/3																									
3				2/3																									
4				1/3																									
5				1/3																									
6				2/3																									
7				2/3																									
8				3/3																									
9				1/3																									
10				2/3																									
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	AG3C	250mL NaOH amber glass
VSG	Headspace septa vial & HCl	BG1H	1L HCl clear glass
WGKU	8oz unpreserved clear jar	BG1S	1L H2SO4 clear glass
WGFU	4oz clear soil jar	BG1T	1L Na Thiosulfate clear glass
JGFU	4oz unpreserved amber wide	BG1U	1L unpreserved glass
CG3H	250mL clear glass HCl	BG3H	250mL HCl Clear Glass

Plastic / Misc.

BG3U	250mL Unpres Clear Glass
BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

COC PAGE ____ of ____

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H VG9H	VOA VIAL HS (<6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	AG3C	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H				Matrix	pH <2	pH >9	pH>10
1			3	2/3																						WT			
2			↓	2/3																						↓			
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL. HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	AG3C	250mL NaOH amber glass
VSG	Headspace septa vial & HCl	BG1H	1L HCl clear glass
WGKU	8oz unpreserved clear jar	BG1S	1L H2SO4 clear glass
WGFU	4oz clear soil jar	BG1T	1L Na Thiosulfate clear glass
JGFU	4oz unpreserved amber wide	BG1U	1L unpreserved glass
CG3H	250mL clear glass HCl	BG3H	250mL HCl Clear Glass

Plastic / Misc.

BG3U	250mL Unpres Clear Glass
BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)

BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

Prepared for:

Geosyntec Consultants, Inc.
1255 Roberts Boulevard, Suite 200
Kennesaw, Georgia 30144

Laboratory Treatability Study to Evaluate Aerobic Remediation of Benzene and para-Cymene in Groundwater

SGW-23 Area Near the Stillhouse Control Room
Hercules/Pinova Facility, Brunswick, GA

Prepared by:

130 Stone Road West
Guelph, Ontario N1G 3Z2

SiREM Ref: GR6881C

27 January 2021

siremlab.com

TABLE OF CONTENTS

LIST OF TABLES

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LIST OF ABBREVIATIONS

%	percent
°C	degrees Celsius
°C/min	degrees Celsius per minute
µg/L	micrograms per liter
CB	chlorobenzene
CO_2	carbon dioxide
DHG	dissolved hydrocarbon gases
DO	dissolved oxygen
EISB	enhanced *in situ* bioremediation
FID	flame ionization detector
g	grams
GC	gas chromatograph
Geosyntec	Geosyntec Consultants Inc.
mg/L	milligrams per liter
min	minutes
mL	milliliters
mL/min	milliliters per minute
mmol/bottle	millimoles per bottle
QL	quantitation limit
SiREM	SiREM Laboratory
VOC	volatile organic compounds

1. INTRODUCTION

Geosyntec Consultants, Inc. (Geosyntec) retained SiREM Laboratory (SiREM) to conduct a biotreatability study to assess the potential for enhanced *in situ* bioremediation (EISB) of benzene under aerobic conditions in groundwater at the Brunswick site in Georgia (the Site). Site materials were collected from the SGW-23 area near the Stillhouse Control Room. Geologic materials were collected by Geosyntec on 19 February 2020 and received by SiREM on 21 February 2020. The shallow groundwater used for the study was collected on 20 February 2020 and received by SiREM on 24 February 2020. The chain of custodies received with these samples are provided in Appendix A.

The remainder of this report is divided into four sections. Section 2 contains a summary of key degradation processes for the target compounds of concern. Section 3 presents the experimental materials and methods; Section 4 presents the results and Section 5 provides references.

2. SUMMARY OF DEGRADATION PROCESSES

Benzene can be biologically degraded under a variety of aerobic and anaerobic conditions (Wiedemeier *et al*. 1995).

Under aerobic conditions, benzene is rapidly oxidized using oxygen as an electron acceptor producing carbon dioxide (CO_2) by indigenous microbial populations. Although benzene biodegradation under anoxic and anaerobic conditions is less energetically favorable, it has been observed to occur in situ at sites containing benzene. Under appropriate conditions, benzene acts as an electron donor for nitrate-reducing, iron-reducing, sulfate-reducing, or methanogenic microbial populations. Ultimately benzene can be degraded via anaerobic pathways to CO_2 (Ulrich *et al*., 2005). Enhanced biological remediation of benzene can, in certain cases, be achieved by stimulating the indigenous microbial populations through the addition of electron acceptors, such as oxygen and sulfate (De Silva and Alvarez, 2004).

P-cymene is an alkyl-substituted aromatic hydrocarbon which would be expected to degrade under aerobic conditions (Eaton, 1997).

In this study, degradation of benzene and p-cymene under aerobic conditions was investigated

3. MATERIALS AND METHODS

The following sections describe the materials and methods used for microcosm construction, amendments and incubation for the aerobic study.

3.1 Microcosm Construction and Incubation

The geologic material was collected during the MPE pilot test well installation (SGW-23) area near the Stillhouse Control Room at the Hercules/Pinova Facility in Brunswick, Georgia. The geologic material was homogenized on 22 February 2020. A composite test sample was prepared by combining the geologic material collected from the MPE-01 location (depths from 2-5', 5-10', 6-8' and 8-10' below ground surface) and the PZ-1 location (depths from 2-5' and 5-10' below

ground surface). Initially the Site materials were used to prepare anaerobic microcosms (not discussed in this report). Therefore, cores were placed in a disposable anaerobic glove bag purged with nitrogen gas in order to create an anaerobic environment. Once removed from the cores, the geologic material was homogenized manually and passed through a ¼ inch sieve to remove larger particles and to improve reproducibility between microcosm replicates. Unused Site materials were placed in cold storage in case there was a need for additional testing.

Geosyntec instructed SIREM to prepare aerobic microcosms based on their review of other anaerobic treatability study results and as a results two aerobic tests were set up. Test 1 investigated benzene degradation and Test 2 investigated both benzene and p-cymene degradation. Microcosms were constructed in the fume hood on 8 July 20 (Test 1) and 20 November 2020 (Test 2) by filling sterile 250 milliliter (mL) (nominal volume) screw cap Boston round clear glass bottles (Systems Plus, New Hamburg, ON) with 60 grams (g) of geologic material and 180 mL of site groundwater. Microcosms were constructed by combining MPE/PZ-1 geologic material and Pinova MPE groundwater. The microcosms were then capped with Mininert™ (VICI Valco Instruments Canada, Brockville, Ontario) closures to allow repetitive sampling with minimal volatile organic compound (VOC) loss and to allow amendments, as needed, throughout the incubation period. All controls and treatments were constructed in triplicate. In order to provide sufficient sample volumes for external laboratory analysis, additional sacrificial microcosms were constructed for each external analysis time-point throughout the study. Table 1 summarizes the details of microcosm construction.

All aerobic microcosms were incubated under ambient aerobic conditions in the laboratory. During quiescent incubation, all microcosms were covered to minimize photodegradation. Microcosms were incubated for a period of up to 80 days at approximately 22 degrees Celsius (°C) (room temperature).

3.1.1 Microcosm Amendments

The first microcosm of each treatment and control was amended with resazurin (Sigma, St. Louis, MO) to monitor redox conditions on Day 0. Resazurin remains pink in the presence of oxygen and can be used as a visual indicator for the presence or absence of oxidizing conditions. Geosyntec specified that the initial benzene concentration in the shallow zone microcosms should be 5 milligrams per liter (mg/L). The initial concentration of the microcosms in both Test 1 and Test 2 were not at the target concentrations and therefore on Day 0 (13 July 2020 and 20 November 2020 respectively), the microcosms were spiked with benzene to achieve the target concentration. P-cymene was not spiked. Details of resazurin amendment as well as benzene spiking are provided in Table 1.

Oxygen was amended into the treatment microcosms to maintain aerobic conditions. 100% Oxygen (Linde, Cambridge, Ontario) was amended into the treatment microcosms. Oxygen was monitored and amended as needed, to maintain a dissolved oxygen (DO) concentration between 5 – 8 mg/L in the aqueous phase. Additional oxygen was amended throughout both Tests 1 and 2, as needed, throughout the study and monitored by both the resazurin color and the measurement of DO (Tables 3-1 and 3-2). To account for potential headspace losses of volatile contaminants due to multiple oxygen amendments, the sterile control microcosms received equal

volumes of nitrogen amendments. Details of gas addition are provided in Table 1, Tables 2-1 and 2-2.

3.2 Microcosm Sampling and Analysis

3.2.1 Microcosm Sampling

Aqueous samples were collected from the control and treatment microcosms for analysis of benzene, dissolved hydrocarbon gases (DHGs – specifically methane), pH and DO at SiREM. Microcosms were sampled for these parameters using gas-tight 1 mL Hamilton glass syringes. Syringes were cleaned with acidified water (pH ~2) and rinsed 10 times with deionized water between samples, to ensure that VOCs and microorganisms were not transferred between different samples or treatments. Baseline total organic carbon (TOC) samples were collected on the geologic materials at the beginning of the study by filling a 250 mL glass jar with geologic material. Samples were stored on ice and picked up by ALS (ALS Analytical Inc., Waterloo) personnel. P-cymene samples were preserved with hydrochloric acid and shipped on ice to an external laboratory.

The analytical methods employed by SiREM are described below.

3.2.2 Analysis of VOCs and DHGs

This section describes the methods used to quantify the VOCs and DHGs. The quantitation limits (QL) for the VOCs and DHGs were typically 10 micrograms per liter (µg/L) in the microcosms based on the sample dilution factor used and the lowest concentration standards that were included in the linear calibration trend.

Aqueous VOC and DHG concentrations in the microcosms were measured using a Hewlett-Packard (Hewlett Packard 7890) gas chromatograph (GC) equipped with an auto sampler (Hewlett Packard G1888) programmed to heat each sample vial to 75°C for 45 minutes (min) prior to headspace injection into a GSQ Plot column (0.53 millimeters x 30 meters, J&W) and a flame ionization detector (FID). Sample vials were heated to ensure that all VOCs in the aqueous sample would partition into the headspace. The injector temperature was 200°C, and the detector temperature was 250°C. The oven temperature was programmed as follows: 35°C for 2 min, increased to 100°C at 50 degrees Celsius per minute (°C/min), then increased to 185°C at 25°C/min and held at 185°C for 6.80 min. The carrier gas was helium at a flow rate of 11 milliliters per minute (mL/min).

After withdrawing a sample (as described in Section 2.2.1) from the microcosms, the sample was injected into a 10 mL auto sampler vial containing acidified deionized water (pH ~2). The sample volume was added to the vial containing deionized water bringing the total volume up to 6 mL. The water was acidified to inhibit microbial activity between microcosm sampling and GC analysis. The vial was sealed with an inert Teflon™-lined septum and aluminum crimp cap for automated injection of 3 mL of headspace onto the GC. One VOC standard was analyzed with each set of samples to verify the instrument five-point calibration curve using methanolic stock solutions containing known concentrations of the target analytes. Calibration was performed using external standards purchased as standard solutions (Sigma, St Louis, Missouri), where known volumes of

standard solutions were added to acidified water in auto sampler vials and analyzed as described above for microcosm samples. Data were integrated using Chemstation Software (Agilent Technologies, Santa Clara, California).

3.2.3 Analysis of pH

The pH measurements were performed using an Oakton pH spear with a combination pH electrode (Oakton, Vernon Hills, IL). A 0.5 mL sample was collected from the microcosms (as described in section 2.2.1), and the pH was measured on the lab bench. The pH spear was calibrated at each sampling event according to the manufacturer's instructions using pH 4.0, 7.0 and 10 standards.

3.2.4 Analysis of Dissolved Oxygen

The DO analyses were performed using a Mi-730 Micro-Oxygen Electrode (Microelectrodes, Inc., Bedford, NH, USA) in conjunction with the ES350 Pod-Vu software (eDAQ, Denistone East, Australia). A 0.25 mL sample was collected (as described in Section 2.2.1) and placed in a 1.5 mL microcentrifuge tube. The DO was measured on the lab bench immediately after sampling. The DO probe was calibrated before each use according to manufacturer's instructions.

3.2.5 External Laboratory Analysis of Total Organic Carbon and P-cymene

Analysis of total organic carbon (TOC) on the geologic material was performed at ALS (ALS Environmental, Waterloo). Geologic samples were prepared by filling 250 mL amber glass jars with geologic material from the shallow zone.

Analysis of p-cymene (Test 2) samples was conducted by Pace Analytical in Indianapolis, IN. Samples were collected in 40 mL glass vials and preserved with hydrochloric acid.

4. RESULTS

Table 2-1 provides the benzene and methane data collected at SiREM from the control and treatment microcosms for Test 1. Table 2-2 provides the benzene data collected at SiREM, as well as the external benzene and p-cymene data generated by analysis at Pace. Results are presented in units of mg/L and millimoles per microcosm bottle (mmol/bottle). Concentrations were converted from mg/L to mmol/bottle using Henry's Law as demonstrated in Appendix B.

Table 3-1 provides TOC, pH and DO results from Test 1 and Table 3-2 from Test 2. The TOC values are reported as a percentage and the DO is reported in mg/L. The mass of oxygen per gram of TOC and per gram of VOC was calculated based on the amount of oxygen added. Figure 2 presents the benzene trends for Test 1 while Figure 3 present the benzene trends for Test 2. Appendix C presents external laboratory reports.

5. REFERENCES

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TABLES

TABLE 1: SUMMARY OF AEROBIC MICROCOSM CONTROLS, TREATMENTS AND AMENDMENTS
SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

SiREM

Test	Treatment/Control	Assigned Microcosm Number	Number of Microcosms	Geological Material (g)	Groundwater (mL)	Headspace (mL)	Sodium Azide	Mercuric Chloride	Resazurin	Benzene	Gas amendment
1	Shallow Aerobic Sterile Control	1 to 3	3	Amended with 60 g of MPE and PZ-1.	Amended with 180 mL of MPE site groundwater.	40	Amended with 0.45 mL of a 5 % solution on Day 0.	Amended with 2.52 mL of a 2.7% solution on Day 0.	Amended first replicate with 100 µL of a 1,000 mg/L solution on Day 0.	Spiked with 78 µL of saturated benzene to target a final benzene concentration of 2.3 mg/L.	Amend with nitrogen gas as needed.
	Shallow Aerobic Treatment	4 to 6	3			40	--	--			Amend with oxygen gas to an initial target of 21 % of the headspace and then maintain as needed between 5-8 mg/L DO.
2	Shallow Aerobic Sterile Control	13 to 15	3	Amended with 60 g of MPE and PZ-1.	Amended with 180 mL of MPE site groundwater.	40	Amended with 0.45 mL of a 5 % solution on Day 0.	Amended with 2.52 mL of a 2.7% solution on Day 0.	Amended first replicate with 100 µL of a 1,000 mg/L solution on Day 0.	Spiked with 528 µL of saturated benzene to a target concentration of 5 mg/L.	Amend with nitrogen gas as needed.
	Shallow Aerobic Treatment	16 to 18	3			40	--	--			Amend with oxygen gas to an initial target of 21 % of the headspace and then maintain as needed between 5-8 mg/L DO.

Notes:
-- - not applicable
% - percent
µL - microliter
DO - dissolved oxygen
g - grams
mg/L - milligrams per liter
mL - milliliters

TABLE 2-1: SUMMARY OF AEROBIC MICROCOSM BENZENE, CB AND METHANE RESULTS (TEST 1)

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

SiREM

Treatment	Date	Day	Replicate	Benzene	Methane	Comment
				mg/L	mg/L	
Shallow Aerobic Sterile Control	13-Jul-20	0				Poisoned with mecuric chloride and sodium azide.
						Amended the first replicate with resazurin.
						Spiked with benzene to target a final concentration of 5.0 mg/L.
						Amended with 16.8 mL of nitrogen gas.
			SASC-1	4.8	<0.10	
			SASC-2	4.5	<0.10	
			SASC-3	4.6	<0.10	
			Average Concentration (mg/L)	4.6	ND	
			Standard Deviation (mmoles)	4.4E-04	0.0E+00	
			Average Total mmoles	**0.011**	**ND**	
	15-Jul-20	2	SASC-1	4.6	<0.10	
			SASC-2	4.5	<0.10	
			SASC-3	4.4	<0.10	
			Average Concentration (mg/L)	4.5	ND	
			Standard Deviation (mmoles)	2.2E-04	0.0E+00	
			Average Total mmoles	**0.011**	**ND**	
						Amended with 8.4 mL of nitrogen gas.
	17-Jul-20	4	SASC-1	4.6	<0.10	
			SASC-2	4.4	<0.10	
			SASC-3	4.1	<0.10	
			Average Concentration (mg/L)	4.4	ND	
			Standard Deviation (mmoles)	6.3E-04	0.0E+00	
			Average Total mmoles	**0.011**	**ND**	
						Amended with 8.4 mL of nitrogen gas.
	20-Jul-20	7				Amended with 8.4 mL of nitrogen gas.
	23-Jul-20	10				Amended with 8.4 mL of nitrogen gas.
	27-Jul-20	14	SASC-1	4.4	<0.10	
			SASC-2	4.2	<0.10	
			SASC-3	4.0	<0.10	
			Average Concentration (mg/L)	4.2	ND	
			Standard Deviation (mmoles)	5.5E-04	0.0E+00	
			Average Total mmoles	**0.010**	**ND**	
						Amended with 8.4 mL of nitrogen gas.
	05-Aug-20	23	SASC-1	4.3	<0.10	
			SASC-2	4.1	<0.10	
			SASC-3	4.1	<0.10	
			Average Concentration (mg/L)	4.2	ND	
			Standard Deviation (mmoles)	2.8E-04	0.0E+00	
			Average Total mmoles	**0.010**	**ND**	
						Amended with 8.4 mL of nitrogen gas.
	14-Aug-20	32				Amended with 8.4 mL of nitrogen gas.
	19-Aug-20	37	SASC-1	4.3	<0.10	
			SASC-2	4.2	<0.10	
			SASC-3	3.8	<0.10	
			Average Concentration (mg/L)	4.1	ND	
			Standard Deviation (mmoles)	6.4E-04	0.0E+00	
			Average Total mmoles	**0.010**	**ND**	
	27-Aug-20	45				Amended with 8.4 mL of nitrogen gas.

TABLE 2-1: SUMMARY OF AEROBIC MICROCOSM BENZENE, CB AND METHANE RESULTS (TEST 1)

SiREM

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	Benzene	Methane	Comment
				mg/L	mg/L	
Shallow Aerobic Sterile Control Continued	02-Sep-20	51	SASC-1	4.3	<0.10	
			SASC-2	4.2	<0.10	
			SASC-3	4.1	<0.10	
			Average Concentration (mg/L)	4.2	ND	
			Standard Deviation (mmoles)	3.3E-04	0.0E+00	
			Average Total mmoles	**0.010**	**ND**	
						Amended with 8.4 mL of nitrogen gas.
	11-Sep-20	60	SASC-1	4.1	<0.10	
			SASC-2	3.8	<0.10	
			SASC-3	4.0	<0.10	
			Average Concentration (mg/L)	4.0	ND	
			Standard Deviation (mmoles)	3.7E-04	0.0E+00	
			Average Total mmoles	**0.0096**	**ND**	
						Amended with 8.4 mL of nitrogen gas.
	01-Oct-20	80	SASC-1	4.3	<0.10	
			SASC-2	4.0	<0.10	
			SASC-3	4.1	<0.10	
			Average Concentration (mg/L)	4.1	ND	
			Standard Deviation (mmoles)	3.0E-04	0.0E+00	
			Average Total mmoles	**0.0099**	**ND**	
Shallow Aerobic Treatment	13-Jul-20	0				Amended the first replicate with resazurin.
						Spiked with benzene to target a final concentration of 5.0 mg/L.
						Amended with 16.8 mL of oxygen gas.
			SAT-1	4.8	<0.10	
			SAT-2	4.8	<0.10	
			SAT-3	5.1	<0.10	
			Average Concentration (mg/L)	4.9	ND	
			Standard Deviation (mmoles)	4.3E-04	0.0E+00	
			Average Total mmoles	**0.012**	**ND**	
	15-Jul-20	2	SAT-1	4.6	<0.10	
			SAT-2	4.4	<0.10	
			SAT-3	5.0	<0.10	
			Average Concentration (mg/L)	4.7	ND	
			Standard Deviation (mmoles)	7.0E-04	0.0E+00	
			Average Total mmoles	**0.011**	**ND**	
						Amended with 8.4 mL of oxygen gas.
	17-Jul-20	4	SAT-1	4.4	<0.10	
			SAT-2	4.5	<0.10	
			SAT-3	4.7	<0.10	
			Average Concentration (mg/L)	4.5	ND	
			Standard Deviation (mmoles)	3.8E-04	0.0E+00	
			Average Total mmoles	**0.011**	**ND**	
						Amended with 8.4 mL of oxygen gas.
	20-Jul-20	7				Amended with 8.4 mL of oxygen gas.
	23-Jul-20	10				Amended with 8.4 mL of oxygen gas.
	27-Jul-20	14	SAT-1	3.8	<0.10	
			SAT-2	3.5	<0.10	
			SAT-3	4.2	<0.10	
			Average Concentration (mg/L)	3.8	ND	
			Standard Deviation (mmoles)	8.1E-04	0.0E+00	
			Average Total mmoles	**0.0092**	**ND**	
						Amended with 8.4 mL of oxygen gas.

TABLE 2-1: SUMMARY OF AEROBIC MICROCOSM BENZENE, CB AND METHANE RESULTS (TEST 1)

SiREM

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	Benzene	Methane	Comment
				mg/L	mg/L	
Shallow Aerobic Treatment Continued	05-Aug-20	23	SAT-1	2.8	<0.10	
			SAT-2	2.5	<0.10	
			SAT-3	3.6	<0.10	
			Average Concentration (mg/L)	3.0	ND	
			Standard Deviation (mmoles)	1.4E-03	0.0E+00	
			Average Total mmoles	**0.0072**	**ND**	
						Amended with 8.4 mL of oxygen gas.
	14-Aug-20	32				Amended with 8.4 mL of oxygen gas.
	19-Aug-20	37	SAT-1	2.1	<0.10	
			SAT-2	1.3	<0.10	
			SAT-3	2.9	<0.10	
			Average Concentration (mg/L)	2.1	ND	
			Standard Deviation (mmoles)	1.9E-03	0.0E+00	
			Average Total mmoles	**0.0050**	**ND**	
	27-Aug-20	45				Amended with 8.4 mL of oxygen gas.
	02-Sep-20	51	SAT-1	1.1	<0.10	
			SAT-2	0.76	<0.10	
			SAT-3	2.2	<0.10	
			Average Concentration (mg/L)	1.4	ND	
			Standard Deviation (mmoles)	1.9E-03	0.0E+00	
			Average Total mmoles	**0.0033**	**ND**	
						Amended with 8.4 mL of oxygen gas.
	11-Sep-20	60	SAT-1	0.84	<0.10	
			SAT-2	0.40	<0.10	
			SAT-3	2.1	<0.10	
			Average Concentration (mg/L)	1.1	ND	
			Standard Deviation (mmoles)	2.2E-03	0.0E+00	
			Average Total mmoles	**0.0027**	**ND**	
	24-Sep-20	73	SAT-1	0.47	<0.10	
			SAT-2	0.37	<0.10	
			SAT-3	<0.020	<0.10	
			Average Concentration (mg/L)	0.28	ND	
			Standard Deviation (mmoles)	6.0E-04	0.0E+00	
			Average Total mmoles	**0.00068**	**ND**	
						Amended with 8.4 mL of oxygen gas.
	01-Oct-20	80	SAT-1	0.30	<0.10	
			SAT-2	0.38	<0.10	
			SAT-3	<0.020	<0.10	
			Average Concentration (mg/L)	0.22	ND	
			Standard Deviation (mmoles)	4.8E-04	0.0E+00	
			Average Total mmoles	**0.00054**	**ND**	

Notes:

< - the compound is not detected, the associated value is the detection limit
CB - chlorobenzene
mg/L - milligrams per liter
mL - milliliters
mmole - millimole
ND - not detected
SASC - shallow arobic sterile control
SAT - shallow aerobic treatment

TABLE 2-2: SUMMARY OF AEROBIC MICROCOSM BENZENE AND P-CYMENE RESULTS (TEST 2)

SiREM

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	SiREM	External		Comment
				Benzene	Benzene	p-Cymene	
				mg/L	mg/L	mg/L	
Aerobic Baseline	20-Nov-20	0	Aerobic 2-Baseline-1	--	1.83	0.122J	
			Aerobic 2-Baseline-2	--	1.83	0.123J	
			Average Concentration (mg/L)	--	1.83	0.123	
			Standard Deviation (mmoles)	--	0.0E+00	7.1E-04	
			Average Total mmoles	**--**	**0.0044**	**0.00018**	
Shallow Aerobic Sterile Control	20-Nov-20	0					Amended with mecuric chloride and sodium azide.
							Amended the first replicate with resazurin.
							Spiked with benzene to target a final concentration of 5.0 mg/L.
							Amended with 16.8 mL of nitrogen.
			SC-Shallow-1	2.18	--	--	
			SC-Shallow-2	2.09	--	--	
			SC-Shallow-3	2.13	--	--	
			Average Concentration (mg/L)	2.13	--	--	
			Standard Deviation (mmoles)	4.8E-02	--	--	
			Average Total mmoles	**0.0042**	**--**	**--**	
	21-Nov-20	1					Amended with 8.4 mL of nitrogen.
	23-Nov-20	3					Amended with 8.4 mL of nitrogen.
	24-Nov-20	4					Amended with 8.4 mL of nitrogen.
							Spiked with benzene to target concentrations of 5 mg/L.
	25-Nov-20	5					Amended with 8.4 mL of nitrogen.
			SC-Shallow-1	5.18	--	--	
			SC-Shallow-2	5.07	--	--	
			SC-Shallow-3	5.03	--	--	
			Average Concentration (mg/L)	5.09	--	--	
			Standard Deviation (mmoles)	7.8E-02	--	--	
			Average Total mmoles	**0.0101**	**--**	**--**	
							Amended with 8.4 mL of nitrogen.
	26-Nov-20	6					Amended with 8.4 mL of nitrogen.
	27-Nov-20	7	SC-Shallow-1	4.74	--	--	
			SC-Shallow-2	4.60	--	--	
			SC-Shallow-3	4.74	--	--	
			Average Concentration (mg/L)	4.69	--	--	
			Standard Deviation (mmoles)	7.8E-02	--	--	
			Average Total mmoles	**0.0093**	**--**	**--**	
							Amended with 8.4 mL of nitrogen.
	29-Nov-20	9					Amended with 8.4 mL of nitrogen.
	30-Nov-20	10	SC-Shallow-1	4.62	--	--	
			SC-Shallow-2	4.42	--	--	
			SC-Shallow-3	4.66	--	--	
			Average Concentration (mg/L)	4.57	--	--	
			Standard Deviation (mmoles)	1.3E-01	--	--	
			Average Total mmoles	**0.0091**	**--**	**--**	

TABLE 2-2: SUMMARY OF AEROBIC MICROCOSM BENZENE AND P-CYMENE RESULTS (TEST 2)

SiREM

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	Benzene	Benzene	p-Cymene	Comment
				mg/L	mg/L	mg/L	
Unamended Sterile Control Continued	04-Dec-20	14	SC-Shallow-1	4.62	--	--	
			SC-Shallow-2	4.46	--	--	
			SC-Shallow-3	4.64	--	--	
			Average Concentration (mg/L)	4.57	--	--	
			Standard Deviation (mmoles)	9.9E-02	--	--	
			Average Total mmoles	**0.0091**	**--**	**--**	
	08-Dec-20	18					Amended with 5.0 mL of nitrogen.
	18-Dec-20	28	SC-Shallow-1	4.27	--	--	
			SC-Shallow-2	4.25	--	--	
			SC-Shallow-3	4.34	--	--	
			Average Concentration (mg/L)	4.29	--	--	
			Standard Deviation (mmoles)	4.7E-02	--	--	
			Average Total mmoles	**0.0085**	**--**	**--**	
	23-Dec-20	33					Amended with 4.2 mL of nitrogen.
	07-Jan-21	48	SC-Shallow-1	4.21	--	--	
			SC-Shallow-2	3.96	--	--	
			SC-Shallow-3	4.28	--	--	
			Average Concentration (mg/L)	4.15	--	--	
			Standard Deviation (mmoles)	1.7E-01	--	--	
			Average Total mmoles	**0.0083**	**--**	**--**	
							Amended with 8.4 mL of nitrogen.
	13-Jan-21	54	SC-Shallow-1	--	3.51	0.310	
			SC-Shallow-2	--	3.32	0.606	
			SC-Shallow-3	--	3.45	0.291	
			Average Concentration (mg/L)	--	3.43	0.402	
			Standard Deviation (mmoles)	--	9.7E-02	1.8E-01	
			Average Total mmoles	**--**	**0.0083**	**0.00058**	
Shallow Aerobic Treatment	20-Nov-20	0					Amended the first replicate with resazurin.
							Spiked with benzene to target a final concentration of 5.0 mg/L.
							Amended with 16.8 mL of oxygen.
			Aerobic-Shallow-1	2.20	--	--	
			Aerobic-Shallow-2	2.25	--	--	
			Aerobic-Shallow-3	2.10	--	--	
			Average Concentration (mg/L)	2.18	--	--	
			Standard Deviation (mmoles)	7.5E-02	--	--	
			Average Total mmoles	**0.0044**	**--**	**--**	
	21-Nov-20	1					Amended with 8.4 mL of oxygen.
	23-Nov-20	3					Amended with 8.4 mL of oxygen.
	24-Nov-20	4					Amended with 8.4 mL of nitrogen.
							Amended with 8.4 mL of oxygen.
							Spiked with benzene to target concentrations of 5 mg/L.

TABLE 2-2: SUMMARY OF AEROBIC MICROCOSM BENZENE AND P-CYMENE RESULTS (TEST 2)

SiREM

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	Benzene	Benzene	p-Cymene	Comment
				mg/L	mg/L	mg/L	
Shallow Aerobic Treatment Continued	25-Nov-20	5					Amended with 8.4 mL of oxygen.
			Aerobic-Shallow-1	4.57	--	--	
			Aerobic-Shallow-2	4.65	--	--	
			Aerobic-Shallow-3	4.55	--	--	
			Average Concentration (mg/L)	4.59	--	--	
			Standard Deviation (mmoles)	5.3E-02	--	--	
			Average Total mmoles	**0.0091**	**--**	**--**	
							Amended with 8.4 mL of oxygen.
	26-Nov-20	6					Amended with 8.4 mL of oxygen.
	27-Nov-20	7	Aerobic-Shallow-1	3.86	--	--	
			Aerobic-Shallow-2	3.93	--	--	
			Aerobic-Shallow-3	4.02	--	--	
			Average Concentration (mg/L)	3.94	--	--	
			Standard Deviation (mmoles)	8.2E-02	--	--	
			Average Total mmoles	**0.0078**	**--**	**--**	
							Amended with 8.4 mL of oxygen.
	29-Nov-20	9					Amended with 8.4 mL of oxygen.
	30-Nov-20	10	Aerobic-Shallow-1	3.50	--	--	
			Aerobic-Shallow-2	3.45	--	--	
			Aerobic-Shallow-3	3.76	--	--	
			Average Concentration (mg/L)	3.57	--	--	
			Standard Deviation (mmoles)	1.7E-01	--	--	
			Average Total mmoles	**0.0071**	**--**	**--**	
	04-Dec-20	14	Aerobic-Shallow-1	3.23	--	--	
			Aerobic-Shallow-2	3.39	--	--	
			Aerobic-Shallow-3	3.54	--	--	
			Average Concentration (mg/L)	3.39	--	--	
			Standard Deviation (mmoles)	1.6E-01	--	--	
			Average Total mmoles	**0.0067**	**--**	**--**	
							Amended with 4.2 mL of oxygen.
	08-Dec-20	18					Amended with 5.0 mL of oxygen.
	18-Dec-20	28	Aerobic-Shallow-1	0.87	--	--	
			Aerobic-Shallow-2	2.36	--	--	
			Aerobic-Shallow-3	2.07	--	--	
			Average Concentration (mg/L)	1.77	--	--	
			Standard Deviation (mmoles)	7.9E-01	--	--	
			Average Total mmoles	**0.0035**	**--**	**--**	
	23-Dec-20	33					Amended with 4.2 mL of oxygen.

TABLE 2-2: SUMMARY OF AEROBIC MICROCOSM BENZENE AND P-CYMENE RESULTS (TEST 2)

SiREM

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	Benzene	Benzene	p-Cymene	Comment
				mg/L	mg/L	mg/L	
Shallow Aerobic Treatment Continued	07-Jan-21	48	Aerobic-Shallow-1	<0.020	--	--	
			Aerobic-Shallow-2	0.86	--	--	
			Aerobic-Shallow-3	<0.020	--	--	
			Average Concentration (mg/L)	0.86	--	--	
			Standard Deviation (mmoles)	5.0E-01	--	--	
			Average Total mmoles	**0.00057**	**--**	**--**	
							Amended with 4.2 mL of oxygen.
	13-Jan-21	54	Aerobic-Shallow-1	--	0.0127J	0.0059J	
			Aerobic-Shallow-2	--	0.037	0.043	
			Aerobic-Shallow-3	--	<0.025	<0.025	
			Average Concentration (mg/L)	--	0.0170	0.024	
			Standard Deviation (mmoles)	--	2.6E+01	2.6E-02	
			Average Total mmoles	**--**	**0.000041**	**0.000035**	

Notes:

BAP - base activated persulfate
g/L - grams per liter
mg/L - milligrams per liter
mmoles - millimoles
ND - not detected
SC - sterile control
J - estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Treatment	Date	Day	Replicate	pH	DO	O_2/TOC**	O_2/VOC***
					mg/L	g O_2/g TOC	g O_2/g VOC
Baseline	S-5715 Geologic Material TOC: 0.73 %						
Shallow Aerobic Sterile Control	13-Jul-20	0	SASC-1	6.16	2.74		
			SASC-2	6.25	1.95	--	--
			SASC-3	6.26	1.28		
			Average	**6.22**	**1.99**	**--**	**--**
			Amended with 16.8 mL of nitrogen.				
	15-Jul-20	2	SASC-1	6.37	5.17		
			SASC-2	6.42	3.75	--	--
			SASC-3	6.48	2.40		
			Average	**6.42**	**3.77**	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	17-Jul-20	4	SASC-1	6.06	2.29		
			SASC-2	6.17	2.51	--	--
			SASC-3	6.25	2.20		
			Average	**6.16**	**2.33**	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	20-Jul-20	7	SASC-1	--			
			SASC-2	--	2.08*	--	--
			SASC-3	--			
			Average	**--**	**2.08***	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	23-Jul-20	10	SASC-1	--			
			SASC-2	--	2.35*	--	--
			SASC-3	--			
			Average	**--**	**2.35***	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	27-Jul-20	14	SASC-1	6.07			
			SASC-2	6.17	2.35*	--	--
			SASC-3	6.20			
			Average	**6.15**	**2.35***	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	5-Aug-20	23	SASC-1	5.97	1.42		
			SASC-2	6.06	3.01	--	--
			SASC-3	6.06	2.40		
			Average	**6.03**	**2.28**	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	14-Aug-20	32	SASC-1	--	1.91		
			SASC-2	--	2.33	--	--
			SASC-3	--	2.47		
			Average	**--**	**2.24**	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	19-Aug-20	37	SASC-1	6.00	2.67		
			SASC-2	6.29	2.27	--	--
			SASC-3	6.17	2.22		
			Average	**6.15**	**2.39**	**--**	**--**
	27-Aug-20	45	SASC-1	--	2.69		
			SASC-2	--	1.93	--	--
			SASC-3	--	1.96		
			Average	**--**	**2.19**	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	2-Sep-20	51	SASC-1	5.93	2.65		
			SASC-2	6.00	2.32	--	--
			SASC-3	6.01	3.20		
			Average	**5.98**	**2.72**	**--**	**--**
			Amended with 8.4 mL of nitrogen.				
	11-Sep-20	60	SASC-1	6.31	3.23		
			SASC-2	6.45	2.09	--	--
			SASC-3	6.50	2.20		
			Average	**6.42**	**2.51**	**--**	**--**
	18-Sep-20	67	SASC-1	--	3.35		
			SASC-2	--	2.11	--	--
			SASC-3	--	4.07		
			Average	**--**	**3.18**	**--**	**--**
	1-Oct-20	80	SASC-1	6.09	3.22		
			SASC-2	6.17	3.04	--	--
			SASC-3	6.13	2.92		
			Average	**6.13**	**3.06**	**--**	**--**
Shallow Aerobic Treatment	13-Jul-20	0	SAT-1	6.50	7.47		
			SAT-2	6.32	6.34	--	--
			SAT-3	6.63	7.04		
			Average	**6.48**	**6.95**	**--**	**--**
			Amended with 16.8 mL oxygen.				
	15-Jul-20	2	SAT-1	6.71	2.20		
			SAT-2	6.74	2.04	0.051	25
			SAT-3	6.36	2.61		
			Average	**6.60**	**2.28**	**0.051**	**25**
			Amended with 8.4 mL oxygen.				
	17-Jul-20	4	SAT-1	6.29	3.08		
			SAT-2	6.32	2.18	0.076	38
			SAT-3	6.44	3.19		
			Average	**6.35**	**2.82**	**0.076**	**38**
			Amended with 8.4 mL oxygen.				
				--	5.8	0.102	51
	20-Jul-20	7	SAT-1	--			
			SAT-2	--	4.33*	0.102	51
			SAT-3	--			
			Average	**--**	**4.33**	**0.102**	**51**
			Amended with 8.4 mL oxygen.				
	23-Jul-20	10	SAT-1	--			
			SAT-2	--	3.97*	0.127	63
			SAT-3	--			
			Average	**--**	**3.97**	**0.127**	**63**
			Amended with 8.4 mL oxygen.				
	27-Jul-20	14	SAT-1	6.32			
			SAT-2	6.29	4.04*	0.153	76
			SAT-3	6.32			
			Average	**6.31**	**4.04**	**0.153**	**76**
			Amended with 8.4 mL oxygen.				
	5-Aug-20	23	SAT-1	6.14	3.58		
			SAT-2	6.14	3.06	0.178	89
			SAT-3	6.24	2.84		
			Average	**6.17**	**3.16**	**0.178**	**89**
			Amended with 8.4 mL oxygen.				

TABLE 3-1: SUMMARY OF AEROBIC MICROCOSM TOC, pH, DO, AND OXYGEN PER TOTAL CARBON RESULTS (TEST 1)
SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	pH	DO	O_2/TOC**	O_2/VOC***
					mg/L	g O_2/g TOC	g O_2/g VOC
Shallow Aerobic Treatment Continued	14-Aug-20	32	SAT-1	--	4.25		
			SAT-2	--	2.85	0.204	101
			SAT-3	--	2.83		
			Average	**--**	**3.31**	**0.204**	**101**
			Amended with 8.4 mL oxygen.				
	19-Aug-20	37	SAT-1	6.16	5.74		
			SAT-2	6.20	4.70	0.229	114
			SAT-3	6.32	2.64		
			Average	**6.23**	**4.36**	**0.229**	**114**
	27-Aug-20	45	SAT-1	--	2.94		
			SAT-2	--	4.13	0.229	114
			SAT-3	--	5.21		
			Average	**--**	**4.09**	**0.229**	**114**
			Amended with 8.4 mL oxygen.				
	2-Sep-20	51	SAT-1	6.05	2.35		
			SAT-2	6.05	2.00	0.255	127
			SAT-3	6.18	3.37		
			Average	**6.09**	**2.57**	**0.255**	**127**
			Amended with 8.4 mL oxygen.				
	11-Sep-20	60	SAT-1	6.52	6.02		
			SAT-2	6.57	5.21	0.280	139
			SAT-3	6.55	6.79		
			Average	**6.55**	**6.01**	**0.280**	**139**
	18-Sep-20	67	SAT-1	--	6.02		
			SAT-2	--	5.31	0.280	139
			SAT-3	--	5.26		
			Average	**--**	**5.53**	**0.280**	**139**
	1-Oct-20	80	SAT-1	6.12	6.25		
			SAT-2	6.28	4.18	0.280	139
			SAT-3	6.17	6.39		
			Average	**6.19**	**5.61**	**0.280**	**139**

Notes:

* Composite sample, measured wit optical DO probe, standard measurements collected using electrode DO probe
**Calculated as total grams of oxygen added per grams of total organic carbon (sum of geologic material TOC and aqueous VOCs) at the start of testing

**Calculated as total grams of oxygen added per grams of total VOCs at the start of testing
% - percent
mg O_2/g TOC - milligrams of oxygen amended to reactor per gram of organic carbon at the start of the incubation period
mg O_2/g VOC - milligrams of oxygen amended to reactor per gram of total VOCs at the start of the incubation period
mg/L - milligrams per liter
mL - milliliters
O_2 - oxygen gas
SASC - shallow arobic sterile control
SAT - shallow aerobic treatment
TOC - total organic carbon
VOC - volatile organic compound

TABLE 3-2: SUMMARY OF AEROBIC MICROCOSM TOC, pH, DO, AND OXYGEN PER TOTAL CARBON RESULTS
SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	pH	DO	O_2/TOC**	O_2/VOC***
					mg/L	g O_2/g TOC	g O_2/g VOC
Baseline Shallow Benzene	S-5715 Geologic Material TOC: 0.73 %						
Shallow Aerobic Sterile Control	20-Nov-20	0	SC-Shallow-1				
			SC-Shallow-2	--	--	--	--
			SC-Shallow-3				
				--	--	--	--
				Amended with 16.8 mL of nitrogen.			
	21-Nov-20	1	SC-Shallow-1	6.52			
			SC-Shallow-2	6.68	--	--	--
			SC-Shallow-3	6.34			
				6.51	--	--	--
				Amended with 8.4 mL of nitrogen.			
	23-Nov-20	3	SC-Shallow-1		4.90		
			SC-Shallow-2	--	3.04	--	--
			SC-Shallow-3		3.50		
				--	**3.81**	--	--
				Amended with 8.4 mL of nitrogen.			
	24-Nov-20	4		Amended with 8.4 mL of nitrogen.			
	25-Nov-20	5	SC-Shallow-1		3.71		
			SC-Shallow-2	--	3.82	--	--
			SC-Shallow-3		3.55		
				--	**3.70**	--	--
	26-Nov-20	6		Amended with 8.4 mL of nitrogen.			
	27-Nov-20	7	SC-Shallow-1	6.20	4.85		
			SC-Shallow-2	6.18	3.75	--	--
			SC-Shallow-3	6.14	4.99		
				6.17	**4.53**	--	--
	27-Nov-20	7		Amended with 8.4 mL of nitrogen.			
	29-Nov-20	9		Amended with 8.4 mL of nitrogen.			
	30-Nov-20	10	SC-Shallow-1	5.91	5.98		
			SC-Shallow-2	5.96	5.08	--	--
			SC-Shallow-3	5.78	5.71		
				5.88	**5.59**	--	--
	1-Dec-20	11	SC-Shallow-1		4.07		
			SC-Shallow-2	--	3.78	--	--
			SC-Shallow-3		3.91		
				--	**3.92**	--	--
	2-Dec-20	12	SC-Shallow-1		3.89		
			SC-Shallow-2	--	3.67	--	--
			SC-Shallow-3		3.89		
				--	**3.82**	--	--
	4-Dec-20	14	SC-Shallow-1	6.33	3.78		
			SC-Shallow-2	6.49	3.76	--	--
			SC-Shallow-3	6.32	3.91		
				6.38	**3.82**	--	--
	8-Dec-20	18	SC-Shallow-1		2.47		
			SC-Shallow-2	--	2.78	--	--
			SC-Shallow-3		2.42		
				--	**2.56**	--	--
				Amended with 5.0 mL of nitrogen.			
	11-Dec-20	21	SC-Shallow-1		3.80		
			SC-Shallow-2	--	3.73	--	--
			SC-Shallow-3		3.31		
				--	**3.61**	--	--
	18-Dec-20	28	SC-Shallow-1		3.08		
			SC-Shallow-2	--	2.74	--	--
			SC-Shallow-3		3.15		
				--	**2.99**	--	--
	23-Dec-20	33	SC-Shallow-1		3.71	--	--
			SC-Shallow-2	--	3.15		
			SC-Shallow-3		3.87		
				--	**3.58**	--	--
				Amended with 4.2 mL of nitrogen.			
	29-Dec-20	39	SC-Shallow-1	5.90	4.23		
			SC-Shallow-2	5.95	3.53	--	--
			SC-Shallow-3	5.82	3.51		
				5.89	**3.76**	--	--
	31-Dec-20	41	SC-Shallow-1		3.67		
			SC-Shallow-2	--	2.92	--	--
			SC-Shallow-3		3.10		
				--	**3.23**	--	--
	4-Jan-21	45	SC-Shallow-1		3.78		
			SC-Shallow-2	--	3.85	--	--
			SC-Shallow-3		3.87		
				--	**3.83**	--	--
	7-Jan-21	48	SC-Shallow-1	6.02	3.91		
			SC-Shallow-2	6.06	3.49	--	--
			SC-Shallow-3	5.91	3.85		
				6.00	**3.75**	--	--
				Amended with 8.4 mL of nitrogen.			
	11-Jan-21	52	SC-Shallow-1		4.32		
			SC-Shallow-2	--	4.30	--	--
			SC-Shallow-3		4.70		
				--	**4.44**	--	--
Shallow Aerobic Treatment	20-Nov-20	0	Aerobic-Shallow-1				
			Aerobic-Shallow-2	--	--	--	--
			Aerobic-Shallow-3				
				--	--	--	--
				Amended with 16.8 mL oxygen.			
	21-Nov-20	1	Aerobic-Shallow-1	6.55			
			Aerobic-Shallow-2	6.70	--	0.017	25
			Aerobic-Shallow-3	6.75			
				6.67	--	**0.017**	**25**
				Amended with 8.4 mL oxygen.			

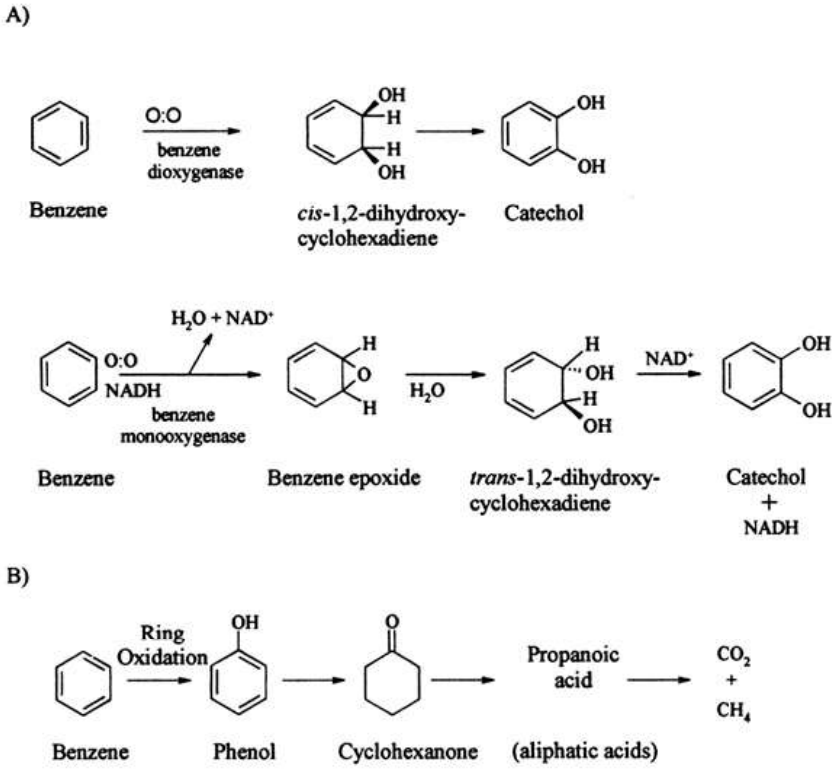
TABLE 3-2: SUMMARY OF AEROBIC MICROCOSM TOC, pH, DO, AND OXYGEN PER TOTAL CARBON RESULTS
SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

Treatment	Date	Day	Replicate	pH	DO	O_2/TOC**	O_2/VOC***
					mg/L	g O_2/g TOC	g O_2/g VOC
	23-Nov-20	3	Aerobic-Shallow-1		4.83		
			Aerobic-Shallow-2	--	3.56	0.025	38
			Aerobic-Shallow-3		3.81		
				--	**4.07**	**0.025**	**38**
				Amended with 8.4 mL oxygen.			
	24-Nov-20	4	Amended with 8.4 mL of nitrogen by accident.				
				Amended with 8.4 mL oxygen.			
	25-Nov-20	5	Aerobic-Shallow-1		4.95		
			Aerobic-Shallow-2	--	4.16	0.042	63
			Aerobic-Shallow-3		4.90		
				--	**4.67**	**0.042**	**63**
				Amended with 8.4 mL oxygen.			
	26-Nov-20	6	Amended with 8.4 mL oxygen.				
	27-Nov-20	7	Aerobic-Shallow-1	6.41	6.95		
			Aerobic-Shallow-2	6.44	5.64	0.059	89
			Aerobic-Shallow-3	6.60	7.14		
				6.48	**6.57**	**0.059**	**89**
				Amended with 8.4 mL oxygen.			
	29-Nov-20	9	Amended with 8.4 mL oxygen.				
	30-Nov-20	10	Aerobic-Shallow-1	6.03	11.68		
			Aerobic-Shallow-2	6.07	9.83	0.076	114
			Aerobic-Shallow-3	6.12	9.99		
				6.07	**10.50**	**0.076**	**114**
	1-Dec-20	11	Aerobic-Shallow-1		7.58		
			Aerobic-Shallow-2	--	7.90	0.076	114
			Aerobic-Shallow-3		7.09		
				--	**7.52**	**0.076**	**114**
	2-Dec-20	12	Aerobic-Shallow-1		5.89		
			Aerobic-Shallow-2	--	5.92	0.076	114
			Aerobic-Shallow-3		5.92		
				--	**5.91**	**0.076**	**114**
	4-Dec-20	14	Aerobic-Shallow-1	6.48	4.50		
			Aerobic-Shallow-2	6.43	4.57	0.076	114
			Aerobic-Shallow-3	6.53	4.72		
				6.48	**4.60**	**0.076**	**114**
				Amended with 4.2 mL oxygen.			
	8-Dec-20	18	Aerobic-Shallow-1		3.76		
			Aerobic-Shallow-2	--	4.29	0.081	120
			Aerobic-Shallow-3		3.92		
				--	**3.99**	**0.081**	**120**
				Amended with 5.0 mL oxygen.			
	11-Dec-20	21	Aerobic-Shallow-1		7.54		
			Aerobic-Shallow-2	--	9.14	0.086	128
			Aerobic-Shallow-3		8.35		
				--	**8.34**	**0.086**	**128**
	18-Dec-20	28	Aerobic-Shallow-1		6.38		
			Aerobic-Shallow-2	--	6.08	0.086	128
			Aerobic-Shallow-3		5.49		
				--	**5.98**	**0.086**	**128**
	23-Dec-20	33	Aerobic-Shallow-1		7.02		
			Aerobic-Shallow-2	--	5.98	0.086	128
			Aerobic-Shallow-3		5.67		
				--	**6.22**	**0.086**	**128**
				Amended with 4.2 mL oxygen.			
	29-Dec-20	39	Aerobic-Shallow-1	5.68	8.15		
			Aerobic-Shallow-2	5.64	6.50	0.090	134
			Aerobic-Shallow-3	5.94	5.42		
				5.75	**6.69**	**0.090**	**134**
	31-Dec-20	41	Aerobic-Shallow-1		8.78		
			Aerobic-Shallow-2	--	8.01	0.090	134
			Aerobic-Shallow-3		4.97		
				--	**7.25**	**0.090**	**134**
				Amended with 5.0 mL oxygen to replicate 3 only.			
	4-Jan-21	45	Aerobic-Shallow-1		7.43		
			Aerobic-Shallow-2	--	6.35	0.090	134
			Aerobic-Shallow-3		5.51		
				--	**6.43**	**0.090**	**134**
	7-Jan-21	48	Aerobic-Shallow-1	6.01	5.33		
			Aerobic-Shallow-2	5.67	4.63	0.090	134
			Aerobic-Shallow-3	5.95	3.73		
				5.88	**4.57**	**0.090**	**134**
				Amended with 4.2 mL oxygen.			
	11-Jan-21	52	Aerobic-Shallow-1		5.85		
			Aerobic-Shallow-2	--	5.47	0.094	141
			Aerobic-Shallow-3		4.81		
				--	**5.38**	**0.094**	**141**

Notes:

* Composite sample, measured wit optical DO probe, standard measurements collected using electrode DO probe
**Calculated as total
**Calculated as total grams of oxygen added per grams of total VOCs at the start of testing
% - percent
mg O_2/g TOC - milligrams of oxygen amended to reactor per gram of organic carbon at the start of the incubation period
mg O_2/g VOC - milligrams of oxygen amended to reactor per gram of total VOCs at the start of the incubation period
mg/L - milligrams per liter
mL - milliliters
O_2 - oxygen gas
TOC - total organic carbon
VOC - volatile organic compound

FIGURES



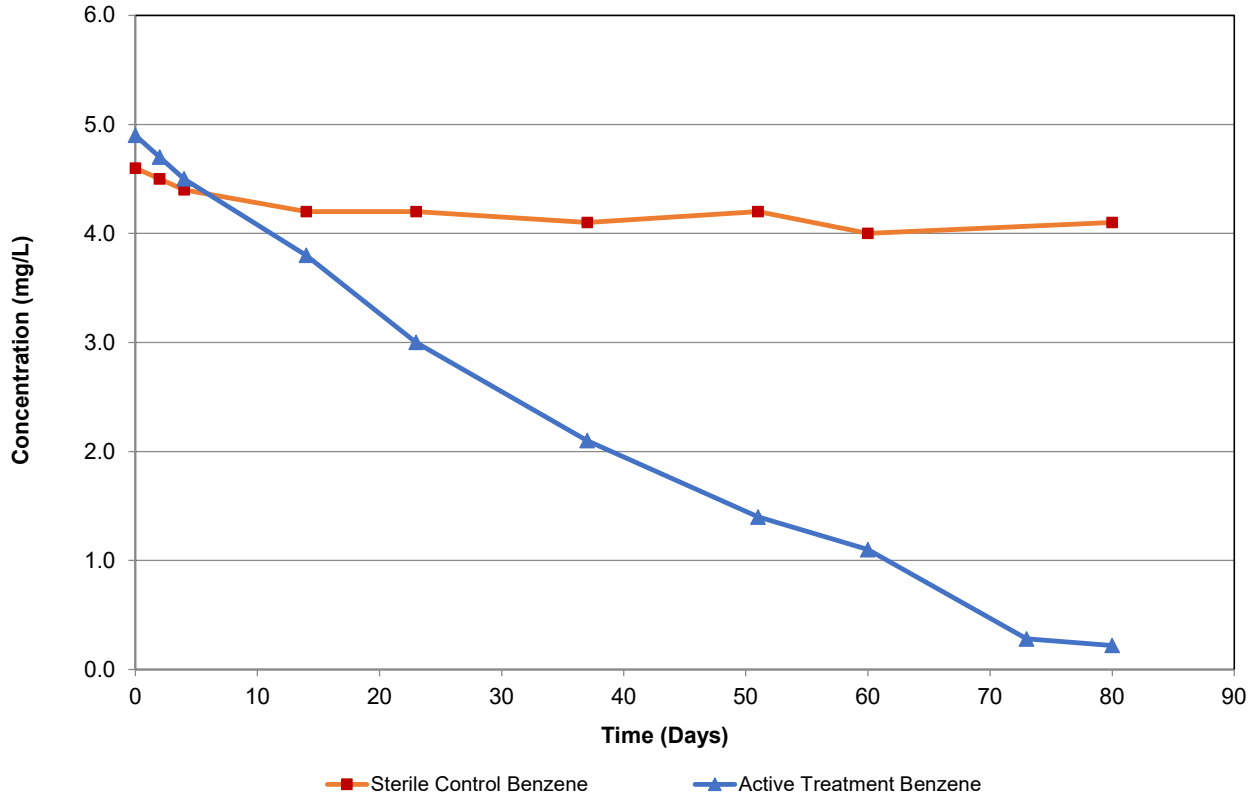
Potential Aerobic Pathway for the Biodegradation of Benzene

Mancini *et al.*, 2002

SiREM

October 2020

Figure: 1



Notes:

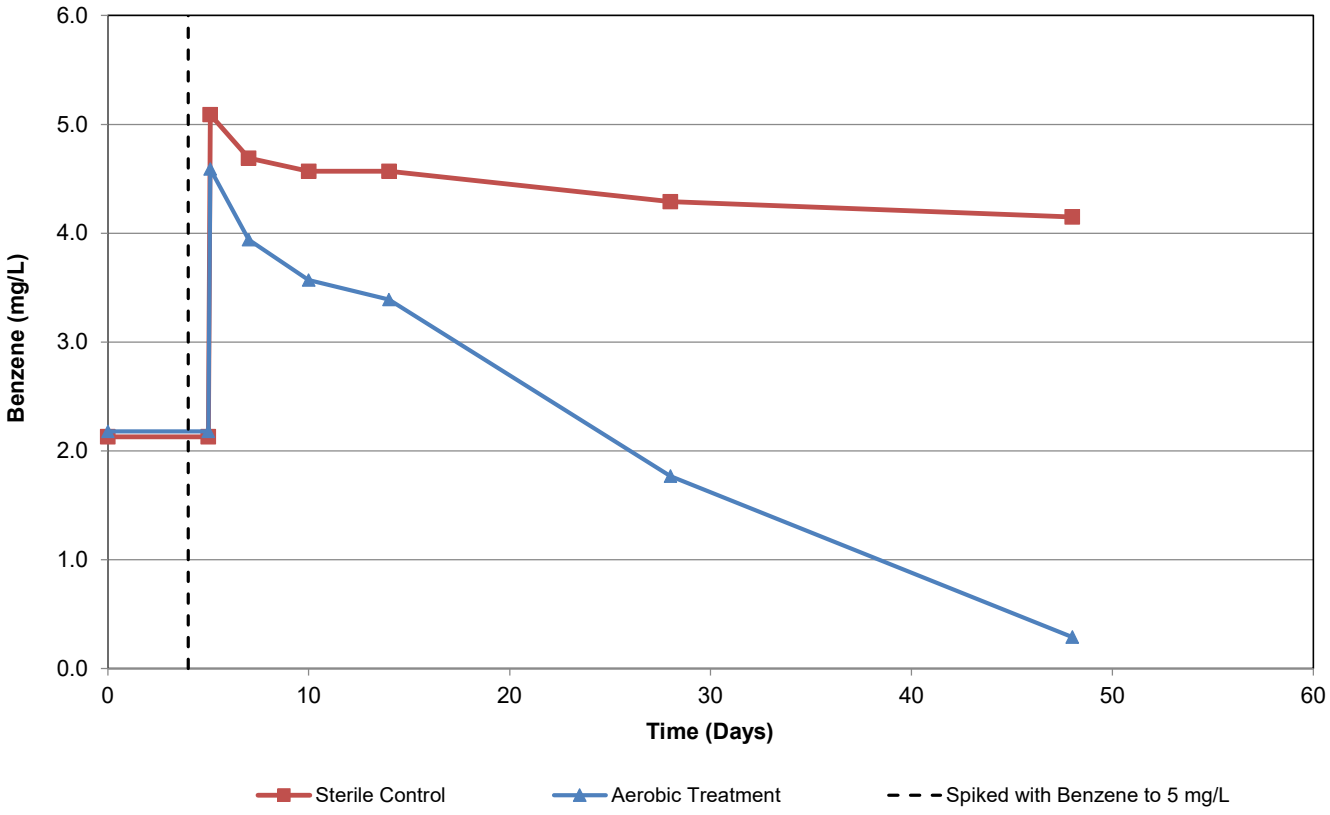
mg/L - milligrams per liter

Benzene Concentration Trends in Aerobic Microcosms (Test 1)

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

January 2021

Figure: **2**



Notes:

mg/L - milligrams per liter

Benzene Concentration Trends in Aerobic Microcosms (Test 2)

SGW-23 Area Near Stillhouse Control Room, Brunswick, GA

SiREM

January 2021

Figure: **3**

APPENDIX A: Chain of Custody Documentation

SiREM

Chain-of-Custody Form

siremlab.com

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Lab # S-5715

*Project Name: Hercules Brunswick	*Project #: GR6881C
*Project Manager: Adria Reimer	*Company: Geosyntec
*Email Address: areimer@geosyntec.com	
Address (Street): 1255 Roberts Blvd.	
City: Kennesaw	State/Province: GA	Country: USA
*Phone #: 678-202-9500	
*Sampler's Signature:	*Sampler's Printed Name: Nardos Tilahun

Analysis

Preservative Key: 0. None; 1. HCL; 2. Other; 3. Other; 4. Other; 5. Other; 6. Other

	Client Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac DHC	Gene-Trac FGA (vcA, bvcA, tceA)	Gene-Trac DHB	Gene-Trac DHG	Gene-Trac SRB	Volatile Fatty Acids	Dissolved hydrocarbon gases	Treatability Study	Other Information
1.	Pinova MPE (2-5')	2/18/20	1400	SO	1								X	Recovery = 12"
2.	Pinova MPE (5-10')	2/18/20	1400	SO	1								X	Recovery = 18"
3.	Pinova MPE (2-5')	2/18/20	1410	SO	1								X	Recovery = 2 ft.
4.	Pinova MPE (6-8')	2/18/20	1410	SO	1								X	Recovery = 4ft (1 of 2)
5.	Pinova MPE (8-10')	2/18/20	1410	SO	1								X	Recovery = 4ft (2 of 2)
6.	Pinova PZ-1 (2-5')	2/18/20	1420	SO	1								X	Recovery = 2ft
7.	Pinova PZ-1 (5-10')	2/18/20	1420	SO	1								X	Recovery = 18"

Billing Information

P.O. #:

*Bill To:

Turnaround Time Requested

Normal ☐
Rush ☐

For Lab Use Only

Cooler Condition: Good
Cooler Temperature: 3°C
Custody Seals: Yes ☐ No ☒

For Lab Use Only

Proposal #:

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: Rich Murray	Printed Name:	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: Geosyntec	Firm:	Firm:	Firm:	Firm:	Firm:
Date/Time: 2/19/2020 1730	Date/Time:	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - return to Originator; Yellow - Lab Copy; Pink - Retained by Client

* Mandatory Fields

SiREM

Chain-of-Custody Form

siremlab.com

130 Stone Rd. W
Guelph, ON N1G 3Z2
(519) 822-2265

Lab # S-5718

GR6881C

*Project Name: Hercules Brunswick	*Project #: ~~678-202-9500~~ (RJ)
*Project Manager: Adria Reimer	*Company: Geosyntec
*Email Address: areimer@geosyntec.com	
Address (Street): ~~2155~~ 1255 Roberts Blvd.	
City: Kennesaw	State/Province: GA
Country: 30144	
*Phone #: 678-202-9500	
*Sampler's Signature:	*Sampler's Printed Name: Rich Murray

Client Sample ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac DHC	Gene-Trac FGA (vcA, bvcA, tceA)	Gene-Trac DHB	Gene-Trac DHG	Gene-Trac SRB	Volatile Fatty Acids	Dissolved hydrocarbon gases	Treatability Study				Other Information
MPE Well	2/20/2020	1400	WG	4								X				4 x 2-L Bottles
~~MPE Well~~ (RJ)																

Preservative Key: 0. None; 1. HCL; 2. Other; 3. Other; 4. Other; 5. Other; 6. Other

Billing Information

P.O. #:

*Bill To:

Turnaround Time Requested

Normal ☐

Rush ☐

For Lab Use Only

Cooler Condition: Good

Cooler Temperature: 4°C

Custody Seals: Yes ☐ No ☒

For Lab Use Only

Proposal #: _____

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: Rich Murray	Printed Name: D. Vespoli	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: Geosyntec	Firm: SiREM	Firm:	Firm:	Firm:	Firm:
Date/Time: 2/20/2020 · 1700	Date/Time: Feb 24 '20 1:30pm	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: White - return to Originator; Yellow - Lab Copy; Pink - Retained by Client

* Mandatory Fields

APPENDIX B: Henry's Law Calculation

The following Henry's Law calculation was used to convert SiREM aqueous concentrations to total mmoles of each analyte per microcosm bottle:

$$Total\ mmoles = \frac{C_{liq} \cdot (V_{liq} + H \cdot V_{gas})}{Molecular\ Weight\ \left(\frac{mg}{mmol}\right)}$$

Where for the study:

C_{liq} = liquid concentration (mg/L)
V_{liq} = liquid volume (0.18 L) per bottle
V_{gas} = headspace volume (0.04 L) per bottle
H = Henry's Law constant (dimensionless)

The Henry's Law constants used are summarized in the table below.

Analyte	Henry's Law Constant [a] (dimensionless)
Benzene	0.222
Chlorobenzene	0.161
Methane	27.27

[a] Source: Montgomery, J.H. 2000. *Groundwater Chemicals Desk Reference, Third Edition.* CRC Press LLC, Boca Raton, FL.

APPENDIX C: External ALS Analytics Reports

SIREM
ATTN: Sandra Dworatzek
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 22-JUL-20
Report Date: 30-JUL-20 12:06 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2478181
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2478181-1 S-5715 ES-1 Sampled By: J. WEBB on 21-JUL-20 @ 16:00 Matrix: SOIL							
Organic / Inorganic Carbon							
Fraction Organic Carbon	0.0073		0.0010		29-JUL-20	30-JUL-20	R5171964
Fraction Organic Carbon	0.0076		0.0010		29-JUL-20	30-JUL-20	R5171964
Fraction Organic Carbon	0.0071		0.0010		29-JUL-20	30-JUL-20	R5171964
Average Fraction Organic Carbon	0.0074		0.0010		29-JUL-20	30-JUL-20	R5171964
Total Organic Carbon	0.73		0.10	%	29-JUL-20	30-JUL-20	R5171964
Total Organic Carbon	0.76		0.10	%	29-JUL-20	30-JUL-20	R5171964
Total Organic Carbon	0.71		0.10	%	29-JUL-20	30-JUL-20	R5171964
L2478181-2 S-5734 TSB-02 Sampled By: J. WEBB on 21-JUL-20 @ 16:00 Matrix: SOIL							
Organic / Inorganic Carbon							
Fraction Organic Carbon	0.0030		0.0010		29-JUL-20	30-JUL-20	R5171964
Fraction Organic Carbon	0.0031		0.0010		29-JUL-20	30-JUL-20	R5171964
Fraction Organic Carbon	0.0032		0.0010		29-JUL-20	30-JUL-20	R5171964
Average Fraction Organic Carbon	0.0031		0.0010		29-JUL-20	30-JUL-20	R5171964
Total Organic Carbon	0.30		0.10	%	29-JUL-20	30-JUL-20	R5171964
Total Organic Carbon	0.31		0.10	%	29-JUL-20	30-JUL-20	R5171964
Total Organic Carbon	0.32		0.10	%	29-JUL-20	30-JUL-20	R5171964

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
TOC-R511-WT	Soil	TOC & FOC-O.Reg 153/04 (July 2011)	CARTER 21.3.2

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2478181 Report Date: 30-JUL-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Sandra Dworatzek

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TOC-R511-WT	Soil							
Batch R5171964								
WG3372585-3 CRM		**WT-TOC-CRM**						
Total Organic Carbon			93.8		%		70-130	30-JUL-20
WG3372585-2 LCS								
Total Organic Carbon			101.3		%		80-120	30-JUL-20
Total Organic Carbon			101.3		%		80-120	30-JUL-20
Total Organic Carbon			101.3		%		80-120	30-JUL-20
WG3372585-1 MB								
Total Organic Carbon			<0.10		%		0.1	30-JUL-20

Quality Control Report

Workorder: L2478181 Report Date: 30-JUL-20

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Sandra Dworatzek

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2478181-COFC

COC Number: 20 -

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	SiREM	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Jennifer Webb & Sandra Dworatzek	Quality Control (QC) Report with Report ☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	130 Stone Road West Guelph, Ontario, N1G 3Z2	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	519-515-0839 519-822-2265	Email 1 or Fax jwebb@siremlab.com Email 2 sdworatzek@siremlab.com	Specify Date Required for E2,E or P:
Invoice To	Same as Report To ☐ Yes ☑ No Copy of Invoice with Report ☑ Yes ☐ No	**Invoice Distribution** Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	**Analysis Request** Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	SiREM a Division of Geosyntec	Email 1 or Fax accountspayablecan@siremlab.com	
Contact:	AccountsPayableCan@Siremlab.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID: / Cost Center:	
Job #:		GL Account: / Routing Code:	
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2478181 AD	**ALS Contact:**	**Sampler:** Jen Webb

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC	Number of Containers
	S-5715 ES-1	21-Jul-20	16:00	Soil	R	1
	S-5734 TSB-02	21-Jul-20	16:00	Soil	R	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			16.8		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	21 July 20	16 00					July 22/20	14:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326a v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

November 25, 2020

Steve Sande
SiREM Lab
130 Stone Road W
Ontario, Canada,

RE: Project: Brunswick Aerobic2
Pace Project No.: 50274153

Dear Steve Sande:

Enclosed are the analytical results for sample(s) received by the laboratory on November 24, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - Indianapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kelly Jones
kelly.jones@pacelabs.com
(317)228-3100
Project Manager

Enclosures

cc: Michael Healey, SiREM Lab
Jen Webb, SiREM

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Pace Analytical Services Indianapolis
7726 Moller Road, Indianapolis, IN 46268
Illinois Accreditation #: 200074
Indiana Drinking Water Laboratory #: C-49-06
Kansas/TNI Certification #: E-10177
Kentucky UST Agency Interest #: 80226
Kentucky WW Laboratory ID #: 98019
Michigan Drinking Water Laboratory #9050
Ohio VAP Certified Laboratory #: CL0065
Oklahoma Laboratory #: 9204
Texas Certification #: T104704355
West Virginia Certification #: 330
Wisconsin Laboratory #: 999788130
USDA Soil Permit #: P330-19-00257

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50274153001	**Aerobic2-BASE-1**	Water	11/20/20 16:00	11/24/20 09:00
50274153002	**Aerobic2-BASE-2**	Water	11/20/20 16:00	11/24/20 09:00

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE ANALYTE COUNT

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50274153001	**Aerobic2-BASE-1**	EPA 8260	ALA	5	PASI-I
50274153002	**Aerobic2-BASE-2**	EPA 8260	ALA	5	PASI-I

PASI-I = Pace Analytical Services - Indianapolis

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50274153001	**Aerobic2-BASE-1**					
EPA 8260	Benzene	1830	ug/L	125	11/24/20 19:53	
EPA 8260	p-Isopropyltoluene	122J	ug/L	125	11/24/20 19:53	J
50274153002	**Aerobic2-BASE-2**					
EPA 8260	Benzene	1830	ug/L	125	11/24/20 20:22	
EPA 8260	p-Isopropyltoluene	123J	ug/L	125	11/24/20 20:22	J

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Sample: Aerobic2-BASE-1 **Lab ID: 50274153001** Collected: 11/20/20 16:00 Received: 11/24/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**1830**	ug/L	125	25		11/24/20 19:53	71-43-2	
p-Isopropyltoluene	**122J**	ug/L	125	25		11/24/20 19:53	99-87-6	J
Surrogates								
Dibromofluoromethane (S)	103	%.	75-120	25		11/24/20 19:53	1868-53-7	D4
4-Bromofluorobenzene (S)	94	%.	85-116	25		11/24/20 19:53	460-00-4	
Toluene-d8 (S)	96	%.	83-111	25		11/24/20 19:53	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Sample: Aerobic2-BASE-2 **Lab ID: 50274153002** Collected: 11/20/20 16:00 Received: 11/24/20 09:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**1830**	ug/L	125	25		11/24/20 20:22	71-43-2	
p-Isopropyltoluene	**123J**	ug/L	125	25		11/24/20 20:22	99-87-6	J
Surrogates								
Dibromofluoromethane (S)	103	%.	75-120	25		11/24/20 20:22	1868-53-7	D4
4-Bromofluorobenzene (S)	94	%.	85-116	25		11/24/20 20:22	460-00-4	
Toluene-d8 (S)	96	%.	83-111	25		11/24/20 20:22	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Brunswick Aerobic2
Pace Project No.: 50274153

QC Batch: 595091
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50274153001, 50274153002

METHOD BLANK: 2745444 Matrix: Water
Associated Lab Samples: 50274153001, 50274153002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	11/24/20 15:01	
p-Isopropyltoluene	ug/L	ND	5.0	11/24/20 15:01	
4-Bromofluorobenzene (S)	%.	95	85-116	11/24/20 15:01	
Dibromofluoromethane (S)	%.	105	75-120	11/24/20 15:01	
Toluene-d8 (S)	%.	96	83-111	11/24/20 15:01	

LABORATORY CONTROL SAMPLE: 2745445

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	43.0	86	75-118	
p-Isopropyltoluene	ug/L	50	49.3	99	82-119	
4-Bromofluorobenzene (S)	%.			99	85-116	
Dibromofluoromethane (S)	%.			110	75-120	
Toluene-d8 (S)	%.			94	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALIFIERS

Project: Brunswick Aerobic2
Pace Project No.: 50274153

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

D4	Sample was diluted due to the presence of high levels of target analytes.
J	Analyte detected below the reporting limit, therefore result is an estimate. This qualifier is also used for all TICs.

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Brunswick Aerobic2
Pace Project No.: 50274153

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50274153001	**Aerobic2-BASE-1**	EPA 8260	595091		
50274153002	**Aerobic2-BASE-2**	EPA 8260	595091		

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical®

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY- Affix Workord

WO# : 50274153

50274153

ALL SHADED

Company: SiREM	Billing Information: accountspayablecan@siremlab.com
Address: 130 Stone Rd W	
Report To: Michael Healey	Email To: mhealey@siremlab.com
Copy To: jwebb@siremlab.com	Site Collection Info/Address:
Customer Project Name/Number: Brunswick Aerobic2	State: ON / County/City: Canada/Guelph / Time Zone Collected: [ ] PT [ ] MT [ ] CT [✓] ET
Phone: / Email:	Site/Facility ID #: / Compliance Monitoring? [ ] Yes [✓] No
Collected By (print): Michael Healey	Purchase Order #: / Quote #: / DW PWS ID #: / DW Location Code:
Collected By (signature): Michael Healey	Turnaround Date Required: 2-day TAT (_____) / Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: _____ [ ] Hold: _____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [✓] 5 Day (Expedite Charges Apply) / Field Filtered (if applicable): [ ] Yes [✓] No / Analysis: _____

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	P-Cymene and Benzene (8260)	Lab Profile/Line:
Aerobic2-BASE-1	GW	Grab	20Nov	16:00				3	X	001
Aerobic2-BASE-2	GW	Grab	20Nov	16:00				3	X	002

Container Preservative Type **: 3

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _____

Analyses

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: _____	
Sample pH Acceptable	Y N NA
pH Strips: _____	
Sulfide Present	Y N NA
Lead Acetate Strips: _____	

LAB USE ONLY:
Lab Sample # / Comments:
See skur

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: (Y) N NA
Therm ID#: D
Cooler 1 Temp Upon Receipt: 4.2 oC
Cooler 1 Therm Corr. Factor: -0.1 oC
Cooler 1 Corrected Temp: 4.1 oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Michael Healey SiREM	23Nov20 16:00	Fedex	
Relinquished by/Company: (Signature) Fedex	11.24.20 0900	Received by/Company: (Signature)	11.24.20 0900
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY

Table #:
Acctnum:
Template:
Prelogin:
PM:
PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

F-IN-Q-290-rev.19,23Jul2020

Pace Analytical

SAMPLE CONDITION UPON RECEIPT FORM

Date/Time and Initials of person examining contents: MN 11.24.20 1405

Courier: (Fed Ex) UPS Client Pace USPS Other _____

Custody Seal on Cooler/Box Present: Yes (No) **(If yes)Seals Intact:** Yes No **(leave blank if no seals were present)**

Packing Material: Bubble Wrap (Bubble Bags) None Other _____

Thermometer: 1 2 3 4 5 6 A B C (D) E F **Ice Type:** Wet · (Blue) None

Cooler Temperature: 4.2/4.1°C **If temp. is over 6°C or under 0°C, was the PM notified?:** Yes No

Temp should be above freezing to 6°C **(Initial/Corrected)**

All discrepancies will be written out in the comments section below.

	Yes	No		Yes	No	N/A
Are samples from West Virginia? Document any containers out of temp.		—	All containers needing acid/base pres. Have been CHECKED?: **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl. Circle: HNO3 (<2) H2SO4 (<2) NaOH (>10) NaOH/ZnAc (>9)** Any non-conformance to pH recommendations will be noted on the container count form			—
USDA Regulated Soils? (HI, ID, NY, WA, OR,CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		—				
Short Hold Time Analysis (48 hours or less)? Analysis:		—		Present	Absent	N/A
			Residual Chlorine Check (SVOC 625 Pest/PCB 608)			—
Time 5035A TC placed in Freezer or Short Holds To Lab	Time:		Residual Chlorine Check (Total/Amenable/Free Cyanide)			—
Rush TAT Requested (4 days or less): 2 day	—		Headspace Wisconsin Sulfide?			—
Custody Signatures Present?	✓		Headspace in VOA Vials (>6mm):	—	MN 11.24.20	
Containers Intact?:	—		Trip Blank Present?		—	
Sample Label (IDs/Dates/Times) Match COC?: Except TCs, which only require sample ID	✓		Trip Blank Custody Seals?:		—	
Extra labels on Terracore Vials? (soils only)		—				

COMMENTS:

COC PAGE ___ of ___

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H (VG9H)	VOA VIAL HS (<6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	AG3C	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H				Matrix	pH <2	pH >9	pH>10
1			3	1/3																						WT			
2			3	1/3																						↓			
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass	BG3U	250mL Unpres Clear Glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass	BP1A	1L NaOH, Asc Acid plastic
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass	BP1N	1L HNO3 plastic
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass	BP1S	1L H2SO4 plastic
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass	BP1U	1L unpreserved plastic
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass	BP1Z	1L NaOH, Zn, Ac
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass	BP2A	500mL NaOH, Asc Acid plastic
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass	BP2N	500mL HNO3 plastic
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass	BP2O	500mL NaOH plastic
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass	BP2S	500mL H2SO4 plastic
VGFX	40mL w/hexane wipe vial	AG3C	250mL NaOH amber glass	BP2U	500mL unpreserved plastic
VSG	Headspace septa vial & HCl	BG1H	1L HCl clear glass	BP2Z	500mL NaOH, Zn Ac
WGKU	8oz unpreserved clear jar	BG1S	1L H2SO4 clear glass	BP3B	250mL NaOH plastic
WGFU	4oz clear soil jar	BG1T	1L Na Thiosulfate clear glass	BP3N	250mL HNO3 plastic
JGFU	4oz unpreserved amber wide	BG1U	1L unpreserved glass	BP3F	250mL HNO3 plastic (field filtered)
CG3H	250mL clear glass HCl	BG3H	250mL HCl Clear Glass		

Plastic / Misc.

BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

January 19, 2021

Steve Sande
SiREM Lab
130 Stone Road W
Ontario, Canada,

RE: Project: Treatability Studies
Pace Project No.: 50277773

Dear Steve Sande:

Enclosed are the analytical results for sample(s) received by the laboratory on January 14, 2021. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:
- Pace Analytical Services - Indianapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kelly Jones
kelly.jones@pacelabs.com
(317)228-3100
Project Manager

Enclosures

cc: Michael Healey, SiREM Lab
Jen Webb, SiREM

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Treatability Studies
Pace Project No.: 50277773

Pace Analytical Services Indianapolis

7726 Moller Road, Indianapolis, IN 46268
Illinois Accreditation #: 200074
Indiana Drinking Water Laboratory #: C-49-06
Kansas/TNI Certification #: E-10177
Kentucky UST Agency Interest #: 80226
Kentucky WW Laboratory ID #: 98019
Michigan Drinking Water Laboratory #9050
Ohio VAP Certified Laboratory #: CL0065
Oklahoma Laboratory #: 9204
Texas Certification #: T104704355
Wisconsin Laboratory #: 999788130
USDA Soil Permit #: P330-19-00257

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Treatability Studies
Pace Project No.: 50277773

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50277773001	**Aerobic2-13**	Water	01/13/21 16:00	01/14/21 08:50
50277773002	**Aerobic2-14**	Water	01/13/21 16:00	01/14/21 08:50
50277773003	**Aerobic2-15**	Water	01/13/21 16:00	01/14/21 08:50
50277773004	**Aerobic2-16**	Water	01/13/21 16:00	01/14/21 08:50
50277773005	**Aerobic2-17**	Water	01/13/21 16:00	01/14/21 08:50
50277773006	**Aerobic2-18**	Water	01/13/21 16:00	01/14/21 08:50

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE ANALYTE COUNT

Project: Treatability Studies
Pace Project No.: 50277773

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50277773001	**Aerobic2-13**	EPA 8260	JPV	5	PASI-I
50277773002	**Aerobic2-14**	EPA 8260	JPV	5	PASI-I
50277773003	**Aerobic2-15**	EPA 8260	JPV	5	PASI-I
50277773004	**Aerobic2-16**	EPA 8260	JPV	5	PASI-I
50277773005	**Aerobic2-17**	EPA 8260	JPV	5	PASI-I
50277773006	**Aerobic2-18**	EPA 8260	JPV	5	PASI-I

PASI-I = Pace Analytical Services - Indianapolis

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Treatability Studies
Pace Project No.: 50277773

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50277773001	**Aerobic2-13**					
EPA 8260	Benzene	3510	ug/L	125	01/18/21 13:42	
EPA 8260	p-Isopropyltoluene	310	ug/L	25.0	01/16/21 00:53	
50277773002	**Aerobic2-14**					
EPA 8260	Benzene	3320	ug/L	125	01/18/21 14:15	
EPA 8260	p-Isopropyltoluene	606	ug/L	25.0	01/16/21 01:26	
50277773003	**Aerobic2-15**					
EPA 8260	Benzene	3450	ug/L	125	01/18/21 14:48	
EPA 8260	p-Isopropyltoluene	291	ug/L	25.0	01/16/21 01:59	
50277773004	**Aerobic2-16**					
EPA 8260	Benzene	12.7J	ug/L	25.0	01/16/21 02:32	
EPA 8260	p-Isopropyltoluene	5.9J	ug/L	25.0	01/16/21 02:32	
50277773005	**Aerobic2-17**					
EPA 8260	Benzene	37.1	ug/L	25.0	01/16/21 03:06	
EPA 8260	p-Isopropyltoluene	43.0	ug/L	25.0	01/16/21 03:06	

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Treatability Studies
Pace Project No.: 50277773

Sample: Aerobic2-13 **Lab ID: 50277773001** Collected: 01/13/21 16:00 Received: 01/14/21 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3510**	ug/L	125	25		01/18/21 13:42	71-43-2	
p-Isopropyltoluene	**310**	ug/L	25.0	5		01/16/21 00:53	99-87-6	
Surrogates								
Dibromofluoromethane (S)	94	%.	75-120	5		01/16/21 00:53	1868-53-7	
4-Bromofluorobenzene (S)	91	%.	85-116	5		01/16/21 00:53	460-00-4	D4,F1
Toluene-d8 (S)	105	%.	83-111	5		01/16/21 00:53	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Treatability Studies
Pace Project No.: 50277773

Sample: Aerobic2-14 **Lab ID: 50277773002** Collected: 01/13/21 16:00 Received: 01/14/21 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3320**	ug/L	125	25		01/18/21 14:15	71-43-2	
p-Isopropyltoluene	**606**	ug/L	25.0	5		01/16/21 01:26	99-87-6	
Surrogates								
Dibromofluoromethane (S)	92	%.	75-120	5		01/16/21 01:26	1868-53-7	
4-Bromofluorobenzene (S)	89	%.	85-116	5		01/16/21 01:26	460-00-4	D4,F1
Toluene-d8 (S)	104	%.	83-111	5		01/16/21 01:26	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Treatability Studies
Pace Project No.: 50277773

Sample: Aerobic2-15 **Lab ID: 50277773003** Collected: 01/13/21 16:00 Received: 01/14/21 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**3450**	ug/L	125	25		01/18/21 14:48	71-43-2	
p-Isopropyltoluene	**291**	ug/L	25.0	5		01/16/21 01:59	99-87-6	
Surrogates								
Dibromofluoromethane (S)	94	%.	75-120	5		01/16/21 01:59	1868-53-7	
4-Bromofluorobenzene (S)	92	%.	85-116	5		01/16/21 01:59	460-00-4	D4,F1
Toluene-d8 (S)	103	%.	83-111	5		01/16/21 01:59	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Treatability Studies
Pace Project No.: 50277773

Sample: Aerobic2-16 **Lab ID: 50277773004** Collected: 01/13/21 16:00 Received: 01/14/21 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**12.7J**	ug/L	25.0	5		01/16/21 02:32	71-43-2	
p-Isopropyltoluene	**5.9J**	ug/L	25.0	5		01/16/21 02:32	99-87-6	
Surrogates								
Dibromofluoromethane (S)	94	%.	75-120	5		01/16/21 02:32	1868-53-7	
4-Bromofluorobenzene (S)	91	%.	85-116	5		01/16/21 02:32	460-00-4	D3,F1
Toluene-d8 (S)	107	%.	83-111	5		01/16/21 02:32	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Treatability Studies
Pace Project No.: 50277773

Sample: Aerobic2-17 **Lab ID: 50277773005** Collected: 01/13/21 16:00 Received: 01/14/21 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	**37.1**	ug/L	25.0	5		01/16/21 03:06	71-43-2	
p-Isopropyltoluene	**43.0**	ug/L	25.0	5		01/16/21 03:06	99-87-6	
Surrogates								
Dibromofluoromethane (S)	94	%.	75-120	5		01/16/21 03:06	1868-53-7	
4-Bromofluorobenzene (S)	89	%.	85-116	5		01/16/21 03:06	460-00-4	D3,F1
Toluene-d8 (S)	103	%.	83-111	5		01/16/21 03:06	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Treatability Studies
Pace Project No.: 50277773

Sample: Aerobic2-18 **Lab ID: 50277773006** Collected: 01/13/21 16:00 Received: 01/14/21 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260/5030 MSV	Analytical Method: EPA 8260 Pace Analytical Services - Indianapolis							
Benzene	ND	ug/L	25.0	5		01/16/21 03:39	71-43-2	
p-Isopropyltoluene	ND	ug/L	25.0	5		01/16/21 03:39	99-87-6	
Surrogates								
Dibromofluoromethane (S)	94	%.	75-120	5		01/16/21 03:39	1868-53-7	D3,F1
4-Bromofluorobenzene (S)	89	%.	85-116	5		01/16/21 03:39	460-00-4	
Toluene-d8 (S)	104	%.	83-111	5		01/16/21 03:39	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Treatability Studies
Pace Project No.: 50277773

QC Batch: 602547 | Analysis Method: EPA 8260
QC Batch Method: EPA 8260 | Analysis Description: 8260 MSV
Laboratory: Pace Analytical Services - Indianapolis
Associated Lab Samples: 50277773001, 50277773002, 50277773003, 50277773004, 50277773005, 50277773006

METHOD BLANK: 2778548 Matrix: Water
Associated Lab Samples: 50277773001, 50277773002, 50277773003, 50277773004, 50277773005, 50277773006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	5.0	01/16/21 00:20	
p-Isopropyltoluene	ug/L	ND	5.0	01/16/21 00:20	
4-Bromofluorobenzene (S)	%.	89	85-116	01/16/21 00:20	
Dibromofluoromethane (S)	%.	95	75-120	01/16/21 00:20	
Toluene-d8 (S)	%.	103	83-111	01/16/21 00:20	

LABORATORY CONTROL SAMPLE: 2778549

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	50	50.1	100	75-118	
p-Isopropyltoluene	ug/L	50	48.7	97	82-119	
4-Bromofluorobenzene (S)	%.			93	85-116	
Dibromofluoromethane (S)	%.			97	75-120	
Toluene-d8 (S)	%.			104	83-111	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALIFIERS

Project: Treatability Studies
Pace Project No.: 50277773

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

D3	Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
D4	Sample was diluted due to the presence of high levels of target analytes.
F1	The sample was analyzed at a dilution due to foaming of the sample in the purge vessel.

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Treatability Studies
Pace Project No.: 50277773

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50277773001	**Aerobic2-13**	EPA 8260	602547		
50277773002	**Aerobic2-14**	EPA 8260	602547		
50277773003	**Aerobic2-15**	EPA 8260	602547		
50277773004	**Aerobic2-16**	EPA 8260	602547		
50277773005	**Aerobic2-17**	EPA 8260	602547		
50277773006	**Aerobic2-18**	EPA 8260	602547		

Pace Analytical®

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY- Affix Work... WO# : 50277773

50277773

ALL SHAD...

Container Preservative Ty...

3

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _____

Company: SiREM	Billing Information: accountspayablecan@siremlab.com
Address: 130 Stone Rd W	
Report To: Jen Webb	Email To: jwebb@siremlab.com
Copy To: mhealey@siremlab.com	Site Collection Info/Address:
Customer Project Name/Number: Brunswick Aerobic2	State: ON County/City: Time Zone Collected: [ ]PT [ ]MT [ ]CT [✓]ET
Phone: Email:	Site/Facility ID #: Compliance Monitoring? [ ] Yes [✓] No
Collected By (print): Jen Webb	Purchase Order #: Quote #: DW PWS ID #: DW Location Code:
Collected By (signature):	Turnaround Date Required: 2-day TAT (_____) Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: _____ [ ] Hold: _____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [✓] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply) Field Filtered (if applicable): [ ] Yes [✓] No Analysis: _____

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Analyses

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: _____	
Sample pH Acceptable	Y N NA
pH Strips: _____	
Sulfide Present	Y N NA
Lead Acetate Strips: _____	

LAB USE ONLY:
Lab Sample # / Comments: SEE SCUR

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	P-Cymene and Benzene (8260)	Lab Sample #
Aerobic2-13	GW	Grab	13Jan21	16:00				3	X	001
Aerobic2-14	GW	Grab	13Jan21	16:00				3	X	002
Aerobic2-15	GW	Grab	13Jan21	16:00				3	X	003
Aerobic2-16	GW	Grab	13Jan21	16:00				3	X	004
Aerobic2-17	GW	Grab	13Jan21	16:00				3	X	005
Aerobic2-18	GW	Grab	13Jan21	16:00				3	X	006

Customer Remarks / Special Conditions / Possible Hazards:

3 day TAT

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y (N) NA
Therm ID#: 2
Cooler 1 Temp Upon Receipt: 7.0 oC
Cooler 1 Therm Corr. Factor: -0.3 oC
Cooler 1 Corrected Temp: 6.7 oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
SiREM	13Jan2021	FedEx	
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
FedEx	1/13/21 0850	Daniel Pearson Pace	1/13/21 0850
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY

Table #:
Acctnum:
Template:
Prelogin:
PM:
PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

Page: _____ of: _____

F-IN-Q-290-rev.19,23Jul2020

Pace Analytical

SAMPLE CONDITION UPON RECEIPT FORM

MB ✓

Date/Time and Initials of person examining contents: DMP 1/14/21 1033

Courier: (Fed Ex) UPS Client Pace USPS Other _____

Custody Seal on Cooler/Box Present: Yes (No) **(If yes)Seals Intact:** Yes No **(leave blank if no seals were present)**

Packing Material: (Bubble Wrap) (Bubble Bags) None (Other) Plastic, Absorbant Material

Thermometer: 1 (2) 3 4 5 6 A B C D E F **Ice Type:** Wet (Blue) None

Cooler Temperature: 7.0 / 6.7 **If temp. is over 6°C or under 0°C, was the PM notified?:** (Yes) No

Temp should be above freezing to 6°C **(Initial/Corrected)**

All discrepancies will be written out in the comments section below.

	Yes	No		Yes	No	N/A
Are samples from West Virginia? Document any containers out of temp.		✓	All containers needing acid/base pres. Have been CHECKED?: **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl. Circle: HNO3 (<2) H2SO4 (<2) NaOH (>10) NaOH/ZnAc (>9)** Any non-conformance to pH recommendations will be noted on the container count form			✓
USDA Regulated Soils? (HI, ID, NY, WA, OR,CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		✓				
Short Hold Time Analysis (48 hours or less)? Analysis:		✓		Present	Absent	N/A
			Residual Chlorine Check (SVOC 625 Pest/PCB 608)			✓
Time 5035A TC placed in Freezer or Short Holds To Lab	Time:		Residual Chlorine Check (Total/Amenable/Free Cyanide)			✓
Rush TAT Requested (4 days or less): 2DAY/3DAY	✓		Headspace Wisconsin Sulfide?			✓
Custody Signatures Present?	✓		Headspace in VOA Vials (>6mm):		✓	
Containers Intact?:	✓		Trip Blank Present?		✓	
Sample Label (IDs/Dates/Times) Match COC?: Except TCs, which only require sample ID		✓	Trip Blank Custody Seals?:			✓
Extra labels on Terracore Vials? (soils only)		NO				

COMMENTS: All VG9H labeled with no time. /

COC PAGE ____ of ____

Sample Container Count

Sample Line Item	WGFU	SBS DI BK Kit R	DG9H VG9H	VOA VIAL HS (<6mm)	VG9U	DG9U	DG9T	AG0U	AG1H	AG1U	AG3S	AG3C	BP1U	BP1N	BP2U	BP3U	BP3N	BP3F	BP3S	BP3B	BP3Z	CG3H				Matrix	pH <2	pH >9	pH>10
1			3																							WT			
2			↓																							↓			
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpres amber glass
DG9H	40mL HCl amber voa vial	AG1H	1L HCl amber glass
DG9M	40mL MeOH clear vial	AG1S	1L H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1L Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpres amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCl clear vial	AG2U	500mL unpres amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 amber glass
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpres amber glass
VGFX	40mL w/hexane wipe vial	AG3C	250mL NaOH amber glass
VSG	Headspace septa vial & HCl	BG1H	1L HCl clear glass
WGKU	8oz unpreserved clear jar	BG1S	1L H2SO4 clear glass
WGFU	4oz clear soil jar	BG1T	1L Na Thiosulfate clear glass
JGFU	4oz unpreserved amber wide	BG1U	1L unpreserved glass
CG3H	250mL clear glass HCl	BG3H	250mL HCl Clear Glass

Plastic / Misc.

BG3U	250mL Unpres Clear Glass
BP1A	1L NaOH, Asc Acid plastic
BP1N	1L HNO3 plastic
BP1S	1L H2SO4 plastic
BP1U	1L unpreserved plastic
BP1Z	1L NaOH, Zn, Ac
BP2A	500mL NaOH, Asc Acid plastic
BP2N	500mL HNO3 plastic
BP2O	500mL NaOH plastic
BP2S	500mL H2SO4 plastic
BP2U	500mL unpreserved plastic
BP2Z	500mL NaOH, Zn Ac
BP3B	250mL NaOH plastic
BP3N	250mL HNO3 plastic
BP3F	250mL HNO3 plastic (field filtered)
BP3U	250mL unpreserved plastic
BP3S	250mL H2SO4 plastic
BP3Z	250mL NaOH, Zn Ac plastic

AF	Air Filter
C	Air Cassettes
R	Terra core kit
SP5T	120mL Coliform Na Thiosulfate
U	Summa Can
ZPLC	Ziploc Bag

WT	Water
SL	Solid
NAL	Non-aqueous liquid
WP	Wipe